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The Legal and Institutional Aspects of Communication, Navigation, Surveillance and Air Traffic Management Systems for Civil Aviation

by

Mahmoud A. Ghonaim

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McGill University
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To my wife

EBTESAM

for her love,
understanding and sacrifice, inspired me to higher achievements
and because of her infinite patience this thesis came into being.

ABSTRACT

Looking at the current air traffic system developments and the use of satellite for communication, navigation, surveillance and air traffic management, an emerging trend of institutions and law can be observed. This thesis assesses the institutional and legal contributions of the satellite services to civil aviation.

This thesis is divided into three parts. Part I sets the scene by giving the reader a brief look at the technical side of the current air navigation system. *Chapter I* explores the current system's deficiencies and *Chapter II* explains the framework of selected existing aeronautical and general operating satellite systems and institutions.

Part II deals with the prospective long-range needs of air navigation. *Chapter III* focuses on the characteristics and capabilities of the new systems and *Chapter IV* sets out the available financial options.

Part III deals with the vital legal and institutional aspects involved in using satellite systems for civil aviation purposes. *Chapter V* reviews the legal problems of safety and non-safety aeronautical air-ground communications, *Chapter VI* identifies the current applicable air, space and telecommunication law, and their impact on the new systems, *Chapter VII* deals with the institutional aspects of the new systems and *Chapter VIII* sets out this writer's recommendations. Lastly, a final remarks is presented.

RÉSUMÉ

L'observation des développements actuels dans le domaine des systèmes de gestion du trafic aérien de même que l'utilisation de satellite à des fins de communication, de navigation, de surveillance et de contrôle du trafic aérien, permettent de discerner de nouvelles tendances institutionnelles et juridiques dans ce domaine. Dans cette thèse, l'auteur évalue l'apport des services de satellite à l'aviation civile au niveau institutionnel et juridique.

Cette thèse se divise en trois parties. La Partie I introduit le lecteur au sujet en lui présentant brièvement les aspects techniques du système actuel de navigation aérienne. Le *Chapitre I* vise à mettre en lumière les déficiences du système actuel alors que le *Chapitre II* donne une vue d'ensemble de certains systèmes de satellite à vocation générale ou aéronautique actuellement en opération et présente le cadre institutionnel dans lequel ils évoluent.

La Partie II porte sur les exigences que pourrait, à long terme, poser la navigation aérienne. Le *Chapitre III* se penche sur les caractéristiques et les possibilités du nouveau système; pour sa part le *Chapitre IV* présente les différentes options financières disponibles dans un tel contexte.

La Partie III traite des aspects juridiques et institutionnels fondamentaux qu'implique l'utilisation de système de satellite dans le domaine de l'aviation civile. Le *Chapitre V* passe en revue les problèmes juridiques posés par les communications air-sol dans le domaine aéronautique, et ce qu'il s'agisse de communications liées à la sécurité ou non. Le *Chapitre VI* identifie les règles actuellement applicables en droit aérien, spatial et des télécommunications et l'impact de ces dernières sur le nouveau système. Le *Chapitre VII* porte sur les aspects institutionnels du nouveau système alors que le *Chapitre VIII* présente les recommandations de l'auteur. En dernier lieu une remarque finale vient terminer la présente dissertation.

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Table of Abbreviations and Glossary of Terms

I. Abbreviations.

AAC	Aeronautical Administrative Communications
AASL	Annals of Air and Space Law
ADS	Automatic Dependent Surveillance
AEA	Association of European Airlines
ACARS	Aircraft Communications Addressing and Reporting System
ACAS	Airborne Collision Avoidance Systems
ACC	Area Control Centre
ADS	Automatic Dependent Surveillance
AEEC	Airlines Electronic Engineering Committee
AFTN	Aeronautical Fixed Telecommunication Network
AIR L.	Air Law
AMCP	Aeronautical Mobile Communications Panel
AMSS	Aeronautical Mobile Satellite Services
AMSSP	Aeronautical Mobile Satellite Service Panel's
ANC	Air Navigation Commission
ANP	Air Navigation Plan
AOC	Aeronautical Operational Control
APC	Aeronautical Public Correspondence
ARABSAT	Arab Satellite Organization
ARC	Aviation Review Committee
ARINC	Aeronautical Radio Inc.
ASECNA	Agence pour la Sécurité de la navigation Aérienne en Afrique et a Madagascar
ASTRA	ICAO's Panel of Experts for Application of Space Technology Relating to Aviation
ASRS	Aviation Safety Reporting System (USA)
ATCA	Air Traffic Control Association
ATC	Air Traffic Control
ATM	Air Traffic Management
ATM-OO	Air Traffic Management Operating Organization
ATN	Aeronautical Telecommunication Network
ATFM	Air Traffic Flow Management
ATS	Air Traffic Service
AW&ST	Aviation Week and Space Technology
BSS	Broadcasting Satellite Services
CAS	Collision Avoidance System
CCIR	International Radio Consultative Committee
CCITT	International Telegraph and Telephone Consultative Committee

CFMU	Central Flow Management Unit
CNS	Communication, Navigation and Surveillance
COCESNA	Corporacion Centroamericana de Servicios de Navegacion Aerea
Collo. L. Outer Space	Colloquium on the Law of Outer Space
COMSAT	Communications Satellite Corporation
COPUOS	Committee on Peaceful Uses of Outer Space
COSPAS	The Russian Search and Rescue Satellite
DEN	Denmark
Doc.	Document
DME	Distance Measuring Equipment
ECAC	European Civil Air Conference
Ed.	Edition
EEZ	Exclusive Economic Zones
EHF	Extra-High Frequency
ESA	European Space Agency
EUROCONTROL	European Organization for the Safety of Air Navigation
EUTELSAT	European Telecommunications Satellite Organization
FAA	Federal Aviation Administration (USA)
FANS	Future Air Navigation Systems
FEATS	Future European Air Traffic System
FCC	US Federal Communications Commission
FIRs	Flight Information Region's
FL	Flight Level
Flight Int'l	Flight International
FSS	Fixed Service Satellite
J. Air L. & Comm.	Journal of Air Law and Commerce
J. ATC	Journal of Air Traffic Control
J. NAVIGATION	The Journal of Navigation
HF	High Frequency
IATA	International Air Transport Association
IAOPA	International Council of Aircraft Owner and Pilot Associations'
ICAO	International Civil Aviation Organization
ICAO J.	ICAO Journal
ICC	International Chamber of Commerce
ICE	Iceland
ICJ	International Court of Justice
IFALPA	International Federation of Airline Pilots Associations
IFRB	International Frequency Registration Board
ILA	International Law Association
ILS	Instrument Landing Systems
IMCO	International Maritime Consultative Organization
Infra	Use to Refer to Materials on Subsequent Pages

INMARSAT	International Maritime Satellite Organization
INTELSAT	International Telecommunications Satellite Organization
INTERSPUTNIK	International Organization of Space Communications
IOS	International Organization for Standardization
ITU	International Telecommunication Union
GATT	General Agreement on Tariffs and Trade
GATS	General Agreement of Trade in Services
GLONASS	The Russian Global Orbiting Navigation Satellite System
GNS	Group of Negotiations on Services (within GATT)
GNSS	Global Navigation Satellite System
GNSSP	Global Navigation Satellite Panel
GPS	US Global Positioning System
GSO	Geostationary Satellite Orbit
KDD	Kokusai Denshin Denwa
KAL	Korean Airline
LDCs	Less Developed Countries
LEO	Low Earth Orbit
LF	Low Frequency
LORAN	Long-Range Radio Aids to Navigation
MF	Medium Frequency
MIGA	Multilateral Investment Guaranty Authority
MLS	Microwave Landing System
NASA	US National Aeronautics and Space Administration
NATO	North Atlantic Treaty Organization
NAVAID	Aid to Air Navigation
NAVSAT	European Navigation Satellite System
NDB	Non-Directional Beacon
NOPAC	North Pacific Route System
OECD	Organization for Economic Cooperation and Development
OST	Outer Space Treaty
PALAPA	Indonesian Domestic Telecommunications Satellite System
RADAR	Radio Detection and Ranging
RARCs	Regional Administrative Radio Conferences
RDSS	Radio Determination Satellite Service
RTCA	Radio Technical Commission for Aeronautics
SARSAT	Search and Rescue Satellite
SARPs	Standards and Recommended Practices
SHF	Super High Frequency
SITA	Société Internationale de Télécommunications Aéronautiques
SRI	Stamford Research Institute
SSR	Secondary Surveillance Radar
TCAS	Traffic Alert and Collision Avoidance Systems
TCB	ICAO's Technical Cooperation Bureau
TMAs	Terminal Control Areas

UHF	Ultra High Frequency
UN	United Nations
UNCTAD	UN's Conference on Trade and Development
UNDP	United Nation Development Programme
UNRes.	United Nations Resolution
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNCITRAL	United Nations Commission for International Trade Law
VFR	Visual Flight Rules
VHF	Very High Frequency
Vol.	Volume
VOR	Omnidirectional Radio Range
WATC	ICAO Worldwide Air Transport Colloquium
WARCs	World Administrative Radio Conferences
WIPO	World International Property Organization
ZLW	German Journal of Air and Space law

II. Glossary.

AERONAUTICAL OPERATIONAL CONTROL
It is a communication function related to safety, regularity and efficiency of flights. Such communication may be between aircraft and its airline, operating agency, maintenance facility or and with the destination airport.

AIR TRAFFIC SERVICES
This type of communication is safety-related. Its purpose is to prevent collisions between aircraft in the air or in terminal areas, to ensure an orderly flow of air traffic; to provide advice and information for the safety of flights; and to notify appropriate authorities of aircraft in need of search and rescue aid.

ALLOCATION
Allocation of a frequency band: the appropriation (by the ITU) of a frequency to a service for example a broadcast satellite service.

ALLOTMENT
Appropriation of a frequency channel to one or more administrations for use in a geographical area or country.

ASSIGNMENT
Authorization or appropriation by an administration of a frequency to a station.

ATFM
Air traffic flow management or flow control is a service which supports air traffic control to ensure an optimum flow of traffic when demand exceeds system capacity.

BAND
A range of radio frequencies within prescribed limits of the radio frequency spectrum. Bands are assigned under ITU regulations for specific purposes to minimize interference between different types of use.

BANDWIDTH
The width of an electronic transmission path or circuit, in terms of the range of frequencies it covers; a measure of the volume of communication traffic that the channel can carry.

CHANNEL
A means of one-way transmission. A voice channel typically has a bandwidth of 3 *KHz* to 4 *KHz*.

DECCA
A continuous-wave low-frequency long-rang hyperbolic navigation system. Coverage is good in Europe, but mainly coastal elsewhere.

FLIGHT INFORMATION REGIONS
Its outside the control zones, terminal areas, airways and special rules areas. It is not protected airspace, and aircraft are free to fly without being subject to control procedures provided they comply with a set of simple rules for flight in instrument conditions and avoid the air traffic zones of aerodromes that do not have protected airspace.

FIBER OPTICAL
A thin, flexible glass fiber the size of human hair which will transmit light waves capable of carrying large amounts of information in the range of a gigabit/second and upward. It can be used as either terrestrial or submarine cables.

FREQUENCY SPECTRUM
A term describing a range of frequencies of electromagnetic waves.

GEOSTATIONARY ORBIT
If it is desired to maintain a satellite stationary above a point on the earth, it must be placed in a geostationary orbit. To accomplish this, the satellite must be travelling east, in a circular orbit above the equator at an altitude of 35,870 km at exactly the same speed as the point on the earth's surface.

HERTZ (Hz)
The frequency of an electric or electromagnetic wave in cycles per second, named after Heinrich Hertz who detected such waves in 1883.

HUMAN FACTORS
The technology concerned to optimize the relationships between people and their activities by the systematic application of the human sciences, integrated within the framework of system engineering.

ID
Refer to a source cited in preceding note for reference to same page, paragraph or statute section.

IBID
Refer to a source cited in preceding note for reference to different page, paragraph, statute section or different treaty article.

INFRA
Use to refer to materials on subsequent page.

LORAN-C
A pulsed low-frequency long-range hyperbolic navigation system. Accuracy depends on chain geometry. World coverage is incomplete.

LOW EARTH ORBIT
An orbit about the earth at an altitude of less than 5,600 km. A high earth orbit has an altitude above 5,600 km.

MICROWAVE
Very short electromagnetic waves having a wavelength of approximately thirty centimetres to approximately one centimetre.

OMEGA
A continuous-wave very-low frequency long-range navigation system. Omega is susceptible to daily errors caused by movement of the ionosphere.

OPERATOR/PILOT ERROR
Those errors which may be ascribed to the person in direct control of a machine.

ORBIT
A space body is considered to be in an orbit or path about the earth if it is capable of completing at least one circumnavigation of the globe before striking the surface.

RADAR
An acronym which stands for *radio detection and ranging*. Radar was fully developed as a useful military sensor system during the second world war and remains the most pervasive of the active surveillance, detection and tracking systems in use today.

RADIO FREQUENCIES
Frequencies used for transmission of information in the range from 10 Kilohertz to about 300,000 megahertz. Radio frequency groups are as follows:

- i. Very Low Frequencies (VLF) 10 to 30 Kilohertz;
- ii. Low Frequency (LF) 30 to 300 Kilohertz;
- iii. Medium Frequency (MF) 300 to 3,000 Kilohertz;
- iv. High Frequency (HF) 3,000 to 30,000 Kilohertz;
- v. Very High Frequency (VHF) 30 to 300 Megahertz;
- vi. Ultra High Frequencies (UHF) 300 to 3,000 Megahertz;
- vii. Super High Frequency (SHF) 3,000 to 30,000 Megahertz; and
- viii. Extremely High Frequency (EHF) 30 to 300 Gigahertz.

RECONNAISSANCE
The examination of an area to determine aspects of characteristics of the area of activities of interest.

SPACE SEGMENT
Any one or more satellites, their tracking and other facilities and equipment required to support the operation of such satellites, operated by one organization.

SURVEILLANCE
An activity that involves maintaining a close watch over a specific area for the purposes of determining what activities are taking place within that area. Surveillance can be continuous or periodic depending of the type of activities of interest. Closer examination triggered as a result of surveillance would be defined as reconnaissance.

TELECOMMUNICATION
Any transmission, emission, or reception of signs, signals, writing, images, and sounds or intelligence of any nature by wire, radio, optical, or other electromagnetic systems.

TERMINAL AREAS
Terminal areas are established around one or more busy aerodromes and extend usually from 2500*ft*. or the top of the concerned control zone(s) to a height of approximately flight level 245. Their purpose is to protect the flight paths of aircraft leaving the airways system to land at an aerodrome in the terminal, or alternatively the flight paths of aircraft departure the terminal for an *en rout* airway.

WIND SHEAR
Is a sudden change in wind speed or direction.

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Part II: The Prospective Long-Term Needs for Air Navigation

General Introduction

Centuries ago, navigators used the sun, stars, terrestrial[1] and celestial methods of navigation to figure out positions. Until quite recently, commercial aircraft crews also gathered positional information from every available source, from map-reading to astro-and radio-aids.[2] Aviation has come a long way from the days when the pilot was alone in the sky.

In the early years of aviation, aircraft navigation was accomplished via pilotage or dead reckoning, using ground contact for reference. With the introduction of radio navigational aids and voice communication in the 1930s, when the Air Traffic Control (ATC) system was created, more accurate navigation was possible. At the end of World War II, ground and airborne radar, and improved navigational aids and avionics were added. This evolution firmly established ground based facilities as a primary means of navigation and the backbone of the ATC system. The space age added new dimensions, and the opportunity to achieve a greater degree of flexibility and accuracy in establishing aircraft position.[3]

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1 Terrestrial navigation is a manner of navigation using geographical points such as bridges, roads, castles, and rivers.

2 Even nowadays, some aircraft in general aviation not equipped with navigational instruments which facilitate flights in poor weather conditions, still use the terrestrial method of navigation; see, Dahl N., "Navigation: A Changing Trade"(May 1992)45:2 ***J. Navigation*** 151; see also International Federation of Air Line Pilots Association (IFALPA) "Pilots Welcome Numerous Benefits Offered by FANS"[December 1990] ***ICAO J.*** 18 at 18; see also, Richey M., "The Navigational Background to 1492"(May 1992)45:2 ***J. Navigation*** 266; Kayton M., "Navigation: Land, Sea, Air and Space"(May 1992)45:2 ***J. Navigation*** 308; see also, Moore P. & Page M. D., "Worldwide Navigation into the 21st Century - An Airline View"(May 1987)40:2 ***J. Navigation*** 158 at 158*ff*; see also, Grocott D. F. H., "The 21st Century Navigation Station"(September 1992)45:3 ***J. Navigation*** 315.

3 Kulikowski A. J. & Harvey M., "Global Positioning System for Precise Navigation and ATC Display"[October/December 1991] ***J. ATC*** 3 at 3.

Today some flights still rely upon geographical points and are subject to the Visual Flight Rules (VFR) referred to in Chapter IV, Annex 2[4] to the Chicago Convention.[5] Air navigation is changing and will continue to do so. The object of system planning is to ensure close integration of the various components into a system, to assure that ground-based facilities and services, aircraft characteristics, airborne equipment and associated procedures are compatible and form a coherent whole. This approach, when combined with a high degree of automation, will make current and future air navigation more manageable and safer, and will have a profound impact on the aviation industry.

With the global increase in the number, size and speed of aircraft, the air navigation situation is becoming acute, particularly in areas of traffic congestion or convergence.[6] According to a study by the International Civil Aviation Organization (ICAO), passengers transported by scheduled airlines grew from 6.0 million in 1947 to about 1.127 billion, in 1994. The potential for air traffic growth at an annual global rate of 5 percent signifies a potential doubling of world air traffic by the year 2001.[7] ICAO predicts that there will also be a strong growth in freight tonne-kilometres over the coming decade, particularly for international traffic, which will grow by 7.5 percent per year; trans-Pacific growth will be 8 percent, and Europe and Asia/Pacific growth will be 7.5 percent. The latter groups will be the fastest-growing routes, according to ICAO.[8]

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4 *Annex 2, "Rules of the Air"* to the Chicago Convention, *9th ed.*, July 1990.

5 Convention on International Civil Aviation (Chicago Convention, 1944); *ICAO Doc.* 7300/6; 15 *U.N.T.S.* 295. Opened for signature at Chicago on December 7, 1944; entered into force on April 4, 1947 **[hereinafter Chicago Convention]**.

6 Richie S. G., "Navigation and Society"(January 1980)33:1 *J. Navigation* 1 at 6.

7 *ICAO Circ.* 2250-AT/102, "The World of Civil Aviation, 1993-1996"; *ICAO News Release PIO* 19/94; Douglas Aircraft *Co.*, "Strong Air Traffic Growth Forecast for 20-Year Period"[January 1992] *ICAO J.* 12; see also, "Scheduled Airline Traffic Expected to Double by the Year 2000"[September 1989] *ICAO Bulletin* 43.

8 "ICAO Analyses Indicate a Decade of Moderate Growth for Scheduled Traffic"[October 1992] *ICAO J.* 19 at 19*ff*; see also, "ICAO Predicts 5% Traffic Growth"[September 9-15, 1992] *Flight Int'l* 16 at 16; two reasons could militate against this prediction, one is the economic deterioration and the second reason is the pure physical capability of the system infrastructure,
(continued...)

The increasing inability of the aviation infrastructure to handle the fast-growing traffic is one of the main crises currently facing the industry. Congestion problems, operating costs through delays, and less-than-optimal routing and service networks are presenting serious problems in the most heavily travelled regions in the world. It must be noted that the congestion dilemma and other system limitations are emerging almost everywhere. The aviation industry faces acute strains on system capacity, both in the air and on the ground, and cannot handle much more.[9] As Dr. Kotaite the President of ICAO Council has stated:

> *"[t]he existing air navigation system has served us well for almost half a century, but it has now reached or is fast reaching its limits in many parts of the world. Furthermore, where the system is saturated, this increasingly creates problems elsewhere through the disruption in flights."*[10]

The growth of congestion now threatens to entangle the air navigation system. At the same time, aviation is developing, in many areas of the world, towards an almost totally integrated system. Such a system is unable to tolerate serious differences in respect of certain international norms governing air navigation. States and the civil aviation industry are facing unprecedented challenges, imposed by traffic growth, emerging new technology, a rapidly changing commercial and regulatory framework, and finally a growing awareness of the need for protection of the environment.[11] The present

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(...continued)
notably airports and ATC services, to endure the increasing volume of traffic; see, Eser O. G., "Effects of Congestion and Aeropolitical Events on the Evolution of the Global International Airline System"(1988)XIII *AASL* 25 at 25; see also, "ICAO Forecasts Doubling of Worldwide Traffic by Year 2000"(September 21, 1989)297 ***Aviation Daily*** 557 at 562.

9 Merdith J., "Finding Solutions"[June 1991] ***Airline Business*** 42 at 43.

10 ICAO News, "USSR/U.S. Aviation Symposium - It Provided Interesting Projections for the Future"[October 1989] ***ICAO Bulletin*** 24 at 24; see also, Park W.-H., "Satellite Application for Aviation Requirements"(1989)XIV:1 *Air L.* 17 at 18.

11 Krull M., "The Role of the ICAO Implementing Satellite Communications to Improve Air Traffic Safety" (Addressed on behalf of Dr. P. Rochat the ICAO's Secretary General to the ***Inmarsat Aeronautical Services Conference*** on the ***Worldwide Aeronautical Satellite Communications Conference***, Montreal, July 13-15, 1992).

industry infrastructure cannot support air transport growth. Action must be taken to ensure that airway congestion will not inhibit the growth of air transport. In this endeavour, it is vital that all components of the industry work closely together. Hence, the lack of capital or political desire to provide the vital infrastructure facilities should not jeopardize the industry's future growth.[12]

As we look to the future we are confronted with various unanswered questions, *inter alia*, what shall we see by the turn of the century? How long will the system be efficient enough to manage congested airways and jammed airports? Ultimately, how will the regulatory system that was initiated some fifty years ago, adapt to the demands of two billion passengers anticipated by the end of this century?[13]

Air navigation systems have been modified as civil aviation technology has improved, through ICAO Council decisions on the recommendation of the Air Navigation Commission (**ANC**). These recommendations are based on conclusions and advice of regional and international air navigation meetings. Then, each country's civil aviation administration modifies its air traffic system, based on the international Standards and Recommended Practices (**SARPs**), according to Article 37 of the Chicago Convention, but with a scope and complexity to suit the specific domestic needs. This system modification procedure creates interface problems in airspace boundaries of adjacent States.

In 1983, ICAO established the Special Committee on Future Air Navigation Systems (**FANS**).[14]

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[12] Nyaga S. R., "Air Traffic System Capacity Constraints and Possible Remedies"[January 1989] ***ICAO Bulletin*** 19 at 23.

[13] Sochor E., ***The Politics of International Aviation*** (Iowa: University of Iowa Press, 1991) at 220.

[14] The activity of the FANS committee was carried out under the auspices of the Aviation Review Committee (**ARC**) which ended in 1982, and emanated indirectly from the recommendations of the Seventh Air Navigation Conference in 1972. It should be pointed out that the FANS Committee largely owes its existence to the Council's decision to continue the work which the ARC had begun, that decision was reached in response to an appeal to ICAO made by the ARC in its final report; see, ***ICAO C-WP/7678*** which concluded nearly four years of uninterrupted work; see also, ***ICAO FANS I-WP/3***, at 2.

The Committee's task was to prepare a general long-term projection to develop the air navigation systems into the next quarter of a century.[15] The Committee performed a comprehensive assessment and analysis of the characteristics and capabilities of the present system, and concluded that there are four deficiencies:

- **i.** line-of-sight constraints;
- **ii.** implementation problems;
- **iii.** lack of air/ground data interchange systems; and
- **iv.** lack of route flexibility and harmonized system developments.[16]

Most of the above deficiencies are intrinsic to the systems. Although their effects are different in every part of the world, one or more of these factors inhibit the further development of air navigation almost everywhere.[17] In addition, the preceding deficiencies inhibit the systems' ability to increase capacity within the existing air navigation systems. This leaves no alternative to the aviation industry but to look for new methods to meet increasing operational requirements.[18]

The FANS Committee therefore proposed new air navigation systems based on satellite technology and a terrestrial system.[19] The exploitation of satellite technology is the only solution now viable, and it is expected that it will enable aviation to overcome the shortcomings of the present air navigation systems.[20] However, in one

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15 ***ICAO FANS/1-WP/2***, at 1.

16 ***ICAO Doc. 9503, FANS/3***, at 1-1.

17 "*Report of the Tenth Air Navigation Conference*", Montreal, September 5-20, 1991, ***ICAO Doc. 9583, AN-CONF/10***, at 2A-1.

18 Gribbin W. J., "Aeronautical Satellite Communications - A Bold, New Capability"[December 1987] ***ICAO Bulletin*** 19 at 19.

19 Fisher D., "Satellites Promise Benefits for All"[1/92] ***IATA Review*** 13 at 13.

20 Because traffic is increasing and will continue to do so in the future, the accuracy of navigation is needed as never before. The cost today of a navigational mistake at sea or in the air can be horrifying, in terms of lives, environmental damage, and money.

commentator's[21] view this will not be the ultimate solution to the entire navigational problem.

The Committee developed guidelines and scenarios to help States in the planning, carrying out, and provision of air navigation services for international civil aviation. Preliminary guidelines were submitted to the 10*th* Air Navigation Conference, which was held in September 1991[22] and were subsequently referred to ICAO's Legal Committee[23] for its consideration. The FANS Committee completed its work in 1988 with a report that outlined the problems and limitations of the present systems. Recognizing the implications of the new systems concept, and to ease the process, ICAO, in July 1989, created a second Special Committee called *FANS Phase II* whose specific tasks included[24] coming up with recommendations for acceptable institutional arrangements with respect to ownership, management and control issues for the global future air navigation systems.[25] The Committee held one meeting in each of the years 1990 - 1993. The final report includes several milestones such as the global coordinated plan, that were accepted by the Committee. The report also contains the ideas of the Committee concerning the institutional elements of the system, guidelines for the Aeronautical Mobile Satellite Services (AMSS), the Global Navigation Satellite System (GNSS) and the Aeronautical Telecommunication Network (ATN), as well as the institutional arrangements and optional financial and cost-recovery mechanisms.[26] The

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[21] Dahl, ***supra***, note 2, at 156.

[22] AN-CONF/10, ***supra***, note 17, at 4-1*ff*.

[23] ***ICAO Doc***. 9588-LC/188; ICAO Legal Committee in its 28*th* Session was informed that subsequent to the 10*th* Air Navigation Conference, the expression "Future Air Navigation Systems" had been changed by the ICAO Council to "Communication, Navigation and Surveillance/Air Traffic Management (CNS/ATM) Systems" *ICAO Doc.*, ***ibid***, at 3-6; even though the committee concerned with the CNS/ATM concept continues to be known as FANS Committee (Whey - the word "future" misleading).

[24] ***ICAO A29-WP/42***.

[25] ***Infra***, Chapter VII, at P. 282*ff*.

[26] ***ICAO Doc. 9623, FANS(II)/4***, at 1.

Legal Committee concluded that the guidelines developed by the FANS Phase II Committee were legally acceptable, the ICAO CNS/ATM concept was compatible with the provisions of the Chicago Convention and with the regulatory role of ICAO, and there was no legal obstacle to the achievement of the CNS/ATM idea.[27] Through ICAO and other institutions, discussion on the technical problems of the new CNS/ATM systems is taking place. Nevertheless, at least one commentator[28] believes that there has been little serious analysis of the legal and institutional obstacles, in spite of the work already completed by ICAO. It may be also noted that the members of the FANS Committee acted in their personal expert capacity, not on behalf of their States. Furthermore, all of them were experts in the technical fields and their pronouncements on the institutional and legal aspects cannot be accepted without criticism. Furthermore, the International Maritime Satellite Organization (INMARSAT) held an aeronautical service conference on global aeronautical satellite communications in July 1992.[29] The Air Traffic Control Association (ATCA) urged the international aviation community to cooperate, through ICAO, in developing a practical approach to resolve the obstacles that remain before the establishment of the global CNS/ATM systems for the 21*st* century.[30] In addition, the International Air Transport Association (IATA) believes that an efficient,

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[27] These guidelines adequately address the specific issues rased in the ICAO Council concerning both legal framework for the provisions of a long-term GNSS and ICAO CNS/ATM policy; see for details, "*Overall ICAO CNS/ATM policy and policy elements to be included in the legal framework for the provision of a long-term GNSS for international civil aviation*", presented by the Secretary General, ***ICAO C-WP/9902***, June 1, 1994.

[28] Khan H. A., "Aeronautical Communication, Navigation and Surveillance by Satellite - Towards a Global Framework for Civil Aviation?" in Masson-Zwaan T. L. & Mendes de Leon P. M. J., *eds.*, ***Air and Space Law: De Lege Ferenda Essays in Honour of Henri A. Wassenbergh*** (The Netherlands: Martinus Nijhoff Publishers, 1992) 43 at 46.

[29] ***Supra***, note 11.

[30] Hartl G., "Embrace Satellite Technology"[September 7-13, 1992] ***Commercial Aviation News*** 36 at 36.

economical ATC in the future can be guaranteed only through the adoption of ICAO's CNS/ATM concept.[31]

We are witnessing a progressive interaction between aviation and space technology. This will benefit the aviation community enormously once the technical, political, economic and legal difficulties that are facing the new CNS/ATM systems are resolved. As the President of the ICAO Council indicated:

> *"[t]he successful implementation of the future air navigation system on a world-wide basis will improve the use of airspace, increase the capacity of air traffic and airports, improve systems integrity and ensure better interchange of information between aircraft and ground centres. From an economic point of view, it will also offer efficiency and savings."*[32]

The ever-increasing aviation globalization will require a flexible imagination and a strategy that will integrate and harmonize techniques and services, which otherwise would be too costly to implement and operate.[33] This writer believes that civil aviation is an indispensable part of the world economy, and is essential to the world community. Hence, its scope and importance will continue to increase in the future. It is important that the entire world work together to achieve a reliable strategy for international air navigation.

Looking to the immediate future, air transport will demand modern styles of global harmony.[34] The need for innovative thinking is more prominent than ever before. While the technical issues have been solved, the institutional and legal framework of the new systems has not yet been determined by the States. The implementation of satellite systems requires financial resources and a highly developed technology base, which exceeds the capabilities of any single country. Technically, satellite systems are

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[31] Eser O. G., "Alleviating Congestion Key to Securing the Future of Civil Aviation" [September 7-13, 1992] ***Commercial Aviation News*** 35 at 35; see also, Fisher, ***supra***, note 19, at 15.

[32] Kotaite A., "Satellites for Safety: ICAO Introduces the Future Air Navigation System"[8/91] ***ICAO Doc. E/P1/5000 1***, at 14.

[33] Krull, ***supra***, note 11, at 6.

[34] Sochor, ***supra***, note 13, at 220*ff*.

extremely complex and sophisticated. The implementation of the CNS/ATM systems will be very costly. Planning and use of the new systems must be at the global level because of the coverage capability of satellite systems. That coverage will extend over several Flight Information Regions (FIRs), national boundaries and even ICAO regional air navigation classifications. States have no alternative but to join their efforts at the regional and global level. There is also the need to harmonize systems and airspace into a virtual global ATM system, and to use limited and expensive resources in a global manner. It seems obligatory to adopt a global view which requires the cooperation and goodwill of all nations.

Furthermore, the systems will require different institutional and legal regulations depending on whether they will be operated on a national, regional or global level. Although various systems providers might offer different systems, it is necessary that the systems remain compatible to preserve harmony and to eliminate market monopolies. Consequently measures must be taken to interconnect the systems. However, the choice of the essential technology to be used must rely on the standards decided in advance by a global authority; ICAO appears to be a most logical focus of such authority.[35]

The prospect of providing aeronautical CNS services by satellite is one of the most fascinating aspects of civil aviation. It is an issue that combines problems of airspace with those of outer space and requires consideration of these two fields of law.[36] The use of satellites for civil aviation purposes can be considered a further step towards the integration of the principles of air and space law. The growing space technology creates complex social relations requiring innovative legal regulation both at the domestic and international levels.

Materials gathered and examined in this thesis, principally a legal study, are intended to make the legal obstacles to the current air navigation system easier to understand. The main purpose of this thesis is to find a legal basis for the implementation of the aeronautical CNS/ATM systems, as the lack of an institutional framework is a

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[35] *Infra*, Chapter III, at P. 123*ff*.

[36] Khan, *supra*, note 28, at 43.

substantial problem facing the future systems. Additionally, this thesis attempts to reconcile the possible conflict between the civil aviation ATC services needs, and sovereign rights of nations. A detailed, but not exhaustive, description of the technical aspects of the CNS/ATM systems is provided, and is specifically intended to give the legal community an understanding of the context in which the problems arise. A comprehensive analysis of the institutional and legal aspects relevant to the subject from international telecommunication law, public international air law, and the law of outer space points of view is given to evaluate the adequacy of the present international regime, and to highlight the need for new regulations. National law has been left outside the scope of this thesis.

The manuscript, of course, does not claim to be the last word on this subject; nor is it an exhaustive examination of the technical, political, or economic difficulties facing CNS/ATM systems. Attention is given to some of the major changes that are expected in the years to come. The CNS/ATM systems are technically feasible and they promise to be cost-effective if implemented on a global basis. The world community must determine the appropriate institutional and legal framework to implement the CNS/ATM systems and to safeguard its harmonious operation. This thesis represents a modest contribution in response to that challenge.

Part I

The Current Air Navigation Systems

Chapter I: The Limitations of the Present CNS and Unfulfilled Air Navigation Needs of Civil Aviation

Introduction

The current air navigation systems, having served aviation well for over sixty years, have inherent drawbacks and are not efficient enough to meet the emerging demands of civil aviation.[1] In the early 1980s, it became clear to ICAO that the present CNS systems would have difficulties dealing with the CNS needs of future air traffic, even though data transmission has become faster, due to telephone, computer, fax machines and satellite. As Prof. Milde has stated: "*[a]viation in the 1980s is based on advanced high technology that appears to reduce the importance of the human element, human judgment and human error.*"[2]

Civil aviation is about to enter the twenty-first century in a world that is politically and economically interdependent.[3] As air traffic multiplies, congestion on the ground and in the air, increase the strain on ATC systems at most of the world's major airports. Because airport and airspace congestion are intertwined, a delay in one causes

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1 Interview, "Philippe Rochat: ICAO has a Spirit of Renewal"[1/92] *IATA Review* 5 at 6.

2 Milde M., "Legal Aspects of Future Air Navigation Systems"(1987)XII *AASL* 87 at 87.

3 There are more than a dozen common markets today, *inter alia*, USA-Canada Free Trade Agreement, USA-Canada and Mexico Free Trade, European Free Trade Association (Austria, Finland, Iceland, Liechtenstein, Norway, Sweden and Switzerland), the Economic Integration of the European Community (12 member States), Asian Pacific Economic Cooperation (Indonesia, Malaysia, Philippines, Singapore, Thailand, Australia, Canada, Japan, South Korea, New Zealand and United States), Economic Cooperation Organization (Iran, Turkey, Pakistan, Azerbaijan, Kyrgyzstan, Uzbekistan and Turkmenistan); see, Silverberg D., "Regional Trading Blocs Emerging Throughout the World"[March 30-April 5, 1992] *Space News* 15 at 15.

a delay in the other.[4] Furthermore air traffic congestion is a serious political subject[5] at most airports.[6]

States are required under Article 28 of the Chicago Convention to provide radio services and other air navigation facilities for international air navigation; that is restricted to the State's own territory and is further limited to what the State may find practicable. Indeed, States often prefer to provide their technical systems for the aviation infrastructure throughout their areas of responsibility. While this had a technical rationale in the earlier days of aviation, it has disadvantages in modern times particularly where the FIRs are small or follow boundaries of national jurisdiction. Some States cannot provide the fundamental services that the increased traffic in their FIR requires.[7] In addition, the individual FIRs usually cover small geographic zones, with limited or ineffective inter-FIR communications. This increases the cost and operational difficulties of flights traversing FIRs, and increases the cost of ATC services. Even when adequate services and communication are provided, the charge of furnishing these services is often higher than in traffic-related control zones or larger FIRs.[8]

By far the most urgent difficulties today facing the air transport industry concern congested airspace and airport *gridlock*. This affects the busiest air routes in North America, Europe and the Asia/Pacific region.[9] Additional attention is being paid to the last two regions because present traffic growth rates show a looming crisis if urgent action is not taken. IATA established the *IATA Congestion Task Force* in 1988, to examine the issues from a technical point of view. The principle task was to recognize

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4 "Airspace Congestion - Any Solutions?"[July 1989] ***Slipstream*** 19 at 19.

5 ***Infra***, Chapter VII, at P. 268*ff*.

6 ***IATA Scheduling Procedures Guide***, 13*ed*., July 1992, at 1.

7 "***Future Air Navigation System***" (Montreal: by Members and Observers of the FANS's Committee, ICAO, September 1991) at 7.

8 ***ICAO Doc. 9458, FANS/2***, at 1-3.

9 Sochor, ***supra***, General Introduction, note 13, at 27.

obstacles, and to come up with practical solutions to enable governments, airports and airlines to overcome them.[10] The work of the Task Force was conducted through its European and Asia/Pacific regional groups.[11]

Unfortunately, in the past, economic downturns were used as an excuse to postpone the vitally needed investment and training of staff necessary to cope with long-term traffic growth. Now the price is being paid by everyone from consumers and airlines to airport operators and ATC. The delays,[12] congestion and *gridlock* on the ground and in the skies have been caused by insufficient investment in the infrastructure.[13] This affects the nations' economy as a whole by threatening jobs and disrupting the lives of millions of people. The mechanisms of the existing ICAO regional air navigation plans, and ICAO assistance seem less than adequate in many parts of the globe, because of lack of funding in various situations, the shortage of trained specialized engineering staff, upkeep, and operational methods in many parts of the world.[14] This has resulted in serious problems often having safety and financial implications for both the providers and users.

In the following, Section I of this Chapter addresses the impact of the problems facing the current CNS systems, and Section II illustrates the differing types of technical drawbacks which confront them.

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[10] See more details, "Areas Requiring Government Action as Identified by Task Force on Airspace and Airport Congestion"[June 1989] ***The Controller*** 9.

[11] Review, "Congestion Threatens Asia/Pacific Growth"[2/92] ***IATA Review*** 10 at 10; see also, "Congestion"[1991] ***IATA Annual General Meeting Report*** 9.

[12] The weather is often cited as being the biggest cause of delays, both on the ground and in the air, also technology to better predict and depict severe weather is one key to reducing delays; see more details, Haines B. Th., "Radar Returns"[April 1991] ***AOPA Pilot*** 65.

[13] Meredith J., "Air Traffic Congestion can be Beaten"[2/1991] ***Airport Forum*** 12 at 12.

[14] *ICAO Doc.*, ***supra***, note 8, at 1-2; see also, Al-Ghamdi S. A., "Alternative Approach to Implementation of CNS/ATM Systems Would Impose User Charge"[April 1993] ***ICAO J.*** 19 at 19.

Section I: Problems of the Present Communication, Navigation and Surveillance Systems

As already mentioned, there are major problems affecting civil aviation, both in the air and on the ground. In the skies, ATC and the development of effective air traffic corridors have lagged far behind the expansion of air travel. The results are delays, congestion at airports where aircraft are awaiting takeoff clearance, and heavy additional costs to customers, airlines and airport operators. On the ground, many airports have been unable to upgrade and expand their facilities to keep pace with the rising demand for air transport services. High traffic growth, restrictive government policies, environmental constraints, capacity limitations of the current air navigation systems, and a shortage of money all play a role in the problems facing aviation.

In order to examine the problems associated with the current CNS systems, some aspects which have critical impact and contribute to the present systems' problems, *inter alia*, scheduling, fleet composition, noise restrictions, industry task force and aeropolitical events, will first be addressed. Then, selected problems facing the systems today, including increasing air traffic delays, airspace and airport congestion, increasing costs for passengers and airline operations, and insufficient system capacity to meet the traffic demand,[15] are covered.

A. Selected Aspects have Critical Impact on the Present CNS Systems Problems

1. Scheduling

As demand grows, various airports are approaching or exceeding their planned capacity. Today, the number of congested airports is increasing so much that negotiation of schedule adjustments to meet airports capacity restrictions outside the United States of America (USA) is becoming a principal task of IATA members. Another aspect of this

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[15] *"Symposium on Future Global Communication, Navigation and Surveillance "CNS" Systems"*, Montreal, September 4-5, 1991, ***ICAO Doc. SYM-IP/1***, at 1.2-6.

problem pertains to slot allocations at busy airports in the USA and Europe. It is becoming more difficult every year to adjust schedules to meet everyone's needs.

Many other administrative and technical scheduling problems need to be settled worldwide. These problems include inadequacies in both aircraft movement capacity, and the number of arrival and departure gates and aircraft parking positions at international airports. There is also a lack of adequate means to expedite the processing of passengers through government checks such as security, immigration, customs and health which sometimes worsen due to lack of funds and staff. Frequently there is inadequate coordination between the various authorities involved in easing traffic flow at the airports and through airspace. Therefore, there is a need for improvement in the management and coordination of existing resources in order to expand airport capacity.[16]

Additionally, airline schedules should be more realistic and recognize that not all aircraft can go to the same destination at the commercially preferred time without causing difficulties. ATC authorities may need to be involved in the development of the schedules. Competition between airlines is, of course, behind this situation but it creates side effects which airlines should be aware of.[17] To conclude, schedule adjustments cannot be changed on an intra-national basis, since they involve two or more airports usually located in different countries. This means that congestion difficulties can be settled only on a multilateral basis, and in an environment of collaboration.[18] However, it should be kept in mind that even though traffic growth exceeds the rate of development of facilities, the resolution of congestion difficulties can be accomplished.[19]

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16 Eser, *supra*, General Introduction, note 8, at 26.

17 Domogala Ph., "Smoothing the Flow to Ease Congestion"[July/August 1992] ***Jane's Airport Review*** 29 at 33.

18 Sochor, *supra*, General Introduction, note 13, at 2.

19 *Ibid.*, at 11.

2. Fleet Composition

The changing fleet combined with an increase in aircraft size contributes to congestion. In the 1960s and 1970s, the increase in airline traffic demand at high density airports was dealt with by the introduction of wide-bodied aircraft with larger passenger capacity.[20] This approach did temporarily avoid expanding airspace and runway capacity obstacles.[21] In the last decade, this trend had stopped or reversed. The outcome is that more traffic may generate more individual aircraft movement, with increased runway and terminal demand.

Liberalization[22] and perceptive airline competition are principal considerations leading to modern means in fleet competition. The entry into service of the latest wide-bodied aircraft, which can fly very long nonstop flights is another consideration for future planning.[23] In Europe, the use of wide-bodied twin-engine aircraft during the peak periods on busy routes will continue to increase. Also the tendency on intra-European routes is for the number of aircraft, and hence operations, to increase more in line with expectations of passenger demand.[24] Airports are also facing difficulties due to the sheer size of the wide-bodied aircraft. While they represent a lower ratio of entire aircraft movements than the smaller types, they create obstacles on aircraft stands and taxiways because of their larger wingspan.[25]

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20 Eser, ***supra***, General Introduction, note 8, at 27*ff.*

21 The wide-body aircraft solution would also avoid increasing the number of ATCs, pilot employees, occupations which are already in short supply, and forecast to worsen; see, Smith R., "The Impact of Airport and Airspace Congestion on Pilots and Controllers"(June 1989)14 ***IFALPA Quarterly Review*** 4 at 7.

22 ***Infra***, Chapter VII, at P. 292*ff.*

23 Eser, ***supra***, General Introduction, note 8, at 27*ff.*

24 Sutton O., "Euro-ATC Stops Dragging Its FEATS"[2/1990] ***Interavia Aerospace review*** 123 at 124.

25 Eser, ***supra***, General Introduction, note 8, at 27*ff.*

3. Noise Restrictions

Aircraft noise is considered to be the dominant environmental air transport issue. It is felt to have harmful effects on individual health and comfort, and is a burden on the world economy.[26] It is a problem for airlines due to airport curfews, and other operating limitations that result from aircraft noise.[27] The key development in the international efforts to reduce aircraft noise was the adoption of *Resolution* A28-3 at the 28*th* Session (Extraordinary) of the ICAO Assembly, in October 1990. This allows States to introduce restrictions, beginning on April 1, 1995, on the operation of aircraft to meet the certification standards specified in "Chapter 2".[28] The resolution also provides for the gradual phasing-out of such aircraft over a seven year period ending April 1, 2002 (exemptions from phase-out between 1995 and 2002 were agreed for Chapter 2 aircraft and for aircraft fitted with high bypass ratio engines).[29]

The airline industry recognizes that noise is a problem, particularly around major airports.[30] The need for airport curfews and other operating restrictions are a consequence of aircraft noise. Also, it is major problem for airline operators.[31] Concurrent with the required reduction in noise, the worldwide air transport industry is

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26 See more details, "The Noise Around Us"[February 1989] ***ISO Bulletin*** at 6.

27 Ghonaim M., ***The Legal Aspects of Aviation Finance in Developing Countries*** (LL.M. Thesis, McGill University, 1991)[unpublished], at 129.

28 ***Annex 16***, *"Environmental Protection"*, to the Chicago Convention, *vol.* II Aircraft Engine Emissions, First *ed.*, 1981; *vol.* I - Aircraft Noise, 2*ed.*, 1988.

29 Ghonaim, ***supra***, note 27, at 129*ff*; some States began to put into effect national or regional restrictions on future operations of Chapter 2 aircraft. In June 1991 the European Civil Aviation Conference adopted a recommendation, calling on member States to introduce such restrictions progressively, commencing in 1995. In September 1991 USA published rules aimed at phasing out Chapter 2 operation at USA airports, ***ICAO Doc. 9581, Annual Report of the Council-1991***, at 2.

30 The fact is that the portion of the population suffering from aviation-generated noise is small when compared to those benefitting from air travel. However, appropriate zoning of land around airports, both new and existing should be established and, no new noise-sensitive activity should be allowed too close to the airport boundary.

31 Eser, ***supra***, General Introduction, note 8, at 28.

expanding dramatically. Noise reduction requirements are preventing the expansion of the capacity at some airports, and is therefore contributing to airport congestion.[32] In this writer's opinion, any excessively exacting noise regulations will increase the financial burden of the airlines of Less Developed Countries (**LDCs**) and will weaken their competitive position and ability to finance the CNS/ATM avionics equipment which is one of the major issues in implementing the new systems.

4. Industry Task Force

The IATA technical conference of September 1987, studied the demands on, and capacity of, the air navigation systems.[33] It was agreed that plans for construction of new runways and new terminal facilities will not bring any great improvement in congestion for the immediate future. The only hope for a *short-term* decrease is better use of available facilities.

It is possible to add to airport capacity, by way of extra runways, but these have not always kept up with aviation growth.[34] New runways at existing airports cannot be expected to solve airport capacity problems, but will undoubtedly ease the current situation.[35] Disruption of schedules affects ground operations, passenger handling and contributes to airport terminal congestion. This is causing general inconvenience to the travelling public and harsh economic consequence for the airlines. Some idea of these consequence was provided in a study made by *Lufthansa*. During 1987, their airliners spent a total of 5,200 hours in holding patterns over Frankfurt, Munich and Dusseldorf alone, an increase of 2,500 hours over the previous year. The cost of the time and fuel

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32 ***ICAO A29-WP/40***, at 2.

33 Review, ***supra***, note 11, at 10.

34 SYM-IP/1, ***supra***, note 15, at 6-4-1*ff*; see also, Nagid G., "Parallel Runway Operations are the Key to Increasing Airport Traffic Capacity"[September 1988] ***ICAO Bulletin*** 24.

35 Meredith J., "The Cost of Congestion"[February 1992] ***Airport Support*** 13 at 15.

wasted was US $29 million. These figures for just one airline at only three airports, hint at the importance of the problem worldwide.[36]

Other attempts underway at ICAO to expand airport capacity to include better surface guidance and control measures include the introduction of the Airborne Collision Avoidance Systems (ACAS), and reducing the existing minimum distance between parallel runways. These are not enthusiastically embraced by pilots, environmentalists, ATC or by people who reside near airports.[37]

5. Aeropolitical Changes Events

Parallel with the problems of systems congestion, political changes are occurring in Europe and LDCs. The political changes in Eastern Europe and the former Soviet Union, and the attempt to establish free market economies in Eastern and Central Europe, will permit increased cooperation with North Atlantic Treaty Organization (NATO) countries and should reduce the adverse impact of special use airspace in Europe.[38] These changes not only open up new markets but also present new regulatory challenges. These shifts will affect the development of the air transport industry and its regulatory framework on a global basis.[39]

European airlines perceive the need to build stronger alliances between themselves. This is to meet the competitive challenge created both by the mega-carriers, which have emerged from deregulation in the USA, and the strong Asia/Pacific airlines. Airlines in the South East Asia/Pacific region are moving in a similar direction. The LDCs' airlines find themselves in a difficult situation as a result of these changes. The answer for the LDCs lies, at least partially, in improved cooperation between their carriers. There are many areas in which the LDCs' airlines could profit from joint

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[36] Eser, ***supra***, General Introduction, note 8, at 32.

[37] Smith, ***supra***, note 21, at 6.

[38] Bauerlein J., "Effects of International Political Developments on the Globalization of Air Traffic Control"[December 1991] *J. ATC* 18 at 18*ff*.

[39] Eser, ***supra***, General Introduction, note 8, at 33.

schemes to improve efficiency and decrease costs, such as the creation of powerful regional airlines. In this writer's opinion, the current European integration as well as American and other *mega-carriers*, mean that the LDCs airline cooperation is a necessary means of survival.

At the ICAO Worldwide Air Transport Colloquium (WATC)[40] there was universal consensus that any change to a new multilateral system would be gradual and evolutionary. There was no agreement on what role ICAO should play. At the WATC, some delegates believed that ICAO should develop a model plurilateral agreement for groups of like-minded States. The American delegation, led by J. Shane,[41] saw a more limited role: *"ICAO will be important for security and safety regulations, but if it moves into aeropolitics and economic relations among States, the US could have some trouble with that. ...*"[42]

Capital markets expect to have a growing influence on the way air transport will develop from the kind of aircraft that will be built, to the way they will be sold or leased. They may also have a growing influence in airline management decisions and strategies. This will force the smaller airlines to become part of regional groupings that can pool airline operations and negotiate traffic rights.

Looking to the immediate future, the increase of air transport on the global scale, with ever-increasing traffic densities involves problems that must be solved through new multilateral mechanisms. As a first step, States must settle on the management of a global navigation system that satisfies the needs of the aviation community without limiting it. In the *long-term*, States will be confronting responsibilities of much greater political

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[40] Proceedings of the, "*ICAO Worldwide Air Transport Colloquium*", Montreal, April 6-10, 1992.

[41] Jeffrey Shane: the former US Assistant Secretary for Policy and International Relations, Department of Transportation from 1989 to early 1993.

[42] Shane J. as cited in Katz R., "ICAO Montreal Colloquium: The Future of Air Transport Regulation"[June 1992] ***IFALPA Int'l Quarterly Review*** 10 at 16.

significance for sovereign rights, *inter alia*, allocation of air traffic control and airspace management.[43]

B. Selected Problems Associated with the Present CNS Systems

1. Increasing Air Traffic Delays

At major airports, delays prevent aircraft from taking off and arriving at their destinations on time. In the high-density airspace, the number of delays has increased year after year. On an average day there are roughly 10,000 flights in the European region, increasing to over 12,000 on peak days. For flights operated by members of the Association of European Airlines (AEA), one passenger in four experiences departure delays of over 15 minutes on international routes.[44] In some views even when traffic is substantially reduced, ATC delays still occur at unacceptable levels in many airports. This suggests that the ATC networks are unable to cope with demand in many parts of the world.[45] The USA Federal Aviation Administration (FAA) estimated in 1989, that the average delay on scheduled flights was 16.6 minutes. This produced a total delay of 1.74 million hours representing the effective use of nearly 500 aircraft for an entire year.[46] In 1990, twenty-three USA airports exceeded 20, 000 hours of airline flight delays. Also, a study by the FAA predicts that by the year 2000 this figure could grow

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[43] ***Infra***, Chapter VI, at P. 184*ff*.

[44] Sutton, ***supra***, note 24, at 123.

[45] Meredith, ***supra***, General Introduction, note 9, at 43*ff*; also, in some view that there are options for reducing air traffic delays in the region such as: *"capacity figures on all ATC sectors in Europe should be reviewed using a commonly agreed method; airspace should be redesigned to produce immediate increases in capacity; legal status should be given to ATFM restrictions by, for example, making the slot time, the routing and the destination an integral part of the ATC departure clearance; and airline schedules should be more realistic... ATC authorities should perhaps be involved in scheduling to regulate this."*; see more details, Domogala, ***supra***, note 17, at 33.

[46] Review, "The Economic Benefits of Air Transport"[1/92] ***IATA Review*** 10 at 11.

to 40, 000 hours unless there are capacity improvements.[47] These delays increase expenses, waste fuel, and decrease efficiency.

2. Airspace and Airport Congestion

The airlines face large direct and indirect costs from airway and airport congestion, according to a study carried out for IATA by the Stamford Research Institute (SRI) International.[48] It is important to keep in mind that airspace congestion and the number of navigation errors that occur every year increase the potential for collision. The problem is even more critical in a region where large zones of the airspace are reserved for military use as prohibited, restricted, danger and other areas. In the worldwide context, air forces have staked out extensive areas of the airspace. Commercial traffic is forced into restricted passageways, restricted altitude options and parallel airways.[49]

The separation of civil and military traffic leads to the allocation of large portions of airspace to military operations.[50] In addition, the shortage of liaison and close harmony between civil air traffic services and relevant military operational control/air defence units, poses critical safety hazards on certain routes.[51] Because States are fiercely protective of their sovereign rights and national interests,[52] there is no doubt that much of the politics of international aviation has revolved around manipulating their

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[47] Lopez R., "Satellites are Key to Reducing Runway Separations"[November 1992] ***Jane's Airport Review*** 41 at 42; see, "Airline Group Reports ATC Delays Cost Carriers $2 Billion in 1987" [May 30, 1988] ***AW&ST*** 124; see also, Martin M., "The Fuel Factor: Air Traffic Special" [February/March 1992] ***Aeronautical Satellite News*** 12.

[48] Woolley D., "Costing Congestion: Air Traffic Special"[February/March 1992] ***Aeronautical Satellite News*** 11 at 11.

[49] Sochor, ***supra***, General Introduction, note 13, at 91.

[50] Sutton, ***supra***, note 24, at 124.

[51] ***ICAO AN-WP/5962***; the two such trouble spots in the world have been the Far East and the Gulf area, where, in a constantly shifting political climate, it has not been easy to devise alternate routings.

[52] ***Infra***, Chapter VI, at P. 192*ff*; Chapter VII, at P. 268*ff*.

airspace.[53] Consequently, the airspace available to civil air traffic is insufficient for its needs because of inadequate airspace design and management. The future airspace structure must satisfy the commercial air transport, general aviation and military aviation demands with an appropriate allocation of priorities.

Flexibility in the use of airspace is required so that all users can gain maximum economy in their operations with minimum constraints. Although it is certain that airspace occupancy rates will increase in the future as a result of using the new CNS/ATM systems, the number of navigational errors must decline, otherwise collision hazards will escalate. Navigational mistakes caused by human error are[54] the major cause of catastrophes in aviation operations[55] according to a 24-year study by the Boeing Company.[56] As the IATA General Director told delegates at IATA's 45*th* Annual

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[53] Sochor, ***supra***, General Introduction, note 13, at 107.

[54] For a variety of reasons, pilots either are incapable of detecting, or are likely to ignore, serious navigational mistakes. Crashes with the ground or intrusion into restricted airspace are the consequence; see, ***ICAO FANS/1-WP/15***, at 12; typical errors that occur in routine cockpit operations include the misreading of navigation charts because of small size print, poor ambient light, or the need to calculate a reciprocal course; one of the most common errors is miscommunications with the ATC or other members of the crew. This is often due to a noisy cockpit environment, attention diverted to another task, or inattention to radio traffic. Speed is another characteristic that changes the complexion of cockpit operations. Increased speed reduces the time required to accomplish a task and imparts an element of urgency to decision-making. The multiplicity of tasks demands during complex operations, such as takeoff, climb, descent, approach or landing, creates pressure that can result in common errors. It may also be due to weather factors outside the cockpit or methods of aircraft operation recommended by the manufacturer and modified by the individual airline; see, "Dick" Stone R. B., Sorsa M. & Frioh L., "Beyond Pilot Error: A Pilot's Perspective"(June 1990)18 ***IFALPA Quarterly Review*** 16 at 17*ff.*

[55] Eser O. G., "The State of the Industry"[June 1989] ***The Controller*** 8 at 8; see also, Lauber J. K., "Human Performance and Aviation Safety - Some Issues and Some Solutions"(September 1989)15 ***IFALPA Quarterly Review*** 27 at 27.

[56] ***Boeing Commercial Airplane Company*** (1985), "Statistical Summary of Commercial Jet Aircraft Accidents, Worldwide Operations, 1959-1985"; many observers of aircraft accident statistics report a similar proportion of accident causes attributable to the human crew; see more details, Nagel D., "Human Error in Aviation Operations" in Wiener E.L. & Nagel D.C., *eds.*, ***Human Factors in Aviation*** (USA: Academic Press *Inc.*, 1988).

Meeting in Warsaw, Poland, the major reason of accidents is human error.[57] For instance, the American National Transportation Safety Board concluded that a cause of the crash of a Delta Air Lines airplane on August 2, 1985,[58] was the shortage of regulations or procedures for escaping low-altitude wind-shear and a lack of definitive real-time, wind-shear hazard data.[59]

Another example is the 1973 Libyan Boeing 727 incident[60] where the aircraft mistakenly entered forbidden airspace in the midst of a sandstorm which had grounded all commercial flights in the region. The tragedy occurred because of the Egyptian ATC center's series of failures and limitations.[61] Also, the 1983 Korean Airlines KAL-007 incident[62] shows that the military and civil ATC coordination that was presumed to have existed on the North Pacific Route System (NOPAC) did not exist at the time of the tragedy. As one commentator[63] notes, if the system had worked on the night of 31 August-1 September 1983, the tragedy of flight KAL-007 would not have occurred.

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57 Eser O. G., "IATA 45th AGM Roundup"[4/89] ***IATA REVIEW*** 3 at 5; the most aviation accidents result from the interplay of a variety of factors which are, among others, weather, technological limitations, and several human factors which do not only involve the crew members.

58 On August 2, 1985 Delta Air Lines Flight 191, a Lockheed L-1011, crashed while approaching runway 17L at the Dallas/Ft. Worth International Airport, of the 163 persons on board, 134 were killed, 26 passengers and three cabin attendants survived; for details see, "Safety Board Cites Limitations of Airport Weather Surveillance"[January 12, 1987] ***AW&ST*** 113 at 113.

59 ***Id.***; see also, "Board Cites Limitations of ATC's Ability To Prevent Collisions in Cerritos Crash"[January 18, 1988] ***AW&ST*** 46 at 51.

60 The 1973 Libyan Boeing 727 aircraft, was downed by Israeli fighters over the Egyptian Sinai desert on February 26, 1973, cost the lives of the 106 passengers and three French crew members; for further details see, Sochor, ***supra***, General Introduction, note 13, at 134.

61 ***Id.***

62 The Korean Airlines "KAL-007" incident, in which 269 passengers and crew were killed, on September 1, 1983; for details see, Richard G., "KAL 007: The Legal Fallout"(1984)IX ***AASL*** at 147; see also, Fitzerald G. F., "The Use of Force Against Civil Aircraft: The Aftermath of the KAL Flight 007 Incident"(1984)XXII ***The Canadian Year Book of Int'l L.*** at 291.

63 Sayle M., "KE007: A Conspiracy of Silence"[April 25, 1985] ***New York Review*** at 46*ff*.

However, the tragedy led to significant amendments of several Annexes to the Chicago Convention.[64]

These incidents clearly could have been avoided by alerting the *cockpit* crew about the route deviation. This cannot be done with today's systems, which have reached their limit, and are based on World War II technology. To reduce errors and incidents, it is necessary to confirm the reliability of the technology and its ease of use before it is put into operation.[65]

3. Increasing Costs for Passengers and Airline Operation

Flight delays and system inefficiencies are costly to both airlines and passengers.[66] Therefore, with an airline operating at best on narrow profit margins, these expenses must be passed on to the consumer.[67] In 1988, economists estimated the value of passengers' lost time because of flight delays at almost US $540 million in the European region.[68] In Europe, the SRI has estimated the annual cost of congestion at US $5 billion. By the turn of the century this will rise to US $10 billion.[69] The SRI forecasts that constraints on aircraft movements in Europe will mean a loss of 95,000 flight hours by 1995 and 200,000 flights hours by the year 2000. These are just the direct costs, without considering commercial and industrial related losses.[70] In other parts of the world the situation is equally alarming: in the USA, airlines recorded losses related

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[64] *ICAO AN-WP/5580.*

[65] Learmount D., "Separate Ways"[June 19-25, 1991] ***Flight Int'l*** 44 at 45.

[66] The consequence of delays mean that more aircraft are required to serve the same level of demand; therefore, will be additional operating costs, extra fuel, extra salaries, and extraordinary maintenance *etc*.

[67] Review, ***supra***, note 46, at 12.

[68] *ICAO FANS (II)/2-WP/79*, at 4.

[69] Eser O. G., "Alleviating Congestion Key to Securing the Future of Civil Aviation"[September 7-13, 1992] ***Commercial Aviation News*** 35 at 35.

[70] Meredith, ***supra***, note 35, at 13; see also, Woolley, ***supra***, note 48, at 11.

to delay of $2 billion in 1990.[71] ICAO figures for the world's scheduled airlines in 1990 show the scale of the sums involved; flight operations and engineering costs totalled $77.5 billion, for an average across all types of operation of about $3,330/*hr*. These direct costs amounted to about 40% of total operating costs.[72] Also, the cost of delays and inconvenience are increasing; therefore solution to delays and congestion become ever more appealing to decision-makers.[73]

The necessity for competent cost-effective operations makes the provision of fuel-efficient direct routing to users of the airspace necessary whenever practical.[74] Air traffic congestion costs aviation and its host economies an estimated $5 billion a year. It is presumed that this will rise to $10 billion by the end of the decade.[75] In terms of cost impact on a single country's economy an inefficient air transport system is a drag on productivity and competitiveness of the country.[76] Air transport is an economic motivator because it provides a new and faster mechanism for distributing goods and services which in turn contributes to industrial growth and increased economic efficiency.[77] Yet, the economic benefits of aviation can only be realized if the industry can meet the demands placed on it.

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[71] The aircraft 747-400 idling on the taxiway, engines running, waiting for clearance to enter runway and take-off, it is a source of frustration for the passengers on board. It would burn fuel worth at least $900 for 40 minuets on ground; for more details see, Martin M., "The Fuel Factor: Air Traffic Special"[February/March 1992] ***Aeronautical Satellite News*** 12 at 12.

[72] Woolley, ***supra***, note 48, at 11.

[73] Poritzky B. S., "Achievement of More Airport Capacity - The Time for Action is Now"[January 1989] ***ICAO Bulletin*** 12 at 12; for more details see, Lopez R., "Satellites are Key to Reducing Runway Separations"[November 1992] ***Jane's Airport Review*** 41 at 42; see also, "Airline Group Reports ATC Delays Cost Carriers $2 Billion in 1987"[May 30, 1988] ***AW&ST*** 124 at 124.

[74] Poritzky, ***id***.

[75] Verchere I., "Satcoms Slow to Capture Audience"[February 1992] ***Interavia Aerospace Review*** 38 at 39.

[76] SYM-IP/1, ***supra***, note 15, at 1.2-2.

[77] Review, ***supra***, note 46, at 11.

4. Insufficient System Capacity to Meet the Traffic Demand

The air transport industry has responded to tremendous increases in demand by investing massively in modern technology, larger, fuel-efficient and quieter aircraft, and improved safety levels. Regrettably, these investments are not matched by government investment in airport infrastructure, ground transport and ATC systems. The industry cannot compromise on safety levels which restrict traffic. This has led to congestion, delays and higher costs for airlines, passengers and freight shippers, and directly jeopardizes the economic benefits of commercial aviation to the world economy.[78] Congestion, delay and higher costs threatens to become the norm. In a commentator's[79] view:

> *"[t]he main problem is that traffic demand considerably exceeds the available capacity of the ATC system and the airports. Both are not able to cope with the high throughput of traffic, thus resulting in airspace congestion."*

The SRI study commissioned by IATA showed that in Europe, the number of air passengers will double by the year 2000, and triple by 2010.[80] No amount of harmony and integrating of the current systems will, by itself, produce sufficient ATC capacity to deal with that kind of growth.[81]

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[78] *Id.*

[79] Leopold W., "Shortcomings, High-Density Regions", *SYM-IP/1*, *supra*, note 15, at 1.2.1.

[80] "Congestion Threatens Industry Growth"[4/89] ***IATA Review*** 9 at 9*ff*; see also, review, "SRI Report Updated"[5/92] ***IATA Review*** 14 at 14.

[81] Mack K., "Air Traffic Control: In Europe"[June 1992] ***IFALPA Int'l Quarterly Review*** 7 at 9.

Section II: Limitations of the Present CNS Systems

Although the above-mentioned systems[82] limitations are not the same in every part of the world, one or more of these limitations restrain the improvement of air navigation practically everywhere.[83] Having indicated the critical impact of some selected aspects on the present CNS systems, the following deals briefly with CNS substantial limitations.

A. Current Line-of-Sight Constraints

Most of the present limitations are restricted to radio propagation over line-of-sight. Although the present systems, *inter alia, VOR, DME, VHF COM, RADAR, SSR, ILS*,[84] contribute services that offer a high degree of reliability and accuracy, their limitations manifest themselves in the form of service area coverage and topographical location limitations,[85] and none of these fulfil the future aircraft requirement to permit coverage up to 70,000*ft* altitude on a global basis.[86] The range and contact below the visible horizon is restricted because of the earth's round shape and the fact that radio waves in the Very High Frequency (VHF) and Ultra High Frequency (UHF) range travel in a straight line. Over long distances, the curvature of the earth, the propagation limitation of the radio signals and other geographical features present problems. As a consequence of line-of-sight restrictions, the flexibility and the ideal utilization of the accessible airspace is restricted. Moreover, any future plan for optimizing the airspace

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82 *Supra*, General Introduction, at P. 5.

83 AN-CONF/10, *supra*, General Introduction, note 17, at 2A-1.

84 Even the second set of systems, *inter alia, LF/MF NDB, HF COM, LORAN, OMEGA*, also have accuracy and reliability limitations imposed partly by the variability of propagation characteristics, *ICAO Doc.*, *supra*, note 8, at 1-1.

85 *Id.*

86 Kaiser St., ***Legal Implications of Satellite Based Communication, Navigation, and Surveillance Systems for Civil Aviation*** (LL.M. Thesis, McGill University, 1990) at 13.

utilization is unimaginable because of the fact that some of the current systems have reached or are reaching the maximum of their accuracy and/or capacity.[87]

B. The Voice Communications Limitations and the Lack of Digital Air-Ground Data Interchange Systems

Generally, voice communication is carried out on VHF. In low traffic density and in Oceanic regions voice communication uses High Frequency (HF).[88] Ambiguity and misunderstanding are common and will persist, even with the effort to develop a common language and accurate pronunciations.[89] Voice communication does not allow for high traffic rates, and is subject to interference and noise. Voice systems are also labour intensive and present priority difficulties because entry to busy circuits is uncontrolled. As has been stated at the 10*th* Air Navigation Conference of 1991, up to eighty percent of all potentially hazardous incidents in USA involved ineffective spoken data transfer.[90] While the lower frequency systems such as *Decca* and *Loran-C*[91] are quite accurate at longer ranges, their reception is often ruined by atmospheric noise and static, particularly in the tropics and in summer. At night, sky-waves affect the resolution of these lower frequency systems at surprisingly short ranges. *Omega* is a Very Low Frequency (VLF) system, although nominally of worldwide coverage, it has problems with accuracy and

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87 *ICAO Doc.*, ***supra***, note 8, at 1-2.

88 Both frequencies have limited range, and distortions caused by atmospheric ionospheric conditions.

89 *ICAO Doc.*, ***supra***, note 8, at 1-4.

90 AN-CONF/10, ***supra***, General Introduction, note 17, at 3-8*ff.*

91 *Omega* has been used in long distance aircraft although it is not very accurate; both *Decca* and *Loran-C* also suffer from similar causes which called sky-wave interference but only at longer distances (300-500 miles) from the stations; for more details on *Omega, Loran-C* and *Decca*, see, Blanchard F. W., "Air Navigation Systems"(September 1991)44:3 ***J. Navigation*** at 284; see also, Pratt A. R., "An Overview of Navigation Systems in the 1990's" in Egan J. J., *ed.*, ***Space Commerce*** (N. Y.: Gordon & Breach Science Publishers S. A., 1990) 233 at 236.

is often ambiguous and noisy.[92] Additionally, they will never have worldwide coverage for economic reasons.[93] Although mobile HF communication allows "over the horizon" contacts, its transmission characteristic is poor since it is limited to voice only communication, and often transmissions are not clear.[94] The deficiencies of the existing systems arise from fundamental limitations of the radio propagation characteristics. Radio Aids to Navigation (**NAVAIDs**)[95] have reached their limits. Many of their problems, such as restricted range, inaccuracy, weather dependence, and propagation variability will be eliminated by satellite based technology.[96]

Air-ground communication is fairly satisfactory but for a few exceptions: shortage of coverage at low altitudes, and unreliable long distance communications.[97] Also, there are some difficulties in navigation and surveillance on the ground, and many accidents in aviation occur during ground operations of aircraft and equipment. Failure to observe rules of safety is certain to cause problems.[98] The foregoing when coupled with decreased ground visibility, caused by weather events, escalate ground collision hazards, increase probabilities of taxiing off-paved surfaces and decrease arrival/departure

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[92] Blanchard F. W., "The Future for Satellite Navigation"[1992] ***World Aerospace Technology*** 145 at 145.

[93] Kaiser stated in his thesis that: "*None of the present day CNS-systems meets the requirement of future aircraft to allow coverage up to 70 000ft altitude and on a global basis.*"; see for details, Kaiser, ***supra***, note 86, at 13.

[94] *ICAO Doc.*, ***supra***, note 8, at 1-4.

[95] It should be remembered that while the use of radio navigation aids can be very useful in following a specific course, they add to the pilot's workload, both mentally and manually. In emergency conditions of flying the aircraft by reference to flight instruments the pilot must divide his attention between control of the aircraft and the operation of the navigation equipment, which is often a difficult task even for an experienced crew; see more details, Federal Aviation Administration, ***Flight Training Handbook*** (N. Y.: Doubleday, 1980) at 188.

[96] Blanchard F. W., "Radio Navigation - The Outlook for Europe"(September 1992)45:3 ***J. Navigation*** 442 at 442.

[97] ***ICAO Doc. 9524, FANS/4***, at 2A-1.

[98] Federal Aviation Administration, ***supra***, note 95, at 5.

frequencies.[99] There is a need to improve ground navigation capability, and airport-ground surveillance and detection. Additionally, 70 to 80 percent of all hazardous situations which were reported in the USA Aviation Safety Reporting System (**ASRS**), involved ineffective information regarding movement, and most of the involved air-ground radio communication.

Communication problems include acoustic confusion, pilot *readback* mistakes, and controller *hearback* errors. Also, misinterpretation caused by poor pronunciation, failure to use standard terminology and improper radio keying techniques have the same effects.[100] These and natural barriers such as mountains, with the inherent ground-based line-of-sight CNS constraints make it practically impossible to enhance CNS usefulness in such regions as oceans, deserts, jungles and polar regions. Unless modern approaches are adopted, the current air navigation situation will not improve in the immediate future.[101]

In view of the foregoing, it is apparent that there is an enormous demand to introduce digital data communications, in order to increase data transfer rates, increase reliability and integrity, and improve spectrum utilization and more efficient interface to various systems.[102]

Concluding Remarks

Although ICAO has been developing regional air navigation plans, because of the lack of financing, lack of clearly justified and accepted needs and lack of trained technical personnel,[103] there are large regions of the globe in which States have been

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[99] *ICAO Doc.*, ***supra***, note 8, at 1-5.

[100] *AN-CONF/10*, ***supra***, General Introduction, note 17, at 3-9.

[101] ***Ibid.***, at 9-3.

[102] *ICAO Doc.*, ***supra***, note 8, at 1-4.

[103] These also include other natural obstacles as mountains, lake of availability of reliable primary power, lack of adequate frequency assignments, *etc.*

incapable of implementing or operating the system in an orderly way.[104] The foregoing shortcomings make it difficult to improve the capabilities of the current CNS systems and to operate them consistently in large parts of the world. As increasing coverage, reliability, and complexity is required, the systems become more expensive to maintain. The demands of the growth in aviation require substantial increases in the efficiency of the air navigation systems, both in airport and airspace capacity, otherwise there will be a dramatic increase in congestion.

Declining airport productivity and airspace crowding will be among the technical factors, along with economic, and management issues, confronting ICAO's air transport activities. Increases in the efficiency of airports and use of airspace are required to deal with growing congestion, and to adopt the best flight paths of aircraft to control costs.[105] However, there is some advancement potential for the existing air navigation systems. These possible interim developments[106] might improve the existing aeronautical CNS systems for the next decade, particularly in the areas of long range aircraft operations in the non-radar surveillance environment of oceanic, and distant land zones.[107] Furthermore, there is agreement within the aviation community that the above measures are not able to respond to the present needs of the aircraft operators. The FANS Committee decided that the restrictions of the existing systems are inherent to the systems themselves. Thus the problems cannot be overcome unless there are new ideas, and new CNS systems to support more capable ATM systems to be implemented on a global scale.[108] Also, the above shows that the current CNS technology has reached its outer limits in some regions of the world. In the other regions the services are lacking

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[104] *ICAO Doc.*, *supra*, note 8, at 1-2.

[105] SYM-IP/1, *supra*, note 15, at 6-4-1*ff.*

[106] The interim improvements consist of, *inter alia*, decrease of vertical separation standards at and above FL 290, automatic dependent surveillance, improved quality and presentation to controllers of traffic information on aircraft location and intent, ACAS, *etc.*

[107] *ICAO Doc.*, *supra*, note 8, at 1-5*ff.*

[108] SYM-IP/1, *supra*, note 15, at 6-4-1*ff.*

due to technical and economic reasons.[109] It is broadly recognized that it is beyond the power of any particular government, acting on its own, to remedy these deficiencies. Also, long term solutions must lie in improving, and increasing infrastructure facilities. Therefore, coordinated efforts among governments, airports, airlines, national and international institutions are an essential endeavour. Finally, it should be realized that the essential contribution of air transport to future economic advancement and employment relies upon a considerable amount of new infrastructure development.[110]

The world's present air transport services include a ground-based CNS system that is labour and capital intensive.[111] This restricts the prospects for substantial future global advancements. This has led to the conclusion that exploitation of satellite technology complementary to certain terrestrial systems, is the only practical response to fulfil the future necessity of civil aviation.[112] It becomes increasingly obvious that the future growth of air transport cannot be considered in isolation, particularly in the developed areas of the world. We have to keep in mind the social, environmental, economic, technological, and political costs of providing the expanded infrastructure which is required to meet the increased demand for air travel as we approach the beginning of the new century. Air traffic scenarios in different parts of the world contrast widely, and will continue to do so in the future. Therefore, new systems must be able to work with a diversity of traffic densities, types of aircraft, and avionics' sophistication, without leading to extreme diversification or proliferation of avionics and ground space segments.[113]

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[109] Park W.-H., "Satellite Application for Aviation Requirements"(1989)XIV:1 ***Air L.*** 17 at 18.

[110] ***Ibid.***, at 22.

[111] ***ICAO FANS(II)/2-WP/89.***

[112] Ostiguy G. J. N., "Potential Impact of FANS Far-Reaching and Positive"[December 1991] ***ICAO J.*** 7 at 7.

[113] ***Id.***

The international civil aviation industry will continue to change dramatically in the upcoming years, as the industry grows and new technology evolves. This offers the potential of fare decreases, and will further contribute to the industry's growth. Also, better automation technology will play a significant role in all aspects of the airline industry strategies and the marketing of services. As airports and airways are becoming increasingly congested, the aviation industry, governments, airlines and CNS service providers will be compelled to cooperate in order to fulfil the needs of the future.

CHAPTER II: Framework of the Existing Satellite Systems Institutions

Introduction

The technical possibilities and the economic benefits afforded by telecommunication satellites motivated a number of countries to establish organizations, both national and international, for the improvement and operation of satellite telecommunication systems for worldwide, regional, and domestic communication.[1] Telecommunication satellites have significant political implications. Consequently, it is not surprising that the prior political split of the world into blocs was reflected in the division of global telecommunication satellite organizations. Also distinct applications of space technology are prompted by creative ideas which have created new institutional frameworks for the service of mankind.[2]

One of the principal tasks of ICAO's FANS Committee was to study the appropriate institutional framework for the implementation of the new CNS/ATM systems.[3] It is M. Milde's[4] view, that while the FANS Committee was studying various institutional solutions existing outside ICAO's framework, it should have also considered the Chicago Convention's institutional framework as a model for the central management of the CNS/ATM systems. It is worthwhile to take a brief look at the current institutional structures as a base for any proposal for the institutional structure of CNS/ATM systems.

In the following, Section I addresses the selected existing aeronautical mobile satellite systems institutions for national, regional, and global coverage as well as the

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[1] Matte N. M., "Aerospace Law: Telecommunication Satellites"[1980/I]166 ***Recueil des Cours*** 123 at 167.

[2] Jasentuliyana N. *et al*, "The Arab Corporation for Space Communications (ARABSAT)" (1979)1 ***Manual on Space Law*** 467 at 467.

[3] Milde, ***supra***, Chapter I, note 2, at 89*ff*.

[4] ***Ibid.***, at 96.

national military systems with global coverage and capability. Section II examines the selected general operation satellite systems with global, regional and national coverage capability. The institutions are examined in a general manner, in order to stress aspects of particular relevance to the CNS/ATM systems.

Section I: Selected Existing Aeronautical Mobile Satellite Systems and Institutions

Developments in space technology during the last two decades have led to the creation of some space systems involved with orbit/spectrum resource issues. Aeronautical satellite systems are either still in the planning or early operation stage. They are capable or will be capable of providing some navigation facilities to aircraft. Nonetheless, presently there is no system which could cover all aspects of the CNS/ATM concept.

A. Global Coverage Capability Systems

1. SITA

La *Société Internationale de Télécommunications Aéronautiques* (**SITA**), is a cooperative non-profit organization, founded in 1949, by a group of airlines which were looking for rapid, reliable and economical ways to transmit their telecommunication.[5] SITA is administered by a:

> **i.** *Board of Directors*, composed of not more than twenty-five members. Each airline member holding at least twenty shares may nominate a Director;
>
> **ii.** *Director General*, nominated by the Board. He is responsible for the implementation of the Board's decisions, and is charged with the management of the organization. The Director General is assisted by Technical, Financial, Services Development, and Data Processing Users

[5] "A Worldwide Telecommunications Network"[September 1986] ***ITA Magazine*** 26 at 26.

as Specialized Committees. The Committees are limited in size, and members are appointed by the Board from airline experts.[6]

SITA is a private organization established under Belgian cooperative law, and operates an aeronautical telecommunication network and digital data air-ground communication service in Europe and the Far-East/Pacific Region. Lastly, SITA provides more than 20 data processing services, an especially useful operation for all its members.[7]

For more than 42 years, SITA has been operating shared systems on a non-profit basis to enable those engaged in civil air transport to communicate with one another at minimum cost. Today SITA is a global organization, serving over 440 member companies and operating in 187 countries.[8] SITA membership is open to scheduled and non-scheduled airlines, whether they carry passengers, freight or mail, and to air transport related companies. The capital shares held by each member is proportional to the actual participation of the airlines in the total cost of the shared services. The core of SITA's services is worldwide telecommunication.[9] The organization also provides several other services for air carriers through its participation with other organizations, *inter alia*, SITA/ARINC Joint Venture,[10] and SITA/IATA Joint Venture, such as the lost baggage tracing programme called *Bagtrac*. As it has gained experience, SITA progressively has become a unique *worktool* for air transport as a whole, since it supplies telecommunication services according to the demand of its member airlines on a global scale. This enables participating airlines to exercise the duties vested in them by the Chicago Convention Annexes. In this context, SITA is complementary to the Aeronautical Fixed Telecommunication Network (AFTN) operated under ICAO's freight

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6 ***ICAO FANS/3-WP/4, Appendix D***, at 5.

7 Medhane S., "SITA in Brief"[December 1990] ***ICAO J.*** 11 at 11.

8 "SITA in Brief"[1994] ***Airport Technology Int'l*** 112 at 112.

9 ***Id.***

10 ***Infra***, at P. 40*ff.*

flight operations.[11] SITA does not have its own space hardware but leases capacity from INMARSAT and other providers.

2. ARINC

Aeronautical Radio *Inc*. (**ARINC**) was incorporated in 1929 by the commercial aviation industry. Its headquarters is in Annapolis, Maryland, USA. ARINC was functioning as the single licensee and coordinator of aeronautical communication radio.[12] Today it provides aeronautical communication on a non-profit basis in the oceanic flight information regions adjacent to the USA, as well as aeronautical operational communication in the USA, and parts of Canada and Mexico.

The Aircraft Communication Addressing and Reporting System (**ACARS**)[13] has been developed by ARINC to provide voice and data ATC services, and to offer new facilities for airline passenger communication.[14] The global ACARS service is planned for the Atlantic, Pacific, and Indian Ocean areas.[15] Under the auspices of ICAO, ARINC developed the Selective Calling *SELCAL* system, which was implemented in the 1960s. *SELCAL* provides a ground/air service to flight crews globally. In 1958, ICAO designated ARINC as the registrar for *SELCAL* codes. ARINC is governed by a Board of 14 Directors, selected from the air transport industry. These Directors come from a

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11 ***Supra***, note 5, at 26.

12 ***ARINC, 90-200195K***.

13 The ground system is composed of two organs. One is the radio and message handling network, which is controlled by ARINC in the USA, the Air Canada Network in Canada, JACARS in Japan and SITA in Europe and other parts of the globe.

14 As an outcome of ACARS data transmission, there is improved operating economics and increasing in safety margins by better oceanic ATC through ADS. Data transmitted ranges from fuel-supply to food supplies, without involving the flight crew, which should reduces the flight crew workload. The standardization of the system will be beneficial to all, as well as being a precursor to part of the future CNS/ATM system; see details, Lee N. J.,"ACARS" [January/March 1990] ***Airliner*** 13 at 14; Guest T., "Anytime, Anyplace, anywhere"[1992] ***World Aerospace Technology*** 164 at 166.

15 ***ARINC***, 91-201489K-1.

broad cross-section of aviation and represent the interests of the ARINC user community at large, and that of the company's individual shareholders.[16] ARINC continues to represent the airlines in legislative and regulatory areas within the USA, and performs a major liaison role with other international organizations, including IATA and ICAO.[17] Currently, ARINC operates three communication centres, which provide ATC communication between the FAA's air traffic controllers, and all flights in oceanic control space administered by the USA. Also, ARINC provides and coordinates necessary communication facilities required by civil aviation on a non-profit cooperative basis.[18] Today, the company owns and operates one of the largest privately owned communication systems in the world. Its services include the terrestrial data network service, which connects airlines in North America, Asia, Europe, and Latin America.[19]

Looking toward the future, it is planning a satellite program to satisfy aviation industry requirements for improved communication to support ATC, airline operational control, and surveillance.[20] Like SITA, the company does not have its own space hardware but leases capacity from INMARSAT and other providers. The efforts of ARINC remain to fulfil the company's early objective of speaking for the industry to enhance safety, guaranteed economy-of-scale benefits, arrange joint demands, and to seek an encouraging regulatory environment.[21]

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16 ICAO, *supra*, note 6, at 7.

17 *The ARINC Story* (USA: Arinc Incorporated, 1987) at 89*ff*.

18 "FAA Approves Use of ARINC's GLOBALINK for ATC Communications with United Airlines"[HRAD 6-92] *ARINC News Release*.

19 *Supra*, note 8, at 11.

20 *ARINC*, *supra*, note 12.

21 The ARINC Story, *supra*, note 17, at 130.

(a) ARINC/SITA Joint Venture

The two airline service providers ARINC and SITA are collaborating to provide a uniform, single-supplier access to *Satcoms* for ATC services and to assure the delivery of safety messages under all circumstances worldwide.[22] Both ARINC and SITA operate on a non-profit basis, and have the experience to provide global ground-ground and air-ground communication to the aviation industry. The ARINC/SITA Joint Venture will establish contacts with Aeronautical Administrative Communications (AACs) to ensure the consistent, uninterrupted delivery of ATC messages from aircraft worldwide at the lowest possible cost.[23] It will also enable fully redundant satellite communication to be made available to civil aviation administrations expeditiously and without capital expenditures on satellite systems.[24]

IATA endorses this venture to provide air-ground satellite services. The venture will count on the resources of ARINC and SITA, including existing ground-ground communication networks, to provide worldwide satellite communication to any participating ATC centre.[25] Joining the resources of the two companies, the joint venture will be able to provide at least four earth stations in each oceanic region capable of providing the level of service availability required for air traffic services.[26] IATA also believes that airlines should promote the use of the ARINC/SITA Joint Venture to facilitate early implementation of air ground satellite communication for ATC.[27]

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22 "ARINC-SITA Joint Venture"[December 1992/January 1993] ***Aeronautical Satellite News*** 17 at 17.

23 *ARINC*, ***supra***, note 12.

24 Lake G., "Oceanic Clearance Trial Proves Utility of Data Link Communications for ATC"[December 1990] ***ICAO J.*** 8 at 10.

25 Hughes D., "U.S. and Soviets Offer Civil Aviation Free Access to Satellite Navigation Signals"[September 9, 1991] ***AW&ST*** 38 at 38.

26 Gribbin W. J.,"Commercial Satellite Communications Undergo Pacific Trials"[march 1991] ***ICAO J.*** 13 at 14.

27 ***Ibid.***

Nowadays, several North Atlantic ATC service providers are using the communication networks supplied by the ARINC/SITA Joint Venture to ensure a smooth transition to the future CNS system. Furthermore, as ICAO standards for aeronautical communication are developed, the airline communication networks of the ARINC/SITA Joint Venture are being upgraded to meet those standards.[28] The joint venture service is available to all airlines and supports the universal access principle which was postulated by ICAO.[29] The joint venture can and should join the CNS/ATM service providers.

3. INMARSAT

The importance of a maritime satellite system was recognized early. INMARSAT owes its origins to the Inter-Governmental Maritime Consultative Organization (IMCO), a specialized agency of the United Nations (UN).[30] In 1972, it was IMCO's view that a new international maritime satellite system should provide for exchanges via satellites of telephone, telegraph and facsimile messages, provide for radio determination and, in combination with existing navigational and communication services, improve such services in safety and navigation, information and data exchange from ship-to-shore, and improve public correspondence service for passengers and crew.[31]

IMCO convened an international conference, in 1975/76, to consider the establishment of an international maritime satellite system. This conference adopted the INMARSAT Convention between participating States called *Parties*,[32] and an Operating

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[28] Walker D., "Atlantic Trials Demonstrate Operational Capability of Data Link Communications" [March 1993] ***ICAO J.*** 19 at 20.

[29] Saunders M., "SITA: Harnessing Technology to Facilitate Airport Operations"[1994] ***Airport Technology Int'l*** 109 at 110*ff.*

[30] See for details, ***UN Doc. A/AC.105/100(1972).***

[31] ***Id.***, IMCO became subsequently the International Maritime Organization (IMO).

[32] Convention on the International Maritime Satellite Organization (INMARSAT); 31: ***U.S.T.*** 3 (1979). Opened for signature 3 September 1976; entered into force on July 16, 1979 [hereinafter INMARSAT Convention].

Agreement[33] between States or entities, public or private, designated by a State, called *Signatories*. On September 3, 1976, in London, the charter of the INMARSAT was brought into being, culminating a four-year effort of study, analysis, planning and negotiation.[34] The Agreement entered into force in July 1979, when the Organization was formally established.[35] INMARSAT was established with the purpose of providing the space segment necessary for improving maritime communication.[36] INMARSAT became operational in February 1982.[37]

In October 1985, the INMARSAT Assembly, at its Fourth Session, adopted and confirmed further amendments to the Convention and Operating Agreement, thereby permitting the organization to provide aeronautical mobile satellite telecommunication services on the same basis as maritime services.[38] The amendments entered into force on October 13, 1989, and are incorporated in the texts of the Convention and Operating Agreement.[39] INMARSAT has three principal organs:[40]

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[33] Operating Agreement on the International Maritime Satellite Organization (INMARSAT); 31:1 *U.S.T.* 135 (1979). Opened for signature 3 September 1976; entered into force on July 16, 1979 [hereinafter **INMARSAT Operating Agreement**].

[34] See details for reference to the "Sessional Act of the International Conference on the Establishment of the INMARSAT"(1976)4 ***J. Space L.*** at 135.

[35] ***UN Doc.*** A/AC.105/193, at 111 (1977); see, for details, ***IMCO Doc.*** MARSAT/CONF/3, Presentation on the Establishment of a Maritime Satellite System; report of the Panel of Experts, at 1-2 (October 30, 1974); see INMARSAT historical background, Doyle S. E., "INMARSAT: The International Maritime Satellite Organization - Origins and Structure" (1977)5:1 ***J. Space L.*** at 45; see also, Sondaal H. M., "The Current Situation in the Field of Maritime Satellite Communication Satellites: INMARSAT"(1980)8:1,2 ***J. Space L.*** at 9.

[36] INMARSAT Convention, ***supra***, note 32, Article 3 (1).

[37] "New Maritime Satellite System Launched"[February 2, 1982] ***INMARSAT New Release*** at 1; see also, Doyle, ***supra***, note 35, at 45.

[38] Von Noorden W. D., "Space Communication to Aircraft: A New Development in International Space Law (Part 1)"(1987)15:1 ***J.Space L.*** 25 at 25; see, ***infra***, Chapter III, at P. 119*ff*.

[39] INMARSAT Convention, ***supra***, note 32, Article 3 (amended text).

[40] ***Ibid.***, Article 9.

i. the *Assembly*, which is composed of all the Parties, each of which has one vote.[41] The Assembly decides on questions of formal relations between the organization and other national and international organizations.[42] Also as in the Article 12(1)(b), the Assembly ensures that the organization's activities are consistent with the basic documents of the organization and with the UN Charter and any other treaty to which the organization becomes bound;

ii. the *Council*, which has twenty-two representatives elected from the signatories. As per Article 13(1)(a), eighteen are the signatories or the groupings of signatories with the largest investment shares in the organization. The other four are elected by the Assembly as per Article 13(b), in order to fulfil the geographical balance and the interests of the developing countries. The Council decides substantive issues by a majority of the delegates with two-thirds of the shares of the signatories on the Council. Procedural issues are resolved by a simple majority;[43] and,

iii. the *Directorate*, which is headed by a *Director General*, who is appointed by the Council. The main consideration in his appointment and that of other Directorate personnel is to ensure "*...the highest standards of integrity, competency and efficiency.*"[44] He is appointed for a term of six years.[45] He is the chief executive and legal representative of the Organization.[46]

The Organization has full legal personality and can: "*...contract, acquire, lease, hold and dispose of movable and immovable property, be a party to legal proceedings and conclude agreements with States or international organizations.*"[47]

Where a Signatory is an entity designated by a Party, that Party is not liable for obligations arising under the Operating Agreement. State parties do not bear any

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[41] *Ibid.*, Articles 10(1), 11(1).

[42] *Ibid.*, Article 12 (1)(f) for the functions of the Assembly.

[43] *Ibid.*, Article 14(2).

[44] *Ibid.*, Article 16(6).

[45] *Ibid.*, Article 16(2).

[46] *Ibid.*, Article 16(3).

[47] *Ibid.*, Article 25.

responsibilities for financial, technical and operational matters.[48] However, the State is required to give guidance and instructions to ensure that the Signatory fulfils its obligations.[49] Like most international governmental organizations, INMARSAT and its property are exempted from national income and property taxation and customs duties.[50]

The INMARSAT Convention provides, in Article 31, an arbitration procedure. The purpose of the procedure is to smooth over disputes, and to settle disputes between the parties concerned. Failing that, the parties have the right to proceed to the International Court of Justice (ICJ). Also, they may consent to arbitration in accordance with the procedures for the settlement of disputes delineated in the annex. As regards disputes arising from agreements concluded between the Organization and any parties, recourse to arbitration is obligatory unless otherwise mutually agreed.[51] Finally, differences arising between parties and signatories may be submitted to arbitration if the disputants so agree.[52]

The membership of the organization is open to all States, unlike INTELSAT, which is open only to ITU members; hence, it gives effect to the principle of universality contained in the resolution and the Convention.[53] The Organization has an obligation to serve all areas of the world where there is a need for maritime communication and its space segment is available for use by ships of all nations on a non-discriminatory basis.[54] Thus, as in the case of INTELSAT, one sees in INMARSAT a mixture of

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[48] Sondaal, *supra*, note 35, at 12.

[49] INMARSAT Convention, *supra*, note 32, Article 4(b)(c).

[50] *Ibid.*, Article 26(1).

[51] *Ibid.*, Article 31(2).

[52] *Ibid.*, Article 31(3).

[53] Currently INMARSAT has 75 member States as at July 26, 1994, *INMARSAT News nr94\16\Senegal*; also about 40,000 customers worldwide use the INMARSAT system, *INMARSAT News nr94\10\prospect*, May 13, 1994.

[54] INMARSAT Convention, *supra*, note 32, Articles 3(2), 7(1).

public service organization and commercial enterprise. However, even though there is no provision of INMARSAT stipulating that it shall be a commercial organization it is required, in Article 5(3) that: "*[t]he Organization shall operate on a sound economic and financial basis having regard to accepted commercial principles.*" This, in one commentator's[55] view, has been interpreted to mean that the Organization is: "*a hybrid institution which is neither entirely a public service organization nor entirely a commercial enterprise.*"

As has been pointed out by another commentator,[56] it is a generally accepted commercial principle that an organization should derive whatever revenue it can from surplus assets. A surplus asset can be residual space segment capacity, which, in case of INMARSAT, may be made available for non-maritime communication.[57] These different services are established by the Council decision, and charges are set for each of them. The objective of these charges is to earn sufficient revenue to cover the operating, maintenance and administrative costs. Also, the provision of any operating funds, repayment and compensation for use of capital contributed by signatories[58] helps to lower the maritime communication charges, and indirectly serves the express purposes of the Organization.

A party may withdraw from the organization by written notice, which becomes effective after three months from the date of receipt. The party, however, remains liable for any obligations arising from acts or omissions before receipt of the notification.[59]

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[55] Jasentuliyana N., "The International Maritime Satellite System (INMARSAT)" in Jasentuliyana N. & Lee R. S. K., *eds.*, ***Manual on Space Law***, *vol.* I (N.Y.: Oceana Publications, *Inc.*, Dobbs-Ferry, 1978) at 443.

[56] Von Noorden & Dann Ph., "Land Mobile Satellite Communications: A Further Development in International Space Law"(1989)17:1 ***J. Space L.*** 1 at 4.

[57] The surplus asset has been a basis for authorizing the use of the space segment for aeronautical and land communications, ***COUNCIL/18/SR/FINAL*** 16.3.4.

[58] INMARSAT Operating Agreement, ***supra***, note 33, Article III(1); INMARSAT Convention, ***supra***, note 32, Article 19(1).

[59] INMARSAT Convention, ***supra***, note 32, Article 29.

Article 30 provides for the suspension and termination of States and signatories which do not fulfil their obligations under the Convention. Nevertheless, as to third-parties, the member parties may be liable under treaties such as the 1972 Liability Convention.[60] Article 8 of the INMARSAT Agreement obliges members of the organization to notify it in the event that they intend to use a satellite system separate from INMARSAT, to ensure technical compatibility and to avoid significant economic harm to the organization.

The future of INMARSAT seems to be bright. Although it continues to provide more and more land and air mobile satellite services, its major market continues to be in the maritime sector. As indicated above, the steps that have been taken to permit the organization to provide an aeronautical service are an obvious extension of the organization's purpose.[61] INMARSAT in May 1994 decided to develop what is known as the *INMARSAT-P* hand-held phone system to enter service by the end of this century in order to provide voice, fax and data communication. This system will play a key role into the next century for global mobile communication services; also, COMSAT of the USA, and Kokusai Denshin Denwa (KDD) of Japan, are cooperating to provide a worldwide INMARSAT type service.[62]

The possibility of INMARSAT furnishing aeronautical communication in addition to maritime services was recognized even before the organization was constituted. At the 1971-WARC, adjoining frequency bands were allocated for this purpose.[63] Its first and second satellite generation have the capability to furnish these communication services. The third generation INMARSAT-III which is scheduled to be launched by the end of

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[60] Convention on International Liability for Damage Caused by Space Objects; 961 *U.N.T.S.* 187. Opened for signature 29 March 1972; entered into force 9 October 1973 **[hereinafter Liability Convention]**.

[61] ***Infra***, Chapter III, at P. 119*ff*.

[62] INMARSAT, "Satellites Usher in New Era in Aeronautical Communications"[August 1991] ***ICAO J.*** 14 at 15; "Merrill Lynch Assists INMARSAT with Formation of Affiliate Company"[July 26, 1994] ***INMARSAT News nr94\15\ml.***

[63] Long M., "World Satellite Almanac: The Complete Guide to Satellite Transmission & Technology, 2*ed*. (USA: Howard W. Sams & Company, 1985) at 115.

1994 or early 1995,[64] will provide capabilities complementary to the USA Global Positioning System (GPS), and the former USSR system Global Orbiting Navigation Satellite System (GLONASS) in order to facilitate their use by the aviation community, in other words it will generate GNSS signals.[65] The INMARSAT-III satellite generation will meet the presumed increase in aeronautical traffic adequately into the twenty-first century[66] and also will provide an increase in capacity for aeronautical communication and will result in a decrease in user-charges compared with existing *INMARSAT-2s*.[67] Furthermore, INMARSAT Aero-C, as a digital mobile voice communication system, is an important step in Project-21,[68] INMARSAT's personal satellite communication system.[69] This system was approved in 1993, to enable the use of the INMARSAT-C system on board aircraft[70] for communication services and may be used to provide a civil GNSS.[71] In short, INMARSAT will perform a major role in providing its service to civil aviation. It should be noted that the Preamble of the INMARSAT Convention refers to:

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[64] ***ICAO FANS(II)/4-Flimsy no. 1***, at 2.

[65] Nagata H. & Wright D., "A Short History of Maritime Communications"(February 1990) 57:II ***Telecommunication J.*** 117 at 124.

[66] Featherstone D. H., "Specialist Providers Offer Cost - Effective Approach to Obtaining ATS Satellite Communications"[June 1993] ***ICAO J.*** 21 at 24; Guest, ***supra***, note 14, at 164; see also, Chien Ph., "Taking Off Toward Success"[May 1991] ***Via Satellite*** 29 at 34.

[67] Klass Ph. J., "INMARSAT Orbit to Impact Aviation"[March 29, 1993] ***AW&ST*** 58 at 58; "INMARSAT Selects Ariane to Launch Fifth INMARSAT-3 Satellite"[August 4, 1994] ***INMARSAT News nr9417 as.***

[68] That project was set up to prepare possible scenarios for the fourth generation of INMARSAT satellites, see, "*INMARSAT Annual Review and Financial Statements*", London, 1993, at 16*ff.*

[69] "Smallest Mobile Satellite Telephone Now Available Globally"[October 7, 1993] ***Inmarsat News nr93\59\m.***

[70] Sagar D., "INMARSAT"[1993]XVIII:I *AASL* 440 at 444*ff.*

[71] ICAO, ***supra***, note 64, at 2.

i. the UNGA *Res. no.*1721(XVI) "*...communication by means of satellites should be available to the nations of the world as soon as practicable on a global and non-discriminatory basis. ...*";

ii. the 1967 Outer Space Treaty, in its Article 1, "*...outer space shall be used for the benefit and in the interest of all countries. ...*"

This is an indication that INMARSAT system will be available to aircraft of all countries on a non-discriminatory basis, whether the aircraft's country of registry, or the nationality of the operator (according to Article 83*bis* of the Chicago Convention) is a Party to the INMARSAT Convention or not.[72] Furthermore, INMARSAT will fully adopt the major roles and responsibilities of ICAO and its contracting States with regard to air safety.[73] It will not affect the sovereignty of States over their airspace[74] nor the information there transmitted.[75] One can conclude that this satisfies the FANS Committee's General Institutions Guiding Principles.[76] The organization operates more or less according to commercial management techniques.[77] Competition between various service providers is not inhibited under the INMARSAT Convention. Exclusive control and oversight of the organization's services by its member States is consistent with ICAO principles and the presumed availability of services to the aviation industry. Finally, INMARSAT technique could be a cost-effective because the only costs for users will be the minimum possible for the level of service provided.

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72 ***ICAO FANS/3-WP 3***, at 2.2.

73 ***Ibid.***, at 2.1.c.

74 For the reason that the ground earth stations would be owned and operated by Parties or entities subject to their jurisdictions. Also, governments would determine the conditions under which aircraft operating under their authority may be authorized to use communications services in conformity with domestic laws and regulations, and in accordance with Article 30 of the Chicago Convention and the ITU Radio Regulations.

75 ***ICAO, supra***, note 72, at 2.1.d.

76 *ICAO Doc.*, ***supra***, General Introduction, note 26, at 8A-24*ff*; see also, ***infra***, Chapter III, at P. 119*ff*.

77 Van Traa-Engelman H. L., ***Commercial Utilization of Outer Space - Legal Aspects***, Part A (The Netherlands: ISBN 90-9002839-0, 1989).

B. Regional Coverage Capability Systems

1. MTSAT[78]

The idea of the MTSAT system began in 1989, although the final decision to launch and operate the system for air traffic services was based on the ICAO 10*th* Air Navigation Conference of 1991.[79] It is expected that the system will provide full service by the end of this century. The system will provide not only Aeronautical Mobile Satellite (Route) Service (**AMS(R)S**) but also the GNSS services, including global positioning. The primary objective of the MTSAT system is to promote Automatic Dependent Surveillance (**ADS**) in the Asia and Pacific Region in order to decrease ATC separation to the minimum distance possible, and to raise air traffic capacity on the routes between the USA and Japan. This traffic is anticipated to double on these routes by the beginning of the next century.

The FANS(II) Committee favoured and supported the Japanese motivation on MTSAT and noted the significance of observing the AMSS institutional guidelines for the transition to one global coordinated plan for the ICAO CNS/ATM systems.[80] A Japanese scholar[81] observed that it is desirable that the MTSAT system will join ICAO's global satellite system, and Japan is willing to respond to ICAO's regulatory role. The liability and responsibilities for managing, operating and maintaining the MTSAT system must be harmonized with and observe the law of telecommunications, outer space and other relevant international regulations and standards, specifically the FANS Committee guiding principles and standards, in order to assure a reliable system for the use of global civil aviation.

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[78] The Japanese Ministry of Transport has recently decided to initiate a large scale national aviation project called the Multi-Functional Transport Satellite (MTSAT); see, Ohada K., "Japan Launches Major Programme to Provide Satellite-Based Aeronautical Services" [October 1993] *ICAO J.* 24 at 25.

[79] *AN-CONF/10*, *supra*, General Introduction, note 17.

[80] *ICAO FANS(II)/4-WP/82*, Report on Agenda Item 4, at 4-5.

[81] Ohada, *supra*, note 78, at 25.

In spite of the fact that MTSAT will benefit the civil aviation community, it must be clear that the benefit will depend largely on participation and coordination of neighbouring countries in the Asia/Pacific region and the international civil aviation community.

2. ASECNA

Agence pour la Sécurité de la navigation aérienne en Afrique et a Madagascar (**ASECNA**) is an intergovernmental organization created by an international Convention, [82] between 14 African States and France as signatories in 1959 to operate route facilities, airport services, and certain non-aeronautical services for and on behalf of the African States parties to the Convention, to ensure the regularity and safety of air traffic operations in their territories and airspace.[83] Currently the Organization has 16 member States.[84] The Convention established a Governing Committee of Ministers which defines general policy.[85] The Organization is administered by an *Administrative Council*, composed of one representative from each signatory State, assisted by a *Director General*.[86] It is financed by revenues from separate route facility, airport charges, and by contributions from the signatory States. State contributions to operating costs are determined on the basis of their budget revenues, and aeronautical activity in terms of traffic at their aerodromes.[87] For the purposes of efficiency and economic operation, the ASECNA's administrative structure was modified at the Dakar Conventions of 1974,

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[82] Convention relative à la création d'une agence chargée de gérer les installations et services destiné à assurer la navigation aérienne en Afrique et à Madagascar, of 1959 **[hereinafter ASECNA Convention]**; see, Matte N. M., ***Treatise on Air-Aeronautical Law*** (Toronto: The Carswell *Co. Ltd.*, 1981), Appendix III.

[83] ***Ibid.***, Article 2; see also, *ICAO*, ***supra***, note 6, at 3.

[84] ***ICAO CASITAF/1, Mechanism Paper no. 4***, May 24/26, 1994.

[85] **ASECNA Convention**, ***supra***, note 82, Article 3.

[86] ***Ibid.***, Article 5; Articles 5, 6 Annex 1 to the Convention.

[87] ***Ibid.***, Article 7.

1989 and again in 1991. Although the amendments would improve the organization's function, they are not in force yet.[88] In any case ASECNA and its member States believe: "*...the new CNS/ATM system shall make optimum use of the existing infrastructure and shall be operated in accordance with existing institutional arrangements and legal regulations.*"[89]

3. COCESNA

In 1960, the *Corporacion Centro-Americana de Servicios de Navegacion Aerea* (**COCESNA**) was created,[90] as a cooperative means for five Central American States as signatories, to provide air traffic, communication services, and radio aids to navigation for international air service operations within their areas of responsibility.[91] The Corporation has legal personality,[92] and is administrated and governed by a *Board of Directors*, which is composed of one member from each Contracting State.[93] The Agency is exempt from taxes, dues and various charges that would arise from contracting States. Route facility charges and other user charges constitute COCESNA's only source of revenue.[94] It operates its own facilities and also has the use of equipment owned and maintained by the contracting States. The authority to approve user charges, operating budgets and capital expenditures rests with the Governing Council.

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88 For details see, Tahou R. S., "Les aspects institutionnels et juridiques de restructuration de l'asecna"(1993)XVII *AASL* 315 at 315*ff.*

89 *ICAO, supra*, note 84, at 4.

90 Convention establishing the Central American Air Navigation Services Corporation (**COCESNA**), *U.N.T.S. 418-6022*, at 171. Signed at Tegucigalpa, on February 26, 1960 [**hereinafter COCESNA Convention**].

91 *Ibid.*, Article 2.

92 *Ibid.*, Article 3.

93 *Ibid.*, Article 4.

94 ICAO, *supra*, note 6, Appendix C, at 4.

4. DEN/ICE

Jointly financed air navigation services have been provided by Iceland since 1948 and by Denmark since 1949. The service is provided to promote the safe operation of civil aircraft crossing the North Atlantic. The original arrangements were revised by the 1956[95] Joint Financing Conference.[96] It was deemed that joint financing of certain air navigation services provided by the governments of DEN/ICE were justified and that adequate joint financing agreements should therefore be concluded pursuant to the principles of Chapter XV of the Chicago Convention. Today, the joint services are provided and financed in accordance with the two 1956 Agreements as amended by the 1982 Montreal Protocols.[97] The services covered by the DEN/ICE Agreements are specified in the ICAO Air Navigation Plan for North Atlantic, North American and Pacific Regions.[98] These services are subject to change due to advances in technology or to cope with the growth in international traffic, to ensure that only those services required are included. The agreements specified the ICAO Council as the governing body, and its Committee of Joint Support of Air Navigation Services monitors the operation of the agreements. The air navigation services are provided and operated by two of the signatories, which hold title to the facilities required. The agency is financed by charges on all traffic crossing the North Atlantic, with shortfalls contributed by the signatory States apportioned on the basis of the number of North Atlantic crossings

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[95] There are two Agreements: i. Agreement on the Joint Financing of Certain Air Navigation Services in Greenland and the Faroe Islands (1956), ***ICAO Doc.*** 9384-JS/679; ii. Agreement on the Joint Financing of Certain Air Navigation Services in Iceland (1956), ***ICAO Doc.*** 9385-JS/680.

[96] FitzGerald G. F., "ICAO and the Joint Financing of Certain Air Navigation Services" (1986)XI *AASL*, Part I, 17 at 17*ff*; (1987)XII *AASL* Part II, 33 at 33*ff*.

[97] There are two Protocols: i. Protocol for the Amendment of the 1956 Agreement on the Joint Financing of Certain Air Navigation Services in Greenland and the Faroe Islands, done at Montreal on November 3, 1982, ***ICAO Doc.*** 9384-JS/679; ii. Protocol for the Amendment of the 1956 Agreement in Island, done at Montreal on November 3, 1982, ***ICAO Doc.*** 9384-JS/680.

[98] ***ICAO Doc.*** 8755, 13*th ed.*, October 1990.

performed by their civil aircraft.[99] The ICAO Secretary General supervises the service operation. The ICAO Council is the governing body of the joint financing system and the day-to-day operation is the responsibility of the two governments of Denmark and Iceland. The joint financing is under close international supervision.[100]

The financial policy is the key-issue of the arrangements, as they were initiated, because the financial load on the provider States would have been inappropriate in view of the limited benefit accruing to these countries. Therefore, the services provided under the DEN/ICE Joint Financing Agreements operate efficiently and economically on the basis of a high level of international cooperation among the two provider States, the other twenty contracting governments, and ICAO.[101] This DEN/ICE Joint Financing Agreements strategy, in this writer's opinion, is one of the most suitable mechanisms for CNS/ATM systems.[102]

5. EUROCONTROL

Following the rapid development of commercial aviation in Europe, and the need for coordinated ATC, six European States signed, on December 13, 1960, the International Convention relating to Cooperation for the Safety of Air Navigation (EUROCONTROL).[103] The organization was set up with an independent legal personality and regulatory powers relating to ATC in the upper airspace of the contracting States.[104] EUROCONTROL is exonerated from taxes, duties and various

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[99] *ICAO*, ***supra***, note 6, Appendix A, at 2.

[100] For details see, Milde, ***supra***, Chapter I, note 2; and FitzGerald, ***supra***, note 96.

[101] Recasens O., "Continued MET Services are Provided by Danish/Icelandic Agreements"[April 1991] ***ICAO J.*** 18 at 20.

[102] ***Infra***, Chapter VIII, at P. 336*ff*.

[103] International Convention Relating to Cooperation for the Safety of Air Navigation (EUROCONTROL). Signed in Brussels in 1960; entered into force in March 1963; see, Matte, ***supra***, note 82, Appendix II [hereinafter **EUROCONTROL Convention**].

[104] Bax J.-H., "Eurocontrol: UK Detention Rights"(1992)XVII:1 ***Air L.*** 2 at 2.

charges that would arise under laws of contracting States.[105] The organization consists of two parts:

> i. the *Commission*, which is composed of two representatives of each contracting party. Each party has one vote. Its members are Ministers; and,
>
> ii. the *Agency*, which is, in effect, the executive arm of the Organization, and takes the day-to-day operation of providing ATS.

The scope of EUROCONTROL has long been limited by its membership. Initially, when the first discussions took place at ICAO in 1958, the Benelux countries[106] and West Germany envisaged the integration of traffic control in their upper airspace with France, Italy and Britain joining later.[107] Unfortunately, the organization was never given the executive power or resources to do the job, mainly because of France and Great Britain who chose not to entrust control of their upper airspace to a supranational body. So the organization was hobbled before it could even start.[108] Also, it was hampered by military restrictions and limited membership.[109] In the early 1980s, when there was no way for the European countries to turn over control of their airspace to a supranational organization, EUROCONTROL adopted an amended convention on several occasions, culminating in the Brussels Protocol of 1981,[110] making the organization an optional advisory agency.

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[105] EUROCONTROL Convention, ***supra***, note 103, Article 21.

[106] Belgium, the Netherlands and Luxembourg.

[107] Sochor, ***supra***, General Introduction, note 13, at 90.

[108] Sutton O., "Eurocontrol Back in Favour"[2/1989] ***Interavia*** 113 at 113.

[109] Sochor E., "Air Transport in the European Community: The Hard-Core Problem"[December 1990] ***ICAO J.*** 15 at 18.

[110] Blackshaw C., ***Aviation Law & Regulation: A Framework for the Civil Aviation Industry*** (UK: Lingman Group UK ***Ltd.***, 1992) at 13; the three new legal instruments which were signed in 1981 are: i. Protocol Amending the EUROCONTROL International Convention Relating to Cooperation for the Safety of Air Navigation of December 13, 1960, ***BGBL.*** 1984 II, 71; ii. Multilateral Agreement Relating to Route Charges, ***BGBL.*** 1984 II, 69; iii. The Final Act of the Diplomatic Conference on the Protocol Amending the EUROCONTROL International

(continued...)

The main purpose of the organization was expressly shifted from operations to collective planning of European ATC services. This modification should facilitate the organization's decision-making procedures, and result in a change of its bodies, based on ICAO's legal structure.[111] As a supranational ATC organization, EUROCONTROL often lacked support, but as an optional advisory agency whose advisory role does not impinge on the sovereignty of individual States, it seems to be attracting a queue of applicants waiting to join.

The amended EUROCONTROL Convention of 1981, confirmed each contracting States' sovereignty over its airspace. In contrast to the earlier proposals, the objective of the amended EUROCONTROL Convention is to improve the technical and administrative liaison between the existing ATC systems of every State.[112] Member States are no longer required to transfer ATC of their upper airspace to EUROCONTROL, but may do so at a subsequent date if they desire. At the same time, EUROCONTROL decided to change its approach and seeks to harmonize and integrate existing European ATC management systems, rather than replace them.[113] The activities of the organization are financed by annual contributions[114] of the eleven States currently signatories to the amended EUROCONTROL Convention.

In April 1990, the European Civil Air Conference (ECAC) convinced the 23 European States that it was urgent to resolve the problem of airspace saturation in Europe

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(...continued)
Convention Relation to Cooperation for the Safety of Air Navigation of December 13, 1960, ***BGBL***. 1984 II, 75.

[111] The name of the EUROCONTROL Agency was changed from *"Agency for Air Navigation Services"* to *"Agency for the Safety of Air Navigation"*, ***EUROCONTROL Convention***, Article 1(2); see, Lambert Y., "EUROCONTROL et l'OACI"(1994)XIX ***AASL***, Part I, 349 at 349*ff*.

[112] The Amended EUROCONTROL Convention, Article 3(1).

[113] Advertising Supplement, "Harmony in Europe"(January/February 1993)5:1 ***Jane's Airport Review*** VIII at VIII.

[114] EUROCONTROL Convention, ***supra***, note 103, Article 19 of Annex I.

and to adopt a programme of ATC integration and harmonization. ECAC's strategy consists of two phases:

> **i.** The first extends until 1995 and is aimed at increasing the efficiency of the existing ATC systems.
>
> **ii.** In the second phase from 1995 on, the new ATC systems currently under development will be introduced. These will be more advanced and will operate with greater harmony. EUROCONTROL has been selected to carry out this job.[115]

The constitutional change in the Brussels Protocol of 1981, gives EUROCONTROL an important strategic role. It will be able to analyze future needs, coordinate national ATC planning and increase its research activities. EUROCONTROL is already developing a flow management system. These changes have made membership more attractive[116]. Many believe that a major part of the responsibility for the imperfect functioning of the system ties in with the policies pursued over previous years by governments of some countries in Europe. Moreover, a less nationalistic approach to EUROCONTROL can help to eliminate a major part of the ATC crisis which requires an effective strategy by an intra-European institution.[117] The main merit of EUROCONTROL is its ability to bring together several European countries, and to improve the cooperation between the administrations responsible for ATC.[118]

6. COSPAS/SARSAT

The distress messages relayed by satellite are one of the breakthroughs that have led satellite communication to be seen as one of the greatest technologies. For example, the Search and Rescue Satellite-Aided Tracking (SARSAT) project was instituted by

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[115] "EUROCONTROL: Safety and Efficiency"(February 1991)XIX:2 *Avianews Int'l* 46 at 46.

[116] Woolley D., "Pressure Building to Free Eurocontrol From Political Constraints"[March 1990] *Airline Executive* 28 at 32.

[117] Majid A. A., "Legal Capacity of Eurocontrol to Ensure Smooth Aviation in Europe" (1991)XVI:6 *Air L.* 267 at 268*ff.*

[118] *Supra*, note 115, at 46.

Canada and the USA in 1976 and joined by France a year later. This was under deliberation for over a year and half, beginning with the primary Memorandum of Understanding signed between delegates of the above-mentioned countries in 1979. In 1980, an Agreement with the former USSR embraced the Russian *Kosmicheskaya Sistyema Poiska Avariynych Sudov* (**COSPAS**) system, and, in 1982, the COSPAS/SARSAT become operational.[119] This cooperation is very informal and based on a Memorandum of Understanding.[120]

It is acknowledged that international civil aviation has a vital interest in satellite aided search and rescue, and the COSPAS/SARSAT system meets the operational requirements of civil aviation. The continued need for a satellite system for location and identification of downed aircraft was confirmed by the ICAO FANS Committee.[121] On July 1, 1988, the international COSPAS/SARSAT Programme Agreement[122] was signed by the above-mentioned four States, with ICAO and IMO as joint depositories of the Agreement, which provides for the use of the system by other States on a non-discriminatory basis, free of charge.[123] The new Agreement did establish the two following bodies:

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119 Vitt E., "COSPAS-SARSAT" in Bockstiegel K.-H. & Benko M., *eds.*, *vol.* 2, ***Space Law: Basic Legal Documents*** (The Netherlands: Martinus Nijhoff Publishers, 1990) at D.II.3.1.

120 Memorandum of Understanding among the Ministry of Merchant Marine of the USSR, the National Oceanic and Atmospheric Administration of the USA, the Department of National Defence of Canada and CNES of France Concerning Cooperation in the COSPAS/SARSAT Search and Rescue Satellite System. Done on October 5, 1984; entered into force on July 8, 1985, Bockstiegel & Benko, ***ibid.***, at D.II.3.2; ***IMO Document COM. 29/INF.2, Annex 2.***

121 *ICAO Doc.*, ***supra***, Chapter I, note 97, at Paragraph. 2.3.3.4.1.

122 International COSPAS/SARSAT Programme Agreement; *ICAO and IMO as a Joint depositary of the Agreement* ***(ICAO Reg. no. 3380)***. Done at Paris on July 1, 1988; entered into force on August 30, 1988[**hereinafter the COSPAS/SARSAT Agreement**].

123 "Carriers Continued to Emphasize Need for Aircraft with Low Operating Costs"[December 1990] ***ICAO J.*** 19 at 22.

i. *the Council*, as the only meeting of the representatives of the Parties to the Agreement;[124] and
ii. *the Secretariat*, as a permanent administrative organ for the Programme and shall assist the Council in its functions.[125]

The establishment of these bodies does not give the programme a legal personality. The Agreement will remain in force for fifteen years and is to be extended automatically for successive five year periods.

The venture derived from widespread dissatisfaction with the means available, up until the late 1970s, for receiving radio distress signals and, equally important, discovering where they came from. This concern related particularly to distress situations involving small aircraft outside radar and ATC surveillance, and ships beyond reliable radio range of shore stations.[126] Although there are problems with a high rate of false alarms, the system is very successful, and it is being developed to increase its effectiveness.[127] The system is expanding its capability since becoming operational in 1982. Satellite-aided search and rescue as related to aeronautical incidents is the responsibility of ICAO. However, at the ICAO's 26*th* Assembly Session in 1986, there was strong support for the review of the satellite-aided search and rescue programme and the development of proposals for action by ICAO.[128] Also, the Chicago Convention in its Article 25 states that every State: "*...undertakes to provide... measures of assistance to aircraft in distress...* ."

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[124] **The COSPAS/SARSAT Agreement**, ***supra***, note 122, Article 8.

[125] ***Ibid.***, Article 10.

[126] Bulloch C., "Search and Rescue by Satellite: Slow Steps Towards an Operational System" [3/1987] ***Interavia*** 275 at 275.

[127] *Id.*

[128] Heijl M., "Satellite - Aided Search and Rescue"[January 1988] ***ICAO Bulletin*** 29 at 30*ff*; ICAO stated that, until 1988 1.126 persons had been rescued by using the COSPAS-SARSAT services and a 590 persons rescued in incidents, 480 in maritime and 47 in terrestrial incidents, see, ***ICAO AN-WP/6218***, 13/6/88 at 2; and until 1992 they were 1.500 persons; see, Riccitiello R., "System Speeds Distress Call Delivery"[March 23-29, 1992] ***Space News*** 24 at 24.

By the end of 1992, a total of twenty-eight States and organizations had officially joined the organization programme, with additional States indicating their intention to participate. The organization's space segment presently consists of six satellites; seven replacement satellites are being built. These satellites are not dedicated entirely to the organization; the USA satellites are basically intended for meteorological observation, while the Russian satellites are a type of navigation satellite. The system is providing an essential service to the international community. No doubt, this system is not perfect, but it is the only one that can be developed as long as the status of the States' integration continues to be insignificant, although today and for the future there is a massive need for stronger global collaborations and better integration. A future global satellites system would improve the system for instant communication, and detection which is not yet possible.

The COSPAS/SARSAT system is still considered to be in the developmental phase. Institutional arrangements and operational procedures and practices also will need to be considered by ICAO. These subjects include the extension of existing COSPAS/SARSAT service areas to cover all the existing aeronautical search and rescue regions. It is also conceivable that ICAO will wish to contribute to the regional planning for additional local user terminals which would provide increased real-time coverage of the system.[129]

The system is one of the few successful examples of East-West cooperation.[130] There is a lack of obligation on the part of the provider States which is apparent from many provisions in the COSPAS/SARSAT Agreement. This was considered appropriate, in order to free the parties from any liability. In this writer's view that was the only possible way to institute public transcontinental service free of charge. Therefore, COSPAS/SARSAT is an international programme which through the cooperation of various agencies from different States, could in respect to CNS/ATM services in regard

[129] Heijl, *ibid.*, at 31.

[130] Bulloch, *supra*, note 126, at 277.

to financing, ownership, management, and operation of the GNSS, offer a most interesting model for the new systems.

7. PRODAT/PROSAT

The PRODAT/PROSAT enterprise is originated by the European Space Agency (ESA), Spain, the United Kingdom (UK) and EUROCONTROL. PRODAT is a part of the ESA PROSAT satellite project, and includes experiments on air traffic services aeronautical applications in which the UK Civil Aviation Authority and EUROCONTROL take part. The purpose of this joint effort is to accomplish some of the recommendations of the ICAO FANS Committee in relation to ADS and satellite data-link communication.[131] On October 24, 1988, the Spanish Directorate General of Civil Aviation, using the ADS and communication satellite-based experimental data-link the PRODAT/PROSAT[132] succeeded in monitoring a *Jetstream* aeroplane.

C. National Coverage Capability Systems

1. TELEGLOBE (Canada)

TELEGLOBE Canada *Inc* was created as a Crown corporation in 1971 and has been a part of MEMOTEC DATA *Inc* since 1987, it has joined a consortium to provide AMSS to airlines passengers internationally. The consortium will provide both voice and data communication for *flight-deck* and airline operations as well as the opportunity for passenger to place telephone calls to virtually anywhere on the planet.[133] The company is a founding signatory of both INTELSAT and INMARSAT. Furthermore, it is partner

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131 "FANS Committee Proposes a Consolidated Global CNS Plan"[June 1988] ***ICAO Bulletin*** 10 at 10*ff.*

132 It succeeded in controlling a *Jetstream* aeroplane, which was the first flight ever to be controlled by a civil ATC centre via a satellite-based data-link; see, Esteban E. & Diez D., "PRODAT/PROSAT Data Links Successful in Controlling Jet Flight"[February 1989] ***ICAO Bulletin*** 30 at 30.

133 "International Consortium Joins to Provide Aeronautical Mobile Satellite Service"[June 12, 1989] ***Satellite News*** 3 at 3.

in *AIRCOM* which includes France TELECOM, Orbital Test Satellite (OTS) *Ltd.* of Australia and SITA. The partners operate six earth stations[134] around the world.[135] The *AIRCOM* service allows passengers to place phone calls anywhere in the world, and keeps airline crews in touch with air traffic controllers. Also, the company is participating in the developing market for aircraft-to-satellite voice and data services.[136] It is expected that the consortium will capture a major share of a worldwide market for AMSS.[137]

D. National Military Systems with Global Aeronautical Coverage Capability

1. GPS/GLONASS

Fortunately, ICAO was spared a political dispute on the selection of a system from among those under consideration when the USA and the former USSR declared, in April 1989, that they would offer their systems, which were initially designed for military purposes, for use by the aviation industry.[138] In earlier FANS meetings the emphasis was on these two major systems and how to utilize them in the best way, and how to complement them most effectively where there are shortcomings.

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[134] The earth stations will consist primarily of radio-frequency function message-switching links to provide aircraft over the Atlantic, Pacific Oceans, North and South America with continuing communications; see, INMARSAT, "Satellites Usher in New Era in Aeronautical Communications"[August 1991] *ICAO J.* 14 at 15.

[135] Ravensbergen J., "Teleglobe Joins Group Offering Air Passengers Phone Service" *The Montreal Gazette* (August 8, 1991) 1 at 1.

[136] Gu-Uy-Gam M., "Satellites Offer Businesses More Ways to Do Business" *The Financial Post* (May 11, 1992) 20 at 20; see also, MEMOTEC DATA, "Annual Report"[1989] 14 at 16.

[137] It is estimated to reach more than $1 billion annually by the year 2000, see, Ravensbergen, *supra*, note 135, at 3.

[138] Sochor, *supra*, General Introduction, note 13, at 26.

The GPS open-use policy was announced by President Reagan in late 1983, following the Korean Airlines-007 incident to help prevent such accidents.[139] The GPS system is a continuous, global satellite navigation system developed by the USA Department of Defense. The system has the capability of providing geodetic position and velocity accurately in three dimensions.[140] The GLONASS system[141] is designed for global radio navigation of aircraft.[142] On May 31, 1988, the USA and USSR signed a bilateral agreement on Cooperation in Transportation Science and Technology, which provides for a joint effort to develop both systems.[143]

The use by the airlines of military systems is not new, international aviation has long been using the *LORAN-C* and the *OMEGA/VLF* system *S/1*, both originally developed by the USA, as long-range navigation aids for naval vessels.[144]

Both GPS/GLONASS systems are now planned to become fully operational by the second half of 1995.[145] The two systems have the same number of satellites,[146] similar orbital structures of the space segment, and the frequency bands are close enough so that users may receive the signals of both systems using a common signal

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[139] Klass Ph. J., "Pentagon Urged to Confirm Policy Allowing Civilian Use of GPS Navsats" [January 8, 1990] *AW&ST* 57 at 57.

[140] *ICAO Doc.*, ***supra***, General Introduction, note 16, at 5-32*ff.*

[141] Salischev V. & Ivanov N., "The Glonass System - An Overview"(May 1992)45:2 ***J. Navigation*** at 175.

[142] *ICAO Doc.*, ***supra***, General Introduction, note 16, at 5-33.

[143] Klass, ***supra***, note 139, at 57.

[144] Sochor, ***supra***, General Introduction, note 13, at 102.

[145] Daly P., "Navstar GPS and GLONASS: Global Satellite Navigation Systems"(1991)25:7 ***ACTA Astronautica*** 399 at 399.

[146] The GPS/GLONNAS systems each will be operated by 21 satellite and three spares.

preamplifier.[147] Moreover, the two systems' segments are passive (they do not need to receive signals from aircraft), also they are not limited by capacity and may prove to be attractive options to current NAVAID equipment.[148] The joining of the two systems will make it possible, even at the partial deployment stage, to perform almost round-the-clock navigation determination in all areas of the world as a result of the larger number of satellites of the combined systems.[149] In other words, this capability would practically insure that regional or global interruption or partial failures of a system would not threaten the safety of civil aviation.[150] The GPS navigation will initially be coupled with inertial navigation, which should permit the number of flights in a given airspace to be increased with reduced separations and higher safety.[151]

However, as we move toward the twenty-first century, changes will slowly take place in the control of the space segments of the two systems. As J. Exon[152] said: *"I am very doubtful that the Department of Defense should be the manager of GPS in the next century. ..."*

One of the principal concerns of civil aviation users of navigation satellites is system dependability and prompt alerts to users of failure of a specific satellite or

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[147] Salischev & Ivanov, ***supra***, note 141, at 176; see also, Hartman R., "Combined Satellite Navigation Systems Could Lead to More Reliable and More Precise Air Navigation"[March 1991] ***ICAO J.*** 9 at 10.

[148] "US and USSR to Agree on Satnav Standards"(September 1989)28:3 ***The Controller*** 19 at 19.

[149] It was stated that neither system by itself provides adequate redundancy to allow for system integrity monitoring; see, Pozesky M. T., "Status Report: US/USSR Avionics Standards Development" (Report to the FANS(II)/2-WP/61).

[150] Anodina T. G. & Turner J. E., "USSR-US Accord Reached on Satellite Navigation"[May 1989] ***ICAO Bulletin*** 12 at 12.

[151] Riffiod M., "The Star Navigation"[November/December 1988] ***ITA Magazine*** 12 at 12.

[152] James Exon is the Chairman of the USA Senate Armed Services Strategic Forces and Nuclear Deterrence Subcommittee as cited in, Latham D., "The GPS War"[July 12/18, 1993] ***Space News*** 15 at 15.

degradation of its accuracy.[153] Generally speaking, the American administration is not legally obliged to provide such information to civil users. Although once it proposes such services to civil users in general and to the global aviation industry in particular, service must be provided in good faith in order to provide accurate information.[154] On the other hand the precision of the information is intentionally degraded for national security purposes.[155] For the purposes of this thesis it is fair enough to observe that any claim against the USA as a GPS service provider will be settled under the USA *Federal Tort Claims Act* (FTCA),[156] and the *Suits in Admiralty Act*.[157]

Although these acts waive the American administration's immunity, the reality is that the USA liability exposure will not be as extensive as that of a private party in similar events. Special legislation in the form of the *Foreign Claims Act*,[158] and the *Military Claims Act*[159] only minimally raises this exposure. Moreover, in the case of providing the GPS services to foreign entities neither the FTCA nor the *Suits in Admiralty Act*, as waiver of immunity acts will be available to the claimant. In such situations, the latter may be restricted at the will of the USA administration; that will be

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153 Klass Ph. J., "Soviets' Release of Glonass Data will Ease Acceptance of Navsats"[June 6, 1988] ***AW&ST*** 45 at 45.

154 The primary precedent for this precept is the USA Supreme Court case of *Indian Towing Company vs. United States*, **350 U.S. 61, 76 S. Ct. 12**, 1955.

155 Spradling K. K., "The International Liability Ramification of the U.S., NAVSAT Global Positioning System"(1990)33 ***Collo. L. Outer Space*** 93 at 94.

156 That act waives the USA government immunity in claims counter the USA for damages arising from a loss of property, personal injury or death; see, 28 ***U.S.C.A.*** 1346, 2402, 2671, 2672, 2674-80 (West 1965, 1976 & West Supp. 1990).

157 There is the second broad waiver of sovereign immunity, in the cases where the property damage, personal injury, or wrongful death is caused on the high seas or in the navigable waters of the USA by property controlled by the USA; see, 46 ***U.S.C.A.*** 741*ff.* (West 1975).

158 The purpose of this Act was to fill up the gap in the FTCA, which does not waive sovereign immunity for claims arising in a foreign States; see, 10 ***U.S.C.A.*** 2734*ff.* (West 1983).

159 That Act permits the government agency concerned to settle claims; see, ***U.S.C.A.*** 2733 (West 1983).

subject to the decision of the USA government to use its right of the sovereign immunity as a defense to any claim made against it, which means the government consent must be obtained to be sued.

From the moment that the idea of using the GPS system started until now there have been serious doubts within ICAO to adopt GPS as the international civil standard for transoceanic operations, namely because it is a military system controlled by the USA military. These concerns were expressed by ICAO's LDC member States, Eastern bloc countries and some Western European States.[160] Finally, in May 1988, when the Soviets offered GLONASS system for civil use, it was seen as a potential compromise solution to ICAO objections to the USA GPS system. ICAO recognized the political difficulty of selecting between the two systems and the potential benefits of allowing civil airspace users to make their own choice, or use both systems.[161] The growing civil aviation interest in using the GPS was tempered by European concerns over the ability of the USA Defence Department to degrade the accuracy of the system.[162] In fact, there is distrust between the ICAO member States in general, particularly the European Union, and the USA military which controls GPS system.[163] Also some high-profile aviation, and political leaders seem to be sending signals to ICAO that they won't participate in a new GNSS system if GPS doesn't change. As a hedge against unilateral USA

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[160] The UK is under pressure from their domestic ATC industries; they are keen not to allow a whole new generation of global landing and navigation aids to pass into the hands of USA suppliers. Also, there is fear from using GPS/GLONASS as basis for a new global GNSS approach aid; Butterworth-Hayes Ph., "Improving Satellite Approach Precision"[May 1993] ***Jane's Airport Review*** 24 at 26; see also Klass, ***supra***, note 139, at 58.

[161] ***Id.***

[162] De Selding P. B., "Europeans Fear U.S. Monopoly in New Market"[September 20-26, 1993] ***Space News*** 1 at 20.

[163] Aarons R. N., "GPS Global Politics Seems More Complicated than the Technology" [September 1993] ***Business & Commercial Aviation*** 11 at 11.

degradation, some potential users would like a receiver that can use both the USA and USSR system.[164]

Even though GPS/GLONASS systems will play a prominent role in the new ICAO CNS/ATM concept, the problem is that they are government controlled systems, and as more civilians begin relying on the GPS/GLONASS systems, the political clout of the governments is expected to increase.[165] It should be borne in mind that the matter is not only control of the systems, but also that both systems have a predominantly military mission, which is of no relevance to civil aviation and could be used against the interests of civil aviation in time of any perceived crisis.

There are several complex and challenging policy issues concerning GPS system, the most important of which is the system management and the policy of providing GPS services to the global aviation community free of charge for the foreseeable future.[166] Guaranteeing commercial access to GPS is a prime concern as the global aviation community invests in satellite navigation infrastructure for the future. USA civil and military authorities should reach an agreement on shared responsibility for management of the GPS, which would be consistent with the administration's general goals of defense conversion, civil/military cooperation and economic competitiveness. Such an agreement may ease the concerns of the international community over military dominance of GPS, and civil aviation industry's hesitation of using the system.[167] On the other hand there

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[164] Nordwall B. D., "Civilian GPS User Fear Pentagon's Ability to Degrade System Accuracy" [October 24, 1988] ***AW&ST*** 69 at 69.

[165] Polsky D., "Ground Stations to Correct GPS Inaccuracies"[May 11/17, 1992] ***Space News*** 6 at 10.

[166] Exon J., "A Look at the Future of GPS?"[June 7/13, 1993] ***Commercial Aviation News*** 19 at 19.

[167] Klass, ***supra***, note 67, at 59.

are other views that security problems will be a primary concern in any negotiations over the GPS network's future.[168] As one American official stated:

> "*[c]ivilianization of GPS could occur if we are assured that unique national security requirements will be met and that potentially hostile nations or groups can be denied access, as far as possible, to a signal corresponding to the precise positioning service provided by GPS.*"[169]

A hasty transition to civilian control of GPS is not something the White House will undertake without careful deliberation. Furthermore, the system can be a potent military weapon. It has been stated that any new system of civilian control must include safeguards to protect the security of the USA and its allies.[170] It is apparent that national security will be of paramount importance to the USA government. In other words, the system's dominant control will continue to be in the military hands, and day to day operational control will be shifted at some point into the hands of a civil body, such as the FAA.[171] Also, in the view of a Pentagon official in order to minimize the danger that other countries would use highly accurate signals, special efforts may be made to ensure that highly accurate signals are only available in favoured regions of the world.[172]

As previously mentioned the unilateral provision of an essential service to civil aviation, always bears the danger of unilateral withdrawal for financial, security, political, and military or any other reason.[173] In the view of the above and the current

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[168] According to J. Canny, deputy assistant secretary at the USA Department of Transportation; see, Burgess L. & Munro N., "Officials Seek Wider GPS Access"[April 26/May 2, 1993] ***Space News*** 8 at 8.

[169] Exon, ***supra***, note 166, at 20.

[170] Commentary, "Think Before Transferring GPS"[July 19-25, 1993] ***Space News*** 18 at 18.

[171] "Satellite Navigation Takes to the Slopes"[November 1993] ***Jane's Airport Review*** 39 at 39.

[172] Burgess & Munro, ***supra***, note 168 at 8.

[173] As stated that the USA Defense Departments promised to preserve the system accessible to civil users except in the most critical situations; see, "*Report to the President and Congress by the National Commission to Ensure a Strong Competitive Airline Industry: Change, Challenge and Competition*" (USA: U.S. Government Printing Office, August 1993) at 7.

changes in the global political environment, this writer has no doubt that the GPS/GLONASS systems services will not be free of political interference and the discrimination between States and regions. Also there is the uncertainty of the financial capability of the service providers. This is not to indicate that the difficulty consists of the possible conflict of military and civil uses. Even so, the Secretary General of ICAO has been requested to initiate discussions with the GNSS provider States to resolve the immediate and *long-term* GNSS issues. However, as Del Balzo has also said at the Paris Air Show in June 11, 1993:

> *"I would say to any governments that are hesitating that if they have the money they should put up a satellite to add to the GPS system. It would enhance the reliability of the system and reduce the monopoly of the US."*[174]

The European Union has expressed their aspiration that perhaps they should develop their own version of GPS.[175] The global community will come up with a long-term arrangement for satellite navigation, but the actual obstacle is the immediate and short-term, in the view of Del Balzo.[176]

The total cost of GPS is estimated at $10 billion US,[177] and over $500 million a year to maintain.[178] This is regarded as a financial burden on the USA. On the other hand, according to Pierre Jeanniot, Director General of the IATA, his member airlines would not object to the USA charging fees for value-added services such as satellite signal integrity monitoring or a differential system for higher accuracy-provided as the

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[174] De Selding P. B., "Space Chief Foresees Bleak Future for Europe"[June 14/20, 1993] ***Space News*** 6 at 6.

[175] Lenorovitz J. M., "ESA Offers Updated Navsat Concept as New Civilian Navigation System" [January 25, 1988] ***AW&ST*** 54 at 54.

[176] Del Balzo is the acting chief of the USA FAA; see, De Selding, ***supra***, note 174, at 6.

[177] Latham D., "GPS Does not Need a Bureaucratic Fix"[June 14/20, 1993] ***Commercial Aviation News*** 18 at 20.

[178] Burgess & Mounro, ***supra***, note 168, at 8.

carriers are convinced that such services would help them reduce operating costs.[179] The political fallout from imposing international user fees would be enormous. Also, the failure of the USA civil remote-sensing LANDSAT satellite program commercialization effort should be a lesson to the US Congress in trying to impose GPS user fees.[180]

If the USA continues to provide GPS free of charge to the world, and with the advent of differential GPS, one should ask why the Russians, strapped as they are for money, would continue GLONASS.[181] It seems ironic on the one hand that the USA is planning on sending billions of dollars in aid to the former USSR while they continue expensive programs such as GLONASS. In view of the failure of the Russian economy, their currency is losing against the USA Dollar and it is open to question whether the funds required for GLONASS to be maintained and operated for years to come can be raised.[182]

Following the Reagan Administration's decision to offer GPS for civil use in the wake of the Korean Airlines flight-007 incident a big question was still left up in the air: how would a military system be operated for the benefit of civil users during an armed conflict?[183] After all, one can show that using the GPS/GLONASS systems for the entire civil aviation is not the only problem; but also whether the GPS/GLONASS systems could become accepted as a globally recognized standard and sole means for civil aviation navigation ?[184]

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179 Stump W. D., "IATA Chief: Airlines Willing to Pay for GPS"[July 12/18, 1993] ***Commercial Aviation News*** 2 at 2.

180 Latham, ***supra***, note 177, at 20.

181 Burgess L., "Technical Issue Blurs Global Navigation Future"[August 23/29, 1993] ***Commercial Aviation News*** 4 at 4.

182 "Opinion"[February/March 1994] ***Aeronautical Satellite News*** 20 at 20.

183 Schore, ***supra***, General Introduction, note 13, at 103.

184 Del Balzo J., "Del Balzo Moves to Soothe International GPS Concerns"[June 7-13, 1993] ***Commercial Aviation News*** 26 at 26; see also, "Guarantee GPS Access"[June 7-13, 1993] ***Commercial Aviation News*** 18 at 18.

Lastly, in regard to the appropriate monitoring capabilities, the accuracy and integrity of the GNSS system will be that to serve all navigation function with timely failure warnings for oceanic and overland en-route operations. With appropriate augmentation such as the use of differential techniques, GNSS will also be used in terminal areas. This implies that the users will receive simple and unambiguous information about a satellite navigation system in a way that will enable the airborne system to know what to do if a satellite malfunctions. If the whole system is outside limits, the user must disregard the system; if one particular satellite is misbehaving, the user must disregard information derived from that satellite and be aware instantly in order to take the appropriate decision. For the global navigation service there will be a need for an international detection and alerting system in addition to the GPS/GLONASS as a supplement system that could emit in the GNSS frequency band both differential corrections that provide enhanced precision for the GPS/GLONASS systems, and which also emit a spread spectrum signal providing additional pseudo-range measurements.[185]

Section II: Selected General Operation Satellite Systems and Institutions

A. Global Coverage Capability Systems

1. INTELSAT

The International Telecommunications Satellite Organization (INTELSAT) was established in accordance with principles posited by UN *Resolution*, as stated in its preamble that: "*...communication by means of satellites should be available to the nations of the world as soon as practicable on a global and non-discriminatory basis.*"[186]

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[185] This supplement satellite system is referred to as an overlay, since it does not provide global navigation, but does improve the navigation of the GPS/GLONASS systems, *ICAO Doc.* LC/29-WP/3-3; see also, Sutton O., "Making Navigation by Satellite a Reality"[August 1993] *Interavia Aerospace World* 50 at 51.

[186] *UN Res.* 1721 (XVI) of December 1961.

The INTELSAT's creation was a reflection of the increasing awareness of interdependence between countries and the need for change to achieve international cooperation in outer space.[187] On August 20, 1964, INTELSAT came into being and was initially established under *Interim Agreements*[188] through the leadership of the USA. Therefore, the organization did not have the Soviet bloc in its membership.[189] On August 20, 1971, the interim agreements were superseded by new definitive arrangements, the *INTELSAT Agreement*[190] and *Operating Agreement*.[191] The Preamble expresses the will and wish of the Parties, *inter alia*, to achieve and embody a single global commercial communication satellite system.[192] The new arrangements were the result of complex, protracted, and controversial negotiations extending over a three-year period.[193] Under the definitive arrangements that took effect in 1973,

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[187] Colino R. R., "Global Politics and INTELSAT"(September 1986)10:3 ***Telecommunications Policy*** 195 at 197.

[188] Communications Satellite System (COMSAT) Agreement, August 20, 1964, ***T.I.A.S. no.*** 5646 [hereinafter **INTELSAT Interim Agreements**].

[189] Goldman N. C., ***Space Policy: An Introduction*** (USA: Iowa State University Press, Ames, Iowa, 1992) at 32. The Soviets refused to join the INTELSAT for the following reasons: i. permitting of private corporations to represent their governments; ii. excluding of non-ITU members; iii. apportioning of shares, voting, and profits based on national investment and use of the system; and, iv. temporary managing of INTELSAT by the USA corporation Comsat; see, Matte N. M., ***Aerospace Law*** (London: Sweet & Maxwell *Ltd.*, 1969) at 218.

[190] Agreement Relating to the International Telecommunications Satellite Organization; 23: 4 ***U.S.T.*** 3813 (1972). Opened for signature 20 August, 1971; entered into force on February 12, 1973 [hereinafter **INTELSAT Agreement**].

[191] Operating Agreement Relating to the International Telecommunications Satellite Organization; 23:4 ***U.S.T.*** 4091 (1972). Opened for signature on August 20, 1971; entered into force for the U.S. Communications Satellite *Corp.* on February 12, 1973 [**hereinafter INTELSAT Operating Agreement**].

[192] The Preamble of INTELSAT Agreement, ***supra***, note 190.

[193] Colino R. R., "The Possible Introduction of Separate Satellite Systems: International Satellite Communications at the Crossroad"(1985)42:13 ***Columbia J. Transnational L.*** 14 at 17; for detailed account of the different approaches taken for the renegotiation of the INTELSAT definitive arrangements; see, Trooboff P. D., "INTELSAT: Approaches to the Renegotiation" (1968)9:2 ***Harv. Int'l. L. J.*** 1 at 1.

INTELSAT ceased being a Consortium and became an international legal entity. The organization was created to foster global public satellite service.[194] As stated in the INTELSAT Agreement, Article III(a):

> *"...INTELSAT shall have as its prime objective the provision, on a commercial basis, of the space segment required for international public telecommunications services of high quality and reliability to be available on a non-discriminatory basis to all areas of the world."*

The INTELSAT goal, as stated by one commentator,[195] is:

> *"to achieve a global commercial telecommunications satellite system to provide a global commercial telecommunications and economical facilities possible, consistent with the best and most equitable use of the radio frequency spectrum and orbital space."*

According to Article XIV of the INTELSAT Agreement, there are three forms of services:

> **i.** Space segment facilities intended to meet the needs of domestic public telecommunications services.[196]
>
> **ii.** The international public telecommunications services.[197] The public telecommunications services are defined by Article 1(k).
>
> **iii.** The specialized telecommunications services[198] which are defined by Article I(l) of the Agreement. The definition is broad enough to include current service, except public telecommunications services, presently known or possible in the near future, which could be provided by satellites.

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[194] Goldman N. C., ***American Space Law: International and Domestic*** (USA: Iowa State University Press, 1988) at 56.

[195] Diederiks-Verschoor I. H. Ph., "Implications of Commercial Activities in Outer Space, Especially for the Developing Countries"(1989)17:1, 2 ***J. Space L.*** 115 at 116.

[196] INTELSAT Agreement, ***supra***, note 190, Article XIV(c).

[197] ***Ibid.***, Article XIV(d).

[198] ***Ibid.***, Article XIV(e).

Membership of the organization is only open to International Telecommunication Union (ITU) member States[199] as was the case under the 1964 interim arrangements.[200] A withdrawing party must give written notice to the USA Government who, by Article XXII is the Depository of the Agreement.[201] In the case of the withdrawal of a signatory to the Operating Agreement, the decision to withdraw is to be communicated in writing to the Executive Organ of the organization.[202] It is possible to suspend a signatory's rights or expel it under certain circumstances. The suspension of the rights of a signatory is automatic where it has failed to pay its share of capital requirement due under the Operating Agreement's Article 4(a), as determined by the board of governors, within three months of the payment falling due.[203] In the period between the suspension and the decision of the signatories, however, the signatory continues to have all the obligations and liabilities of that status.[204]

A number of provisions of the INTELSAT Agreement provide that INTELSAT's services are to be made available to all users on a non-discriminatory basis.[205] The INTELSAT Agreement does not permit the organization to establish differential charges on a per-route or per-region basis. In this respect, the provision of Article V(d) requires that the same rates apply to the same type of service and that they be the same for all

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[199] *Ibid.*, Article XIX(a)(ii). This approach was adopted in 1964 to avoid various political problems which mainly concerned the international legal status of the German Democratic Republic and the People's Republic of China at that time. These political reasons now seem to have lost their significance since members of INTELSAT are allowed to continue as members, although they may cease to be members of the ITU, as in INTELSAT Agreement Article XVI(n). In any case, the requirement for prior ITU membership appears to be contrary to the principle of non-discrimination contained in the *UNGA Res. no.* 1721(XVI) of December 20, 1961.

[200] INTELSAT Interim Agreement, *supra*, note 188, Article XII(b).

[201] INTELSAT Agreement, *supra*, note 190, Article XVI(a)(i).

[202] *Ibid.*, Article XVI(a)(i).

[203] *Ibid.*, Article XVI(c).

[204] *Ibid.*, Article XVI(h).

[205] *Ibid.*, Preamble, Articles III(a)(c), VI(c), V and VIII(b)(c)(v).

users of that type of service.[206] The organization is a international non-profit commercial cooperative of 125 member States that owns and operates the system used by 180 member and non-member countries for their international and often domestic communication.[207]

Any amendment to the INTELSAT Agreement is to be submitted to the executive organ,[208] and must be approved by the assembly of parties by an affirmative vote of at least two-thirds of the parties represented at the Assembly.[209] Amendments to the Operating Agreement require similar majorities, as those required in the case of the INTELSAT Agreement before they can be approved and come into force.[210]

INTELSAT has four organs:[211]

> **i.** the *Assembly of Parties*,[212] which is composed of all the Member States which are parties to the INTELSAT Agreement;
> **ii.** the *Meeting of Signatories*,[213] which is composed of all signatories and, at this second level, member governments, directly or through their telecommunications entities, have the opportunity to participate in the activities of INTELSAT;
> **iii.** the *Board of Governors*,[214] which is the principal managing organ of the organization, is composed of one governor representing each signatory, one governor representing each group, one governor representing any group of at least five signatories not represented pursuant to above; and

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206 Colino, ***supra***, note 193, at 22.

207 Seitz P., "Agreement Allows INTELSAT to Lease Three Russian Express Satellites"[March 22-28, 1993] ***Space News*** 8 at 8.

208 INTELSAT Agreement, ***supra***, note 190, Article XVII.

209 ***Ibid.***, Articles VII(f), XVII(b).

210 INTELSAT Operating Agreement, ***supra***, note 191, Article 22.

211 INTELSAT Agreement, ***supra***, note 190, Article VI(a).

212 ***Ibid.***, Article VII(a).

213 ***Ibid.***, Article VIII(a).

214 ***Ibid.***, Article IX(a).

iv. the *Executive Organ*,[215] is headed by a Director General as the chief executive, who is the legal representative of the Organization.

INTELSAT's legal personality, under definitive arrangements, was transformed from a joint venture[216] to an international organization.[217] Disputes between parties and/or signatories, and/or with INTELSAT are to be, in the first instance, resolved by arbitration. The INTELSAT Agreement and the Operating Agreement are silent on the question of which law will govern INTELSAT. Nevertheless, it has been provided that the decisions of the arbitration tribunal handed down in the settlement of disputes arising under the Agreement, are to be based on its provisions and generally accepted principles of law.[218] INTELSAT has an international personality, and is subject to international law. The parties' and signatories' rights and obligations are referred to in a number of Articles both in the INTELSAT Agreement and the Operating Agreement. In INTELSAT Agreement Article XIV(a), the parties and signatories are required to exercise their rights and to fulfil their obligations: *"...in a manner fully consistent with and in furtherance of the principles stated in the Preamble and other provisions of this Agreement."*[219]

INTELSAT member States have the right to establish, operate or use telecommunication satellite systems other than INTELSAT. Domestic and specialized services are to be coordinated for technical compatibility only.

Reviewing the national policies of the States party to the INTELSAT Agreement,[220] it can be confirmed that member States were knowledgeable of the possibility that a number of telecommunication satellite systems would be established

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215 *Ibid.*, Article XI(a)(b).

216 Under the Interim Agreements INTELSAT was established as a *"Joint Venture"*.

217 INTELSAT Agreement, ***supra***, note 192, Article IV; such a personality was required to solve the problem of the organization's dependence on the USA's COMSAT as manager of the system.

218 *Ibid.*, Article XVIII, Annex C; INTELSAT Operating Agreement, ***supra***, note 191, Article 20.

219 INTELSAT Agreement, ***supra***, note 190, Article XIV(a).

220 See, Matte N. M., ***Aerospace Law: Telecommunication Satellites*** (Toronto: Butterworths, 1982) at 125*ff.*

both for domestic and regional services. Accordingly, this writer believes that the delegations to the negotiations of the definitive arrangements intended to strive towards the advancement of INTELSAT as a single global system for international public telecommunication services. Consequently, there is a provision in Article XIV of the INTELSAT Agreement to the effect that other telecommunication satellite systems for international public telecommunication services of INTELSAT member States must be coordinated with the organization, to secure technical and operational coordination and to prevent serious economic harm to INTELSAT. Nevertheless, recently at its 18*th* Assembly of Parities in November of 1992 INTELSAT asserted that separate systems to interconnect with the international publicly switched telephone network would not cause significant economic harm. The economic coordination may now be an irrelevant issue.[221] INTELSAT has a bright future,[222] even with the threats it is facing from the creation of the regional and private corporations.[223] Furthermore, the organization has strived, in recent years, to become more competitive in the new markets, increasing satellite capacity and lowering costs.[224] The organization is expanding its coverage of Asia, and competing against newer companies vying to supply the fast-growing market.[225] Furthermore, INTELSAT may also provide global and domestic specialized

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[221] Harshorn D., "When PSTN Comes to Shove"(March 1993)17:3 ***Satellite Communication*** 24 at 24*ff*; see for the earlier views, Jakhu R. S., "International Regulation of Satellite Telecommunications" in Tatsuzawa K., *ed.*, ***Legal Aspects of Space Commercialization*** (Japan: CSP Japan *Inc.*, 1992) 78 at 94.

[222] In 1992, INTELSAT earned US $622.3 million in profits, with an increase of more than 10 percent over the prior year; see, Seitz P., "John Hampton: Chief Operating Officer International Telecommunications Satellite Organization"[July 19-25, 1993] ***Space News*** 30 at 30.

[223] There are two sources of threats: one with the highest profile which is the establishment of the regional and private corporation of international satellite telecommunication services, the second source is the advance of telecommunications cable technology into *"fibre optics"*, ***infra***, Chapter VII, at P. 262*ff*.

[224] Seitz, ***supra***, note 222, at 30.

[225] Tucci L., "Intelsat Seeks to Expand Pacific Area Coverage"[January 25-31, 1993] ***Space News*** 21 at 21; see also, Riccitiello R. & Saunders R., "Intelsat to Cover Fourth Region" [April 20-26, 1992] ***Space News*** 4.

telecommunication services,[226] either by means of space segment or separate facilities established specifically for those purposes, in accordance with relevant terms and conditions as set forth in the Agreement.[227]

There are a host of new services in various stages of development by the organization, *inter alia*, aeronautical mobile, and radio navigation.[228] These new services are likely to be offered in the near future. The prospect of providing aeronautical communication globally using the organization satellites is being explored in a study undertaken jointly with ICAO. In view of current events, and from the forgoing considerations the aviation industry needs to use satellites for its benefits; therefore it is this writer's view that INTELSAT should not ignore this opportunity and should participate in the implementation of the CNS/ATM systems.

The remarkable technical, operational and financial success of the global system has prompted many developing nations to join INTELSAT.[229] The organization is an illustration of reflecting technological and economic growth and the political wish to foster global evolution and peace.

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[226] INTELSAT Agreement, *supra*, note 190, Article 1, defines specialized telecommunication services as telecommunications services which can be provided by satellite, other than those defined in paragraph(k).

[227] *Ibid.*, Article III(d)(e)(f).

[228] Pelton J. N., Perras M. & Sinha A. K., "Intelsat: The Global Telecommunications Network" in Firstone C. M., Davis D. W. & Greenspan L.I., *eds.*, *International Satellite Television: Resource Manual for the Third Biennial Communications Law Symposium* (USA: Regents, University of California, 1983) 36 at 39.

[229] Smith D. D., *Communication Via Satellite: A Vision in Retrospect* (The Netherlands: Sijthoff International Publishing Company, 1976) at 153.

2. INTERSPUTNIK

In November 15, 1971, the former USSR and several other socialist countries signed the INTERSPUTNIK Agreement.[230] As per the organization's aims, as stated in its Article 1(1), the parties agree that there shall be an international system of communication by satellite and ensured cooperation and coordination of efforts to set up the system.[231] Unlike INTELSAT,[232] it is an open international organization,[233] and as it is an inter-governmental organization, only governments can be members.[234] Any member State which fails to meet its financial obligations within one year, may have its rights of membership suspended partly or completely.[235] In its Article 8, like INTELSAT, INTERSPUTNIK has a legal personality and it is: "*...entitled to conclude contracts, acquire, lease and alienate property and to institute proceedings.*"

The organization, under Article 7, is required to coordinate with the ITU, and other organizations concerned with telecommunication satellites, both in technology and in international regulations. It is not liable in respect of the obligations of contracting parties, and the contracting parties are not liable with respect to the organization

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[230] The Agreement on the Establishment of the International System and Organization of Space Communications (INTERSPUTNIK); *U.N.T.S.* 862:3, 1973. Done on November 15, 1971; entered into force on July 12, 1972 [hereinafter INTERSPUTNIK Agreement].

[231] *Ibid.*, Article 1(2).

[232] INTELSAT was managed by the private USA corporation COMSAT, which retained a decisive number of votes in the board of governors. Also, it had commercial motives, it lacked a distinct legal personality, it was based on the rule of weighted votes, and, finally, it was open only to ITU members, thereby violating the universality principle.

[233] INTERSPUTNIK Agreement, *supra*, note 230, Article 2(1).

[234] *Ibid.*, Article 2(2).

[235] *Ibid.*, Article 15(8).

obligations.[236] INTERSPUTNIK is liable only with respect to its obligations within the limits of its jurisdiction.[237] INTERSPUTNIK consists of the following bodies:[238]

> i. the *Board*, which is comprised of one representative from each member of the organization,[239] each having a single vote in decision-taking;[240] and;
>
> ii. the *Directorate*, which is headed by a Director-General and his deputy;[241] the Director General is responsible to the board for all his activities, and is the chief executive of the Organization.[242]

Although the competition now appears great, in one commentator's[243] view INTELSAT and INTERSPUTNIK have cordial relations and may at some point merge. Furthermore, an Agreement between INTERSPUTNIK and INTELSAT was reached in 1985. Also, most of the INTERSPUTNIK members are using the INTELSAT system on a service basis without becoming members. As F. Lyall[244] has stated:

> *"The official move towards interrelationships between the two non-specialized global systems marks progress towards the single global system which was the original hope of the UN Resolutions of the early 1960s."*

In any case, as stated by A. Betty,[245] Comsat's President, there are ongoing discussions to decide if INTELSAT and INTERSPUTNIK might merge, but how that

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236 *Ibid.*, Article 10(2).

237 *Ibid.*, Article 10(1).

238 *Ibid.*, Article 11.

239 *Ibid.*, Article 12(1).

240 *Ibid.*, Article 12(2).

241 *Ibid.*, Article 13(1).

242 *Ibid.*, Article 13.

243 Goldman, *supra*, note 189, at 33.

244 Lyall F., *Law and Space Telecommunications* (England: Dartmouth Publishing Company *Ltd.*, 1989) at 303.

245 Alewine B., "Newsmaker Forum"[February 24/March 1, 1992] *Space News* 30 at 30.

would happen, if they do, is not clear yet. Even though the organization is currently discussing new memberships with Australia, Chile, Canada and some republics of the former USSR[246] this writer believes that, with the collapse of the former USSR, the future of INTERSPUTNIK is unclear, and its merging with INTELSAT is expected.

3. Motorola Iridium System

In 1990 *Motorola* Corporation of the USA created a system which enabled the GEOSTAR frequencies to be used for cellular phone communication.[247] *Motorola* proposes to place sixty six small satellites and up to twelve spares in the Low Earth Orbit (LEO) to institute a global cellular satellite telephone system.[248] The system is projected to consist of eleven satellites in each of six orbital planes at an inclination of 86.4 degrees, providing continuous global coverage. The system will be capable of two-way voice, facsimile and data messages without land-based relays. As characterized by *Motorola*, the system will function in a cellular mobile telephone climate in which relay cells move instead of the telephone. *Motorola* does not anticipate providing any domestic satellite services over *Iridium* directly to the public. Instead, *Motorola* will be a wholesale supplier of *Iridium*'s transmission capacity to network operators or service providers through US gateways. *Iridium* may provide services to end users to sell capacity in bulk to other service providers, or both. *Motorola* developed GEOSTAR's handhold terminals earlier, to be certain that the *Iridium* technology would work in

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246 Riccitiello R., "Intersputnik Links East to West"(October 5-11, 1992)3:37 *Space News* 1 at 1.

247 *Iridium Inc.* of Washington is partially owned by *Motorola Inc.*, *Iridium* will possess and operate the *Iridium* system. *Motorola* is responsible for the system progress, it will act as a wholesale supplier to other carriers who will offer their services to users and the satellites launch; see Saunders R., "Celsat Joins Mobile Satellite Contenders"[February 17/23, 1992] *Space News* 4 at 21; see also, Saunders R., "Iridium Courts Investors with Move to Lower Risk"[January 27/February 2, 1992] *Space News* 22 at 22.

248 The *Iridium* concept is a constellation in seven orbital planes, each with eleven satellite.

GEOSTAR's frequencies.[249] *Iridium* has attracted the world's attention, and while the *Iridium* technology is established, the political impact continues to be a challenge.

Although every state radio or telephone adminstration will control the operating units and control communication in or from its territory, there will be some difficult export control issues involved for the network equipment.[250] As expressed by some other consortia,[251] *Motorola's* proposal would give that company a global mobile communication monopoly and exclusive control of over 400*MHz* of frequency spectrum.[252] In January 31, 1995 *Motorola* is authorized to construct, launch, and operate its system in the 1616-1626.5*MHz* band[253] *Motorola* got significant help when the 1992-WARC allocated worldwide radio spectrum for this type of telecommunication system. With this system any aircraft can be reached anywhere in the world. In 1996 *Motorola* is expected to launch the first satellite and by the end of 1998 operations will begin.[254] It is projected to have 1.4 million customers by the year 2001, rising to 2.3 million by 2006.[255] It should be borne in mind that in order for the system to succeed, and to provide its services for the aeronautical communication services it should be designed to respect national sovereignties, to be standardized by observing the ICAO

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249 Rothblatt M. A., "Report on ITU's 1992 World Administrative Radio Conference in Torremolinos, Spain"(1992)20:2 ***J. Space L.*** 93 at 40.

250 Burnett D. J. & Fuchs M., "Amendment of COCOM Rules and the Commercialization of Space"(1990)33 ***Collo. L. Outer Space*** 11 at 15.

251 Such as Radiodetermination Satellite Service *Inc.* and *LORAL* Cellular Systems *Corp.*

252 "American Mobile Satellite Corp."[June 17, 1991] ***Telecommunications Reports*** 31 at 31.

253 See, the Federal Communications Commission, Washington, D.C. ***20554, DA 95-131.***

254 Magee M., "Japanese Firms Promise to Invest $240 Million in Motorola's Low-Earth Orbit Iridium Venture"[April 12/18, 1993] ***Space News*** 3 at 3; see also, Seitz P., "Motorola Reveals Equity Investors for Iridium Project"[August 9/15, 1993] ***Space News*** 11 at 11; see for further details, Seitz P., "Mobile Satellite Companies Face Frequency Shortage"[January 31/February 6, 1994] ***Space News*** 8 at 8.

255 Wilson J. R. & Chenard S., "Iridium the Global Cellphone"[3/1991] ***Space Markets*** 26 at 26*ff.*

SARPs and to follow the national and international regulatory regimes.[256] The *Iridium* system could furnish a global telephone communication services for the first time without restrictions or control from governments, which was and is the LDC's[257] and the Europeans' reason for concern.[258]

Iridium has attracted the world's concern. The geopolitical difficulty is the hardest thing to overcome in order to furnish a global system. Since every State has control over communication from/in/to its territory, States would have to designate licenses to operate the system. It has been said: *"[t]he rights and responsibilities of States to control operations of aircraft within their sovereign airspace must not be compromised."*[259] Practical ways to utilize these potential improvements without imposing unacceptable conditions on national sovereignty need to be developed.

There is a need to establish *gateways* in every country. The *gateways* concept was devised to give local governments some control over the system, and to collecting user fees. *Gateways* meet political rather than technological requirements, and their elimination would have little impact on actual use of the system.[260] *Gateways* in every State wishing to have the service under government control and authority to access to the system, is the only adequate solution worldwide.[261] That will promote the CNS/ATM achievement mechanism and utilization of the *Iridium* system. As has been stated: *"[i]f Motorola can overcome the obstacles of setting up an extremely complicated system, it*

256 Mondale L., "Changing World Fits Iridium Project"[January 13/26, 1992] ***Space News*** 19 at 26.

257 Marcus D. J., "Delegates Bestow Mobile Mandate"[March 8/15,1992] ***Space News*** 1 at 20.

258 Riccitiello R., "While Satellite Phone Firms Race, Europe Goes Cellular"[November 23/29, 1992] ***Space News*** 8 at 8.

259 Appendix A to the report on agenda item 4, Guideline(b) "Guidelines to Assess the Adequacy in the Provision of Aeronautical Mobile-Satellite Service(AMSS) and Surveillance", ***ICAO Doc. 9583, AN-CONF/10***, at 4A-1*ff*; see also, Appendix A to the report on agenda item 8, Section II on "Aeronautical Mobile-Satellite Services", ***ICAO Doc. 9623, FANS(II)/4***, at 8A-26*ff*.

260 Wilson & Chenard, ***supra***, note 255, at 28*ff*.

261 Furniss T., "Calling the World"[August 28/September 3, 1991] ***Flight Int'l*** 28 at 29.

will become an extremely important aeronautical communications supplier.";[262] and will be in a direct competition with INMARSAT in providing mobile satellite communication.

B. Regional Coverage Capability Systems

1. PALAPA

On August 17, 1976, Indonesia created its national telecommunication satellite system (**PALAPA**). The system provides a domestic telecommunication service which, in turn, enhances Indonesia's economic, social and educational growth.[263] Indonesia's desire to own and operate a domestic satellite communication system is directly attributable to its geographic and physical features. The success of the system has led to its utilization by neighbouring countries for telecommunication services.[264] To meet future demands for satellite service, Indonesia is planning for its next generation of satellites, and the first such satellite is scheduled for launch in mid-1995. The new generation of satellites is to provide expanded transmission capacity for the island nation and its neighbours by offering an *L-band* transponder to provide for mobile communication, and more *C-band*[265] transponders.[266] This move will broaden Indonesia's role in serving the fast-growing Pacific Rim satellite-user market. Also, the organization will carry on its regional service for Pacific Satellite.[267]

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[262] Chien Ph., "Taking Off Toward Success"[May 1991] ***Via Satellite*** 29 at 34.

[263] Bulloch C., "Satellite Communications: Civil Applications Thriving"[December 1979] ***Interavia*** 1134 at 1136*ff*.

[264] "Indonesia After Palapa"[July 1985] ***Satellite Technology*** 23 at 23.

[265] The frequency range for that band most typically used in satellite communications for the up-link is 6,000 to down-link 4,000 *MHz* range.

[266] Marcus D., "Indonesia Seeks Future Palapa Builder"[May 18-24, 1992] ***Space News*** 4 at 4, 29.

[267] Saunders R., "Indonesian Satellite Company to Offer New Service"[January 27/February 2, 1992] ***Space News*** 23 at 23.

2. ARABSAT[268]

In 1967, the Arab world began debating plans to have its own communication satellite. In 1972, the Arab League member States decided to initiate a communication satellite network for Arab countries and signed an treaty at their Cairo Meeting of April 1976.[269] Members of the organization are States,[270] The objective of the ARABSAT network is:

> *"...to use an Arab satellite as a means of serving the purposes of communications, information, culture, education and any other services for which the above-mentioned network could be utilized and towards the fulfilment of the objectives of the Arab League Charter... ."*[271]

ARABSAT is the earliest cooperative enterprise by developing nations aimed at providing the operational benefits of space technology to its member States. Not only does this cooperation result in sharing costs (thereby increasing the economic attractiveness of the system for every country), but it also results in developing closer ties and greater understanding among its participant States.[272] The organization has three bodies:[273]

> i. the *General Body*, which consists of the ministers in charge of telecommunications in the Arab member States or their deputies; every member is permitted to one vote. The General Body's functions are specified in Article 11;

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[268] The term "*ARABSAT*" is the name given to Arab Satellite Communications, is now applied to the satellites as well as to the organization.

[269] Agreement of the Arab Corporation for Space Communications (ARABSAT); for the text, see, ***Telecommunications J.*** *vol. 44-IX*/1977, at 422. Done on April 14, 1976; enter into force on July 15, 1976 [**hereinafter ARABSAT Agreement**].

[270] ***Ibid.***, Article 1(c).

[271] ***Ibid.***, see the preamble and Article 3.

[272] *UN A/CONF.*101/10, at 83.

[273] ARABSAT Agreement, ***supra***, note 269, Article 9.

ii. the *Board of Directors*, which consists of nine members;[274] each member of the board has one vote; and,

iii. the *Executive Body*, which is headed by the Director General, and made up of a number of sectors and administrative units which are governed by the rules of conduct of the Corporation.[275]

The speed of economic growth, the increase in cultural exchanges and the realization of the Arab role in global relations created the need for an advanced regional communication system able to meet needs in terms of telephone, telex and data transmission.[276] The drafters of the ARABSAT Agreement incorporated several facets of the INTELSAT Agreement, which they used as a model. Unlike INTELSAT, where member States cast their votes in percentage to their financial investments, ARABSAT designated every member State to have the right of one vote in both the General Body and the Board of Directors.[277]

The ARABSAT corporation is being financed by three sources: the contributions of member States, the profits produced by individual and corporate users of the system, and television and radio stations using the satellite for news and programme transaction with other countries.[278] The corporation has a legal personality, and its goal is to provide and set up its own space segment for general and specialized telecommunication services to its member States in harmony with technical, and economic standard accepted in the Arab and international arena.[279] ARABSAT is a profitable corporation, and its

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[274] The nine members of the board are elected as follows: five permanent members (Kuwait, Lebanon, Libya, Saudi Arabia, and the United Arab Emirates) and four members are elected every two years, ***ibid.***, Article 12(1)(a)(b).

[275] ***Ibid.***, Article 14(2).

[276] Ziadat A., "Arabsat: Regional Development in Satellite Communication"[1/1988] ***ZLW*** 35 at 35.

[277] ARABSAT Agreement, ***supra***, note 269, Articles 10(1), 12(6).

[278] ***Ibid.***, Article 8.

[279] ***Ibid.***, Articles 2, 3.

capital is subscribed by member States who are entitled to a share of the system's revenues according to their subscription.[280]

Like any other organizations, ARABSAT provides the Arab region with a flexible communication capability. A multitude of services and applications can be imagined with the system.[281] Ground segment facilities are not the responsibility of the organization, which is concerned only with the space segment, but are entirely the business of the member States.[282] ARABSAT is able to provide services in remote sensing, teleconferencing, telemedicine, weather forecasts for sea and air navigation, the transmission of business data of graphic material for newspapers and electronic mail processing. Thus, the corporation can offer a broad range of services precisely suited for educational, cultural and socio-economic aims. By the consent of the general meeting of the corporation, it can engage in other activities that help meet the corporation's goals.[283]

Like most international governmental organizations, ARABSAT is endowed with specific privileges and immunities. These are stated in the Privileges and Immunities Agreement of the League of Arab States.[284] The provisions concerning the settlement of disputes, unlike the settlement clause in the Liability Convention, are binding on the State parties. Also, it is noteworthy that disputes are not referred to the ICJ, or to arbitration, but are handled internally by the General Body of the corporation, which is to settle all disputes between the corporation and one or more of its members, as well as disputes amongst the members themselves.[285]

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280 ***Ibid.***, Articles 5, 6, 7 and 8.

281 Ziadat A., "Can Arabsat Achieve its Aims?" ***Jordan Times*** (April 29, 1985) at 1.

282 Bulloch C., "Arabsat a Community of Interest Through Satellite Communications ?"[1/1985] ***Interavia*** 31 at 32.

283 ARABSAT Agreement, ***supra***, note 269, Article 3 (3).

284 ***Ibid.***, Article 16.

285 ***Ibid.***, Articles 11(7), 19.

The ARABSAT space segment includes three satellites. Recently *ARABSAT-1C* joined its two predecessors, *ARABSAT-1A/1B*, which have performed very successfully since their launch in 1985.[286] More recently, ARABSAT signed a contract with AEROSPATIALE Paris for the construction of two satellites with more capacity, and the launch of one of them is planned for 1995 or early 1996, and the storing of the second as a backup until it is needed, for a period of up to five years.[287]

In the last two decades in the history of ARABSAT, the irony is that the system which was conceived as a vehicle for broadcasting must now find a new role outside traditional telecommunication.[288] However, there are some problems of substantial limitations keeping ARABSAT from reaching its objectives, which have to be overcome, *inter alia*, the political tensions existing in the region, as H. Kandeel Director of UN Educational, Scientific and Cultural Organization (UNESCO) Public Information Department, stated: "*ARABSAT has not succeeded in making an optimal use of the satellite's facilities because of political misunderstandings and not because of technical failures.*"[289]

ARABSAT inherited the political system and did not create it. However, the organization is expected to move ahead with its plans and aspirations to achieve its essential objectives but only if it is able to secure continued and extensive support from its members.[290] There have been improvements since 1985, and currently there are 19 national earth stations operating, which leaves only three more to install out of the 22

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[286] "ARABSAT-1C in Service"(July 1990)34 *News from Prospace* 65 at 65.

[287] De Selding P. B., "ARABSAT Choice Ends Long Bidding Battle"(April 26/May 2, 1993)4:17 *Space News* 4 at 4; see more details, De Selding P. B., "ARABSAT to Sign With Aerospatiale, Not Hughes"(April 19-25, 1993)4:16 *Space News* at 1; see also, En Vedette Spotlight, "...and ARABSAT II"(June 1993)99 *Revue Aerospatiale* 66 at 66.

[288] ARABSAT has reported a profit of US $12 million for 1991, and the same for 1992. The figures were disclosed in Dubai at a six-day conference hosted by ARABSAT "ARABSAT Profits"(April 1993)9:2 *Space News* 34 at 34.

[289] *Jordan Times* (March 9, 1986) at 3.

[290] See, *UN A/CONF*. 101/BP/IGO/4.

member States. Nevertheless, traffic levels remain well below predictions.[291] The organization has proved that the States of the region can show a high level of political and technical cooperation, overriding their many differences. Even though the political problems are far from being completely resolved, there is confidence in planning for the future.[292] Currently, ARABSAT is making a difficult transition from a poorly-run, debt ridden organization to one capable of managing a regional satellite system with high growth potential for the 1990s.[293]

3. EUTELSAT

In a May 1982 inter-governmental conference, two international agreements were concluded, the first an inter-governmental Convention, which formed the organization EUTELSAT, was signed by the States as parties;[294] the second was the Operation Agreement,[295] signed by signatories, which can be authorized private telecommunication entities. The organization's headquarters is in Paris.[296] EUTELSAT is open to all States in Europe that are members of the ITU. The main purpose of the

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[291] Bulloch C., "Arabsat a Neglected Asset"[1/1989] ***Interavia Space Markets*** 36 at 41; the reduction in rates would certainly increase usage of its system because the rate of charge is the same as that of INTELSAT. However, the only appreciation is the fact that a hook-up can generally be arranged within minutes using ARABSAT, whereas obtaining a slot on INTELSAT can take hours or days; see, Jacob K., "Arabsat: Bridging the Gulf?"[April 1985] ***Satellite Technology*** 8 at 9.

[292] Marfleet P., "Development of Telecommunications Within the Middle East"[January/ February 1986] ***Middle East Transport & Telecommunications*** 24 at 24*ff*.

[293] De Selding P. B., "Arabsat Eyes Alternatives to Ailing Satellites"[October 26/November 1, 1992] ***Space News*** 4 at 4.

[294] Convention Establishing the European Telecommunications Satellite Organization "EUTELSAT"; ***B.G.B.I.*** 1984 II, at 683. Opened for signature on July 15, 1982; entered into force on September 1, 1985 [hereinafter EUTELSAT Convention].

[295] Operating Agreement Relating to the European Telecommunications Satellite Organization; ***B.G.B.I.*** 1984 II, at 713. Opened for signature on July 15, 1982; entered into force on September 1, 1985 [hereinafter EUTELSAT Operating Agreement].

[296] EUTELSAT Convention, ***supra***, note 294, Article XVII.

organization is to provide a space segment that meets the international public telecommunication needs in Europe,[297] and that can also be used for domestic public telecommunication in Europe. On request, and subject to the negotiation of appropriate terms and conditions, the organization can provide separate segments for domestic and international public telecommunication services, and specialized services, other than for military purposes.[298]

Under EUTELSAT Convention Article IV, the organization has the legal personality, and the full capacity necessary to exercise its functions and fulfil its purposes.[299] Therefore, it can enter into contracts, acquire, lease, hold and dispose of movable and immovable property, and conclude agreements with States and international organizations.[300] The organization's structure is composed of the following bodies:

> **i.** the *Assembly of Parties*, which is made up of all the parties, one party getting one vote. The Assembly develops general policy and long-term objectives of the organization through recommendations;[301]
>
> **ii.** the *Board of Signatories*, which is the principal management organ. It is composed of Board Members, each representing one signatory.[302] However, no signatory is to have more than 20 percent of the total voting shares in EUTELSAT.[303] The Board appoints the Director General and it can also remove him from office;[304] and,
>
> **iii.** the *Executive Organ*, which is headed by the Director General, and he is the legal representative of the organization.[305]

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[297] *Ibid.*, Article III(a).

[298] *Ibid.*, Article III(f)(i)-(iii).

[299] *Ibid.*, Article IV(b).

[300] *Ibid.*, Article IV(b)(i) to (iv).

[301] *Ibid.*, Article IX(a)(i).

[302] *Ibid.*, Article X(a).

[303] *Ibid.*, Article XI(c).

[304] *Ibid.*, Article XII(b)(xvi).

[305] *Ibid.*, Article XIII.

The organization is financed by the contributions of member States and the revenues produced by use of the telecommunication network.[306] The traffic generated in telecommunication within Europe is such that a satellite system is likely to have a proportion of the market adequate to sustain it, therefore, EUTELSAT's future seems secure. Disputes arising from the Convention or Operation Agreement are referred to arbitration under the Convention Article XX or the Operating Agreement Article 20, although the referral of a dispute between a party and a signatory is subject to their agreement.

C. National Coverage Capability Systems

1. COMSAT (USA)

The USA 1962 Communications Satellite Act authorized the establishment of the Communications Satellite Corporation (**COMSAT**). The Corporation is a private, shareholder-owned for profit corporation established in 1963. COMSAT was established to develop an international satellite system to be implemented, and operated in conjunction with other nations. COMSAT is the USA participant in INTELSAT and INMARSAT.[307] As R. Mario, the COMSAT President, stated: "*... in the middle of 1994, the aeronautical business is kicking in. So I can see by 2000 a fairly smooth distribution of maritime, land and aeronautical business.*"[308] The company for years, held a monopoly status as the only USA provider of international capacity. As a commentator[309] has stated that COMSAT even though it is a private enterprise, is subject to the USA government's comprehensive control not only as a public utility but also as an agent of national policy. COMSAT faces a rapidly changing and increasingly

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306 *Ibid.*, Article V.

307 "Communications Satellite Corporation (COMSAT)" in ***The World Satellite Directory*** (Phillips Publishing *Inc.* 11*th* Annual *ed.*, 1989) at 324.

308 "Newsmaker Forum"[August 2/8, 1993] ***Space News*** 22 at 22.

309 Katzenbach N. de B., "Communications Satellites, World Peace Through Law" in ***The Athens World Conference Lectures*** (USA: West Publishing Company, 1964) at 520.

competitive environment in the international communication marketplace. In addition, the USA Department of State has announced that restrictions against private USA systems will gradually be lifted, allowing private companies to compete on an equal basis with COMSAT.[310] The affairs of the corporation are administered by a *Board of Directors*, composed of 15 members. The corporation has a *President*, and other officers who are appointed by the Board of Directors.[311]

2. TELESAT "TMI" (Canada)

TELESAT Canada, established by an act of Parliament on June 27, 1969, came into being on September 1, 1969. The corporation was authorized to construct and operate a commercial communication satellite system, the first domestic system of its type. It is a commercial venture, 50 percent of which is owned by 13 of Canada's major terrestrial common carriers and the other half by the Canadian federal government. TELESAT is not a Crown Corporation or a government agency. The corporation is financed by revenues generated from its operations and from commercial loans obtained from banks and other financial institutions; also, it receives no government assistance. It offers special services directly to business users and broadcasters, leases space segment and end-to-end transmission services to the nation's common carriers and provides the only means of reliable telecommunication to vast areas of Canada's North.[312] ARINC has signed a five-year service contract with TELESAT to provide satellite communication to airlines.[313]

Anikom 200 is TELESAT's versatile, interactive data service. The *Anikom* system is ideal for interactive data communication which require immediate information from

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[310] Saunders R., "Comsat Petitions FCC for Rate Reform to Lift Profits"[February 24/March 1, 1992] *Space News* 26 at 26.

[311] *COMSAT Act* of 1962, Section 303(b).

[312] "Telesat Canada"[November 1989] *Telesat Fact Sheet* at 5*ff*.

[313] "Transport Canada Connects Aviation Sites with Anikom 100"(Winter/1991)6:3 *Telesat Canada, Satellite Communications Newsletter* 1 at 3.

a central database. Hotel chains, airlines, and car rental companies use the system to effectively manage their reservation systems.[314]

TELESAT is looking to the future, foreseeing future business opportunities in the sphere of personal wireless communication. One of the biggest markets identified for future growth is that of mobile communication in Canada.[315] TELESAT also plays a major role in aviation safety in Canada. Unfortunately the corporation has been struggling financially since the 1993 fall when 270 million Canadian dollars worth of financing was withdrawn.[316] TELESAT emerged from bankruptcy protection with a new name and owner. The corporation is now called *TMI* communication. The new corporation plans to launch a geostationary communication satellite *MSAT* in November or December 1994 to provide telephone and facsimile and computer data connections to anywhere in North America.[317]

Concluding Remarks

The above discussion briefly describes selected existing aeronautical mobile satellite systems and selected general satellite systems. All systems share many similar characteristics, they provide transnational techniques to pool resources in order to enter the expensive arena of space based communication.[318] Although they are different in concept, these systems have much in common. There are other satellites systems which intend to provide aeronautical and maritime services, they are either being improved, or

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314 "Telesat's Anikom 200 VSAT Service"(Winter/1991)6:3 ***Telesat Canada, Satellite Communications Newsletter*** 3 at 3.

315 "Canada's Place in Space" in, ***Government of Canada, Inter-Departmental Committee on Space*** [1988] at 9*ff.*

316 Knapp B., "Telesat Mobile Financing Package Collapses"[April 12/18, 1993] ***Space News*** 4 at 4; see also, "Telesat Mobile Looks to Regroup After Bankruptcy"[April 13, 1993] ***Space Business News*** 8 at 8.

317 "Telesat Mobile Resurfaces as TMI Communications"[July 19/25, 1993] ***Space News*** 15 at 15.

318 Goldman, ***supra***, note 189, at 65.

in the planning stage, *inter alia*, *MOBILSAT*, *SKYLINK*,[319] which are radio navigation satellite systems providing communication service for aircraft control bodies and helping to establish the distance between en-route aircraft in flight; the European Navigation Satellite System (NAVSAT); and Japan began satellite navigation systems tests in 1987 using its *ETS-5* spacecraft permitting position information with a one-*km*. accuracy; also Australia is considering making use of a satellite for CNS purposes using the geostationary *AUSSAT* system.[320] The question to be addressed here is, whether the foregoing existing institutional regime is adequate to meet the present need, and anticipated developments in the aviation community.

The preceding indicates that the introduction of elements needed for a global satellite-based CNS/ATM systems are emerging. Also, the needs of future aviation will speed up the use of satellites by civil aviation. Institutional solutions will have to be considered for the CNS/ATM systems implementation; different institutions and legal arrangements are required for different types of systems and technologies. This writer believes that these foregoing institutional structures will form the basis of any new institutional arrangements if there will be any; or be the starting point for the same institutions' self-adjusting if they desire to provide any of the CNS/ATM services according to ICAO recommendations and requirements, entirely or partly on national, regional or on a worldwide basis.[321] M. Milde[322] has stated: "*[n]o doubt any of these candidate institutional arrangements can provide valuable elements for consideration by the FANS Committee.*" That view was supported by the ICAO Secretary General in his paper to the 141*st* Session of ICAO Council[323] where he said that ICAO should make

[319] The *Skyphone* consortium combines Norwegian, Singapore, and British *TELECOM*, the world leader in international switched-telephone access, and is the gateway for over half of all private circuits between Europe and the USA, see, *ARINC, supra*, note 12.

[320] Park, *supra*, Chapter I, note 109, at 25.

[321] Riccitiello R., "Civilian GPS Users Eye Future System"[May 11-17 1992] *Space News* 8 at 10.

[322] Milde, *supra*, Chapter I, note 2, at 96.

[323] *ICAO*, *supra*, General Introduction, note 27. Appendix B.

maximum use of existing inter-governmental or governmental agencies, adjusted if necessary, and operated in agreement with existing institutional provisions and legal regulation. The future conduct of the CNS/ATM systems will involve all of the foregoing and other, yet to be created, entities in various roles.

Part II

The Prospective Long-Term Needs for Air Navigation

Chapter III: Characteristics and Capabilities of CNS/ATM Systems

Introduction

Aviation is a complex industry and requires the participation of a number of human and mechanical elements for its effective operation. The FANS Committee looked at the aviation technical infrastructure and recognized the need for new technology in the future.[1] In spite of the fact that the capability of the present system (which is a ground-based line-of-sight CNS) can be improved, its capabilities are limited when we consider its ability to furnish universal coverage. The new technologies could allow for increased capabilities at a lower cost.[2]

The core of the benefits of the CNS/ATM systems will be derived from automation intended to reduce or eliminate constraints on the systems. While construction of new airports, or additional runways at the existing airports, is one way of increasing capacity,[3] technological innovation is another option for increasing airport/airspace capacity. For instance, utilization of satellite technology will improve the range, coverage and accuracy of current ATC; it will also reduce its current topographical limitations. This will increase technical, operational and economic advantages.[4]

In 1949 ICAO laid down requirements for the Instrument Landing Systems (**ILS**), which is still used as the standard precision landing aid. Ten years later, after an exhaustive consideration of alternative short-range navigational aids, ICAO settled upon the **VOR/DME** as the basic international air navigation system aid. By the early 1970s,

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1 Poritzky B. S., "Achievement of More Airport Capacity - The Time for Action is Now" [January 1989] ***ICAO Bulletin*** 12 at 14.

2 *ICAO Doc.*, ***supra,*** Chapter I, note 8, at 1-3.

3 Lopez R., "Satellites Are Key to Reducing Runway Separations"[November 1992] ***Jane's Airport Review*** 41 at 42.

4 *ICAO Doc.*, ***supra***, Chapter I, note 8, at 1-2.

the aviation community concluded that an improved landing aid was needed to meet the growing requirements of the *jet*-age.[5] To ensure the safety and efficiency of air transport the ILS would have to be replaced on a global basis. Also, there are various factors threaten the continued use of ILS such as multipath interference, radio interference from frequency modulation broadcast stations, frequency congestion. This problems are varies from region to the other and State to State. However, the replacement planning of ILS is a factor since the Microwave Landing System (MLS) as a ground equipment is in operation in a number of States, including some twenty five MLS installations in the North American and European Regions. In accordance with the Assembly *Resolution* A29-10, there will be a Special Communications/Operations Divisional Meeting to be held in March 27/April 7, 1995 to decide how and when instrument landing systems will be replaced. However, it seems that the USA and Europe are about to split on the issue. On one hand the European position seems that it will be in favour of the application of MLS as an interim step for certain countries and striking with the current ILS for as long as possible, supplemented where necessary by the MLS. Their reasons are that they are sceptical of the ability of GNSS system consisting of the GPS/GLONASS systems to support approaches and landing in bad weather. Also Europeans are uncertain if they should depend on a satellite system such as GPS/GLONASS controlled by the USA and Russian's military authority. On the other hand, USA sees little reasons to go to a MLS, which was to have followed ILS as the world's international standard, when it believes it can use satellite-based technology directly. The Far-East bloc and Pacific Rim countries will probably vote for GNSS since they are ahead of the application of GPS system operations. For LDC's where Category III is a rarity, it is likely they will support the USA position rather than spend millions on new ground-based systems.[6] For the

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5 The ILS has been the standard landing aid since the 1950s. Its main handicap is that its single narrow approach forces aircraft to line up, single file, and land in turn, the MLS provides a wider approach and operates on much higher frequencies than the ILS.

6 Baumgarner J., "U.S. Europe Move Toward Separate Precision Guidance Systems" [November 1994] ***Forum*** 13 at 13*ff*; Butterworth-Hayes Ph., "ILS Protection is Now the Critical Issue"[December 1994] ***Jane's Airport Reviews*** 37 at 37*ff*.

imminent Special Communications/Operation Divisional Meeting of March/April 1995 the ICAO Secretariat's view will be that: a transition to a single established system is considered impractical and the ILS/MLS transition plan becomes obsolete for regional differences in operations environments and other factors.[7] Instead, strategy is proposed by ICAO's Secretariat which is intended to maintain the current safety level of all weather operations. This strategy, based on a Required Navigation Performance (**RNP**) for en-route operations, is defined as a statement of the navigation performance accuracy necessary for operation within a defined air space. Also, amendments to Annex 10, as recommended under the All Weather Operations Panel (**AWOP**)/15 Recommendation 5/1, are necessary in order to introduce the suggested strategy for implementation and application of non-visual aids to approach and landing in place of the ILS/MLS transition plane.[8] In this writer's view it seems that ICAO Secretariat's proposed strategy will be accepted and the ILS/MLS/GNSS will be the international standards for the precision approach system if they meet the RNP criteria. In such a situation airlines will need multi-mode receivers for all weather operations in areas that have different precision approach and landing systems, whether ILS/MLS or GNSS. Such a solution in this writer' view is not the ultimate, hoping that solution to be only as a temporarily as possible for the transition to the GNSS system which should be the sole global system on the *long-term* period, for cost-benefit, and avoiding the possibility confusion or mistakes by using the multi-mode receivers.

New technologies show much promise in reducing weather related delays on the ground and in airspace. Within the next few years pilots can expect to see better weather forecasts, more precise guidance around storms, more accurate data about winds and temperature aloft, and speedier approaches into airports.[9] Meanwhile, as noted at the

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[7] ***ICAO SP COM/OPS/95-WP 12***, 10/1/95.

[8] ***See, Annex 10***, "*Aeronautical Telecommunications*" to the Chicago Convention, Volume I, Part 1 - Equipment and Systems, Chapter 2 - Radio Navigation aides and Appendix B - ICAO ILS/MLS Transition Plan.

[9] Haines, ***supra***, Chapter I, note 12, at 71.

seminar on *open skies* in 1987, technology is moving the international community towards global open skies.[10] In the following, the impact of automation on aviation industry is illustrated in Section I, the impact of the new CNS systems on the Air Traffic Management (ATM) is expanded upon in Section II, and in Section III the stride into the future will be examined by considering the impact of ICAO role on the CNS systems.

Section I: Impact of Automation on the Aviation Industry

Automation has been gradually introduced in the aviation system. *Flight-deck* automation has made aircraft operations safer and more efficient by ensuring more precise flight manoeuvres, providing display flexibility, and optimizing *cockpit* space. Space technology is increasingly being used to ensure the safety of civil aircraft and, in the second half of the 1990s, one can anticipate that satellite navigation systems will become an important part of the modern system of controlling, and assisting civil aircraft worldwide.[11]

The application of state-of-the-art technology and automation is fundamental to the ICAO CNS/ATM concept. Experience shows that it is essential to take into account the human element during the design phase so that the resulting system capitalizes upon the relative strengths of humans and computer-based technology. The concern is with automation of future aviation related technology and in particular with human factors issues in CNS/ATM systems application. Automation is also essential to the progressive evolution of the CNS/ATM systems and is expected to play a commanding role in future development of aviation technology.

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[10] Sullivan D. C., "Seminar on "Open Skies", Washington, D C, November 4, 1987"(1988) 16:1 ***J. Space L.*** 87 at 87*ff*.

[11] Bordunov V. D., "Utilization of Outer Space Technology in the Interests of Civil Aviation" (1989)32 ***Collo. L. Outer Space*** 283 at 283.

A. IATA and Automation

1. Overview

IATA has a role in influencing the development of the new systems' concept to promote the interests of its member airlines. Standardization of procedures and documents is one part of the compromise between competition and cooperation in which IATA plays a role. In the early 1980s IATA instituted a multi-disciplinary *Automation Policy Group* in order to analyze and rank the automation recommendations for its member airlines.[12]

2. IATA Satcom Agreement

IATA and INMARSAT have agreed to work together on the development of ATC communications, improved emergency services, and passenger communication. In Paris on September 3, 1992, the two organizations signed a cooperation agreement.[13] The agreement includes an exchange of technical information and coordinated inputs to international fora. In its preamble it is stated that:

> "*IATA wishes to achieve efficiencies in operation and enhance passenger services through the use of satellite communications and navigation.* [Also], *INMARSAT, with its satellite technology, can assist in attaining these objectives.* [Furthermore], *IATA's aims are to promote safe regular and economical air transport for peoples of the world, to foster air commerce, and to study the problems connected therewith; to provide the means for collaboration among air transport enterprises engaged directly or indirectly in international air transport services, and represent their interests in this regard.*"

The parties agree in Article 1: "*...[to] maintain close consultation and cooperation ...including cooperation on technical matters* [,] [have] *consistency between the activities of each Organization... .*"

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[12] Eser G. O., "Impact of Automation of the Airline Business"(1986)XI *AASL* 3 at 8.

[13] Consultative Agreement Between the International Air Transport Association and the International Maritime Satellite Organisation; ***IATA Doc. Aug.92/L509.4/IATAagmt***. Signed on September 3, 1992; see also, "IATA/INMARSAT Pact"[October/November, 1992] ***Aeronautical Satellite News*** 3 at 3.

3. IATA ARINC Cooperation

ARINC, in cooperation with IATA, provides a centralized data-base service for global identification of lost or stolen airline documents. Industry resolutions effective in 1990 specify that an airline that enters lost or stolen airline ticket numbers into the *ARINC TICKETS* data-base is not financially responsible, in the interline settlement process, to an airline that accepts that document. IATA recognizes the *ARINC TICKETS* service as the only official industry data base for listing lost or stolen airline documents. On the other hand, ARINC supports IATA by operating and maintaining a real-time computer system for the TICKETS service data-base, which can be accessed from any airline terminal anywhere in the world.[14] Furthermore, ARINC was the first company to join the new Technical branch of the IATA Registered Suppliers' Programme scheme in order to encourage consultation and harmony between airlines and their industry providers.[15]

B. Air Law and Automation

1. Growing Importance of Telecommunication

In the 1940s and 1950s flight operations, traffic and sales, and other airline functions operated in semi-isolated, semi-autonomous subsystems. But with the advent of the *jet*-age, a new communication system was created. The increase in speed necessitated a decrease in time spent for communication, and this led to the need for a more complex system that could link the growing number of users.[16] It should be kept in mind that telecommunication and air transport share various characteristics which are both uniting and divisive elements, for example, the fact that national regulation of aviation and communication is the exclusive prerogative of every country. This has been the case mainly for reasons of national security up to the present. Both, aviation and

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[14] *ARINC* 90-200132K.

[15] "First Registered Technical Supplier"[2/1992] *IATA Review* 22 at 22.

[16] *The ARINC Story, supra*, Chapter II, note 17, at 80.

telecommunication are critical on the global, regional and national stage.[17] Considering that while sovereign rights are significant, they should not restrict international agreements about aviation and telecommunication, both of which are not restricted by national borders.

The use of satellites has vastly improved communication technology through the use of communication services on earth in terms of services provided, and economic import. When space communication technology came into being, States were pleased by the concept and saw it as a mechanism for the interchange of data and the promotion of education. Several States were worried about its possible misuse which might affect their political, economic, social and cultural foundations.[18] Although, for most of the LDCs which are confronted with numerous difficulties, *inter alia*, geographical isolation, limited investment in conventional terrestrial systems and inadequate communication infrastructure, satellite communication is a benefit.[19]

2. The Impact of Transborder Data Flow Legislation

The majority of developed countries have legislated privacy laws that diminish the use of automated files for personal information. These laws control the flow of such information. The free flow of information is decreased by rules that are encouraged by privacy,[20] propriety, avoidance of fraud, or national security protection.[21] These restrictions which are in the interest of individuals, are contrary to the concern of

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[17] It should be mentioned that aside from the communication purpose of transferring or interpreting information, communication is essential to secure control, command, and discipline to improve morale and motivation.

[18] Jasentuliyana N., "Space Telecommunications Issues and Policies: Role of the United Nations"(1983)26 *Collo. L. Outer Space* at 59.

[19] Report of the Second UN Conference on the Exploration and Peaceful Use of Outer Space, at Vienna, *A/CONF.101/10* (August 9/21, 1982) at 35.

[20] In respect to the passengers's privacy see, *infra*, Chapter VI, at P. 238*ff*.

[21] Pool De Sola I. & Solomon R. J., "The Regulation of Transborder Data Flows"[September 1979] *Telecommunications Policy* 176 at 176.

airlines, which prefer to have unrestricted data about their customers for marketing purposes.

Through the international telecommunication and information arena, the USA has encountered resistance by other countries to the application of marketplace and free flow principles. Although the USA is regarded to be the most open nation in respect of the flow of information, nonetheless it limits and restricts the sale or delivery of some technological devices or information to foreign countries which are considered to be less than friendly. It should also be kept in mind that even in a single country the difficulty of intercompany data flow could arise.[22] However, an opinion prevails that there will be a need in the twenty first century for more free flow of information than ever before.[23]

While restrictions on transborder data flows are an inefficient means of protection of privacy or property, in this writer's view it is necessary to balance such conflicting considerations. Also, there is no single solution to a multi-layered problem of the regulation of international data flows.

C. Airline Industry and Automation

Automation will increasingly affect all aspects of airline operations. The application of advanced automation technology could be as important to the airline industry as new aircraft technology was in its formative years, and it will become a factor for dynamic change in airlines as well as business entities. In IATA's[24] view:

> "... *the* [airline] *industry could function without automation but there would certainly be a very marked difference in terms of costs, resources and levels of service.*"

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[22] The USA Department of Justice oversees the airline's computerized reservation systems as a type of data monopoly.

[23] Fitzgerald J., ***Business Data Communications: Basic Concepts, Security, and Design***, 3*ed.* (N. Y.: John Wiley & Sons, 1990) at 18.

[24] Eser, ***supra***, note 12, at 5.

Any new system will need to solve the problem of radically different requirements between airlines, or even the multiple needs of international carriers.[25] Furthermore, automation will improve the efficiency and the capacity of air traffic services, which will save about $4.1 to $5.5 US million annually through increases in airline efficiency.[26] The airlines feel that a transition plan is required which considers their concerns in terms of priority, cost-effectiveness and operational efficiency.[27]

D. Air Traffic Control and Automation

The purpose of ATC is to prevent airplane collisions. This is achieved by providing a separation between them, vertically and laterally or longitudinally, the dimensions of that separation being determined by several factors, mainly the nature of the control service available.[28]

Space technology development, as any other new technology, generally requires a stronger base of high-calibre manpower. Its effective use also requires a large number of trained personnel.[29] In particular, manpower resources are now widely recognized as being one of the biggest problems facing ATC authorities around the globe. Recruitment and training is a crucial part of the development plans for most civil aviation

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25 For example, the military system which enhances pilot visibility in bad weather is being adapted for civil airliners. Every airline has a different approach. The Middle East airlines are indifferent about fog, they want to know how well they can penetrate sand storms; at the same time Europeans have invested in Zero/Zero electronics that can land the airplane, but then they are blind on the ground when they try to taxi. So they don't need it for flight but as a taxi system; Wilson J. R., "Military Infra-Red Goes Civil"[January 1991] *Interavia Aerospace Review* 17 at 17.

26 "Welcome to FANS Facts"(June 1992)1 *IATA FANS Facts*.

27 *ICAO Doc., CASITAF/1, Priorities Paper no. 2*, May 24/26, 1994.

28 Leonard D., "European ATC Requirements"(June 1990)18 *IFALPA Quarterly Review* 10 at 11.

29 Improvement of human resources is the single most significant and time-consuming factor of infrastructure enhancement. Though some LDCs do have a fairly good base of skilful manpower, most are inadequate in this critical circumstance.

authorities.[30] As the world's ATS providers gear up for FANS implementation, there is a general trend towards upgrading the universal standard of services provided.[31]

Automation can enhance efficiency and safety, and improve reliability as well as help in reducing inaccuracy. Developments in ATC technology and airspace use are improving aircraft flow in the air space by reducing the required separation between aircraft.[32]

The present ATC system is costing airlines and consumers billions of dollars yearly because of delays,[33] and it must be modernized to make the economy more productive.[34] Air traffic services recover their costs through user charges, although this income is frequently absorbed into the general State's budget. This has resulted in an ever widening breach between the national authorities' duty to furnish air traffic service, and the persistent and significant investment contributed by the airlines to fulfil augmented consumer needs.[35]

Advancements have persisted in the development of advanced ATC automated systems, including SSR equipment with Mode(S) data link capability. Satellite technology will further enhance ATC and the safety of aircraft in flight which is important for the assurance of efficient and regular air communication. Furthermore, satellite navigation systems make it feasible to state the error boundary more precisely than present ATC technology permit, and this will improve flight safety.[36]

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[30] 1993 ATC World Survey, "A Global Review of ATC Development Plans"(January/February 1993)5:1 ***Jane's Airport Review*** 15 at 16.

[31] ***Id.***

[32] Advertising Supplement, "A Strong Grounding for the Future"(January/February 1993)5:1 ***Jane's Airport Review*** XIII at XIII.

[33] ***Supra***, Chapter I, at P. 21*ff*.

[34] ***Supra***, Chapter II, note 173, at 6.

[35] Galibert D., "Managing the Human Element of ATC"[March 1991] ***The Controller*** 6 at 7.

[36] Bordunov, ***supra***, note 11, at 283*ff*.

It is essential to consider human factors in planning and implementing the new systems, and in achieving optimal airspace design and management. The 10*th* Air Navigation Conference of 1991 acknowledged the importance of human factors in the design and transition of the coming ATC systems, and also noted that automation presented an opportunity for human error.[37]

Even in the most automated systems the human element will continue to be the principal component; machines should aid, not replace, humans.[38] In the new CNS/ATM systems human functions within the ATC system have to be explicitly established, and several restrictions must be met, *inter alia*, that human skill must be preserved. If the system shuts-down or if there is any failure in service, the controller must still be able to manage the traffic within a safe margin. The workload must stay at a reasonable level in order to guarantee safety. Job performance must be maintained by the needed skills, challenge and effort. The controller must be able to trust the system in terms of reliability. The controller's task must be precisely defined. Finally, information transfer between the controller and the system or *vis-versa* must be accurate.[39]

Reliable communication between the controller and the pilot is important to flight safety. Communication is frequently difficult especially in countries where English is not the first language. At present this problem is mastered by using the computer software programme called *ATCoach*.[40]

The legal aspects of automated ATC systems need to be recognized and duties determined. The controller must continue to be a basic part of the ATC system and retain overall system control. The purposes of ATC automation are not only to expand system

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[37] *AN-CONF/10, supra,* General Introduction, note 17, at 3-8*ff*.

[38] "Increased ATC Automation May be Inevitable to Handle Increasing Traffic and Data"[June 1993] *ICAO J.* 16 at 17.

[39] *Id.*

[40] Gerstenfeld A., "Improvement in Flight Safety May be Achieved Through Enhanced Controller Training"[October 1990] *ICAO J.* 19 at 19.

capability but also to reduce human error. It must also facilitate and support ATC in their task, enhance their capabilities and decrease their workload.[41]

Section II: The New CNS Systems' Impact on the ATM

A. Overview

ATM is a scheme of regulations and techniques devoted to ensuring a safe system of air travel.[42] ATM is a component of *Air Traffic Services, Air Traffic Flow Management, and Airspace Management.*[43] The main benefit of an improved CNS systems is that it will be more responsive to users' needs. Through closer interaction between airborne systems and advanced ground based processing systems, ATM will improve the safety level and increase the flexibility of the system.[44] The ATM scheme will rely on the efficiency of its plan and its ability to adjust quickly to changing situations.[45]

Recently SITA and the Russian Federation agreed to work together on the implementation of advanced ATM in the airspace over Russia and central Asia.[46] Although satellite technology is seen by many as complex and therefore expensive, it will eliminate the need for extensive and costly ground installations. And in so doing, it could help to bring international-quality ATM to the skies.[47]

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[41] Rooseman W., "Air Traffic Control and Automation"[December 1991] *The Controller* 19 at 19.

[42] US Federal Aviation Administration, "Concept of the Future"[September 1991] *ICAO J.* 23 at 25.

[43] International Federation of Air Traffic Controller's Associations, "Controllers Look Forward to Technology Enhancements"[December 1991] *ICAO J.* 20 at 20.

[44] *Supra*, note 26.

[45] US Federal Aviation Administration, *supra*, note 42, at 24.

[46] "SITA in Russian Pact"[August/September 1992] *Aeronautical Satellite News* 3 at 3.

[47] Learmount D., "Satellite Signposts for African Skies"[June/July 1993] *Aeronautical Satellite News* 10 at 12.

The future ATM scheme must be compatible with global developments. One set of avionics must be usable everywhere.[48] Under the Chicago Convention, States must secure the provision of safety in implementing and operating the ATM scheme.[49] The ATM scheme will help increase airport capacity. This will be accomplished through techniques, procedures, and technologies that will allow higher traffic throughout the flight in order to utilize airport resources to their highest capacity.

The common purpose of ATM is to permit aircraft operators to meet their planned times of departure and arrival, and hold to their favoured flight profiles with minimal restrictions and without threatening safety.[50] However, ATM depends heavily on knowledge of the weather, and with more accurate forecasting of storm tracks, ATM can be performed more reliably and efficiently.

Customarily, States have furnished aeronautical services within various political and institutional frameworks. Currently, there is shift in which some States have separated ATM services from certification, or regulatory functions. This has been accomplished by having independent corporations, or government-owned formations provide ATM services. An unambiguous division of responsibilities is essential to assure that safety factors and certification responsibilities are not affected by the stress of providing ATM services.[51]

The human being is the essential link in aircraft operations and is also the most flexible for the new systems in general.[52] Appropriate training is basic so as to diminish human error and to furnish skilful, proficient and competent staff. It is clear that management roles have a large influence on safety. Controllers must be assured that

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48 US Federal Aviation Administration, ***supra***, note 42, at 23.

49 ***ICAO C-WP/9860***, at 5.

50 ***ICAO***, ***supra***, chapter II, note 80, at 8A-51.

51 ***Ibid.***, at 5-6.

52 Carel O., "France is Devoting Considerable Resources to the Developments of ATC Capabilities"[June 1993] ***ICAO J.*** 25 at 27.

automation will be used to support the human role in ATM and not to replace it. Generally speaking, human element aspects of automation and man/machine relationships must be adequately considered when forming the new automated systems.[53] It is clear that without the implementation of building new technology, ATM efficiency will diminish due to the anticipated increase in air traffic and the difference in technology capacities on the ground and in aircraft.[54] As we approach the next century, it is increasingly easy to envision a global ATM system.

B. Airspace Management

The objective of airspace management has been defined as attempting to maximize, within a given airspace structure, the utilization of available airspace by dynamic timesharing and, at times, the segregation of airspace among various categories of users.

Today's air traffic congestion is a matter of concern in some parts of the world. Although the rate of increase will differ between regions, all regions are expected to experience growth in air traffic demand in the next century. Such increases will cause increasing strain for service providers and users.[55] These, along with environmental concerns, will restrict the capacity of air space.

Despite the global economic slow-down, fuel crises, wars and other inhibiting factors which have influenced global economic development, the aviation industry is still developing and it is expected to grow by the same rate until the end of the year 2005.[56]

Airspace capacity depends on airspace organization, en-route traffic, controller sector capacity, ATC system support and operational procedures. Unlike the ATM in

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[53] Stuart D. C. B., "ICAO 10th Air Navigation Conference-Montreal, 4 to 20 September 1991" [December 1991] *The Controller* 10 at 14.

[54] *SYM-IP/1*, *supra*, Chapter I, note 15, at 2.4-2.

[55] *ICAO CASITAF/1, Information Paper no. 1*, April 21, 1994, at 6.

[56] Shepherd G. J., "Automated Airside Operations"[1993] *World Aerospace Technology* 134 at 134.

which air traffic services and ATFM are normally part of one organizational structure, airspace management is often the responsibility of two or more organizations; one for civil aviation and the other for military. This necessitates the examination or development of a new organization for airspace management.

The cooperation between civil and military activities, although not an issue at the time of the Chicago Conference, is essential today for efficient airspace management. In 1956 the ICAO Assembly adopted a resolution on joint civil/military use of airspace and air navigation facilities and services, by stating:

> "[contracting States should] *encourage coordination between their various aeronautical activities in order that the common use of airspace and of certain facilities and services be so arranged that safety, regularity and efficiency of international civil air navigation will be safeguarded.*"[57]

European experience with civil aviation during World War II had been different because commercial operations were restricted to a few neutral States. The sharing of airspace did not present too many problems. Today, with traffic growth and congestion problems getting worse, the need to share the increasingly busy airspace led to new forms of coordination between civil and military services. This cooperation reflects a state of affairs in which: "*the rules of the game include some national rules, some international rules, some private rules and large areas of no rules at all.*" [58]

Solutions to air traffic *gridlock* require urgent action in the sky and on the ground. One of ICAO's priorities is to convince States that they must provide more airspace for civil traffic to allow a more direct and efficient route structure.[59] Technical solutions can provide *short-term* relief by increasing, to an extent, the flow of traffic and the capacity of airports. Studies on congested airways are under way in several countries to

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57 ***ICAO Assembly Resolution*** A10-19; in similar terms this concern is expressed at each regular session of the assembly in resolutions defining the continuing policy of ICAO in the field of air navigation.

58 Keohane O. R., "Reciprocity in International Relations"(1986)40:1 ***Int'l Organization*** at 20; see also, Sochor, ***supra***, General Introduction, note 13, at 86*ff*.

59 Sochor, ***ibid.***, at 28.

reduce the separation of aircraft in flight. Horizontal separation between adjacent aircraft has been reduced several times thanks to improved radar surveillance and better navigation systems. Improving the altitude-keeping accuracy to reduce vertical spacing is more difficult. It is, however, technically feasible to reduce by half the 2000-foot vertical separation in the upper airspace and increase capacity with a modest investment in air-data systems. Such implementation would be based on regional air navigation agreement.[60]

New separation rules will improve the flow of traffic but will not address the problem of congestion in terminal areas. Possible solutions to terminal congestion include an increase in the number of runway exits, and a reduction in the three-mile separation between landing aircraft as well as the space between parallel runways. The safety risks inherent in drafting new separation specifications must be assessed constantly. The International Federation of Airline Pilots Associations (IFALPA) has opposed reducing separation rules before they are demonstrated to be safe.[61] Finally, global navigation systems can further reduce minimum separation distances between aircraft and provide precision landing approaches, and thus greatly expand the number and safety of flight operations.[62]

In the near-term, there is a need for airspace improvement which is hindered by limitations of capability in the North Atlantic/Pacific Oceanic airspace, in some

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[60] Changes in the separation minima are being considered by a special ICAO panel based on studies and evaluations being carried out in Canada, Western Europe, the US and the USSR; see *ICAO Doc.* 9530, the 1988 Annual Report of the Council, at 46; at the seventh meeting of the Review of the General Concept of Separation Panel developed corresponding amendments to existing ICAO documents, including Annexes 2, 6 (Part I and II) and the Procedures for Air Navigation Services - Rules of the Air and Air Traffic Services (PANS-RAC, Doc. 4444), see *ICAO Doc.* 9568, the 1990 Annual Report of the Council at 37.

[61] Pilots have been at odds with the airlines over this issue since 1966 when IFALPA successfully delayed the introduction of reduced separation standards over the North Atlantic until proven operationally safe. It has insisted on thorough statistical research every time the question has come up.

[62] Simpson Th. R., "Managing the World's Air Traffic"[March 1993] *Aerospace America* 15 at 16.

continental airspace and in the terminal zones of numerous airports globally. In continental airspace, some FANS improvements are needed. With the achievement of the FANS notion, the utilization of multinational management of overflights by civil aviation aircraft could enormously improve the efficiency of high altitude airspace. In terminal areas and at airports, the FANS technology, once it is implemented, will improve efficiency and allow capacity to meet demand.[63]

C. Air Traffic Services

1. Alerting Services

The alerting services' objective is to inform a pertinent organization regarding aircraft in need of search and rescue. Today, ATC flight information and alerting services, which jointly form the air traffic services, rank high among fundamental ground support facilities required to ensure the safe and efficient operation of air traffic globally, and this is partly because of the danger of collisions which could result from a breakdown of the ATC system. Accordingly, IATA attracted worldwide attention and led the establishment of the ICAO Panel to develop the SSR and the Traffic Alert and Collision Avoidance Systems (TCAS).[64]

D. Air Traffic Flow Management

Air Traffic Flow Management (ATFM) is a theme with which not many controllers outside of Europe and the USA are familiar. The flow management service is designed to guarantee a suitable flow of air traffic to or through areas where air traffic demands surpass the limit of the ATC system. The problem was first recognized in Europe in the early 1970s when air traffic services were not able to handle traffic requirements. It was obvious that the proper solution was on a regional level.[65] ATFM

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[63] IATA, "Airlines Foresee FANS Utilization in Oceanic Airspace by End of Decade" [December 1991] *ICAO J.* 16 at 16*ff.*

[64] "Traffic Alert and Collision Avoidance System (TCAS)"[June 1989] *The Controller* 23 at 23.

[65] Russo G., "Air Traffic Flow Management"[December 1987] *The Controller* 14 at 14*ff.*

ensures an ideal flow of air traffic to or through zones in peak periods when demand exceeds ATC capability. It also helps ATC in fulfilling its purposes and achieving practical use of airspace and airport capability while keeping delay costs to a minimum.[66]

The future flow management mechanisms will be based on the function of extensive data-bases characterizing present and projected levels of requirement and capability resources. There will be an improvement between ATC and flow management in the arrangement of air traffic service performance.[67]

To conclude, the purpose of ATFM is to facilitate ATC by creating, and maintaining an expeditious flow of traffic in the ATC system and to help aircraft operators by providing more efficient traffic patterns or flows. Furthermore, the computerization of ATFM has proved to be an essential element to efficiently deal with the various flow control rates and increases in traffic demand.

Section III: Stride Into the Future

A. Considerations on the Role of ICAO

1. Overview

ICAO will play a key role in any institutional arrangements to be established; Articles 37, 44, 54(l) and 90 of the Chicago Convention provide full flexibility for the Organization to address all issues of the CNS/ATM systems. Furthermore, *Resolution* A29-8 recognized that ICAO is the only international organization in a position to effectively coordinate the new system's activities. In this respect, a document presented by ICAO to the Second UN Conference on the Exploration and Peaceful Uses of Outer Space held in 1981 stated:

> *"...ICAO is responsible for developing the position of international civil aviation on all matters related to the study of questions involving the use*

[66] *SYM-IP/1*, ***supra***, Chapter I, note 15, at 3.2-2.

[67] *ICAO*, ***supra***, Chapter II, note 80, at 8B-26.

of space technology for air navigation purposes, including the determination of international civil aviation's particular requirements in respect of space technology."[68]

Furthermore, ICAO Assembly *Resolution* A22-20 recognized that the exploration and use of outer space for peaceful purposes were important to international civil aviation, and affected matters falling within the Organization's competence under the Chicago Convention.[69] While the competence of the ICAO respecting the breach of rules of air law is regulated, and claiming liability in this area is left to the discretion of the State, the ICAO competence with respect to the breach of the rules respecting space law is not precisely defined in the Chicago Convention. The rules of codified air law are in the Annexes to the Convention under ICAO auspices; they are applicable to space segment operation. Therefore, ICAO should assume an appropriate procedure for such systems in harmony with the Chicago Convention Article 12. Also, with respect to space activities, ICAO should contribute to the determination and elaboration of the concept of global duties such as, ATC liability and CNS service providers' liability. This should lead to more clarification of the global duties of the State regarding CNS/ATM with respect to space activities. Throughout the years, the growth of international aviation has been promoted by the powerful commitment of ICAO member States in structuring a global network of routes and facilities. The application of the Chicago Convention is proof that States can jointly work to make air transport a safe system of travel. Moreover, due to crowded airspace, the distinction now drawn in the Chicago Convention and in national laws between civil aviation and other forms of aviation, is becoming meaningless for the purposes of allocating the use of airspace. ICAO is the only appropriate body to establish technical standards for international aeronautical communication, navigation, and surveillance services.[70] Furthermore, ICAO is

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[68] International Civil Aviation Organization, Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space, Report on the Civil Aviation Interests in the Use of Outer Space, ***Background Paper 1, A/CONF.101/BP/IGO/1*** (1981).

[69] *ICAO Doc.*, *supra*, General Introduction, note 23, at 3-4.

[70] *Infra*, at P. 123*ff*.

responsible for the coordination of the use of frequencies allocated exclusively to the AMSS by the ITU. ICAO could have a substantial institutional role to play, if its member States were to adopt an option involving a mechanism within ICAO stipulating financial management by ICAO as has been done for the joint financing of North Atlantic agreements. Here, ICAO could define the polices and operating standards for the services, furnish guidance and equipment specification *etc*. Under such a scheme ICAO could initiate the *User Charges* system. The institutional role of ICAO would need its active involvement and this would be in addition to its customary roles. Consequently, the legal issues originating from the rules of international air law, international space law, and international telecommunication law fall within the scope of ICAO competence. The principal challenge facing ICAO today, in relation to prospective technical and operational requirements, is the use of new technology.[71] Other issues concern further improvement of airport facilities, the requirement for increased automation in all areas, and measures to alleviate airport and airspace congestion,[72] *etc*. The ICAO objectives and responsibilities under Article 44 of the Chicago Convention are as relevant today as they were in 1944.

ICAO as a specialized agency of the UN has its goal to uphold the principles and techniques of international air navigation and to promote the planning and advancement of the aviation industry. It has *quasi-legislative* and *regulatory roles*[73] in the technical domain and performs an advisory and consultative function in the economic field.[74] Article 22 of the Chicago Convention refers to ICAO's functions in the field of facilitation. To implement its rules, ICAO must rely on the goodwill of States rather than on legal requirements. A major restriction on its activities is the fact that it is not allowed

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71 Such as MLS, ACAS, and CNS new systems.

72 "The Convention on International Civil Aviation: ...the First 46 Years"[2/91] ***ICAO Doc.*** E/P1/8000, at IV.

73 Naveau J., ***International Air Transport in a Changing World*** (London: Nijhoff Publishers, 1989) at 54.

74 Milde M., "The Chicago Convention - After Forty Years"(1984)IX ***AASL*** 119 at 122.

to exercise any kind of regulatory authority in the field of economics, which remains the sole prerogative of sovereign States. Article 1 of the Chicago Convention generally restricts the authority of ICAO as an intergovernmental regulatory agency.

ICAO was created as a result of a political act, and it reflects the policies and objectives of large aeronautical States which control its decision making process. The important decisions of its governing body can be justified on technical, economic or legal grounds but they are, nevertheless, political decisions which cannot be separated from their political context. Although ICAO was created to oversee the orderly development of civil aviation, it cannot live up to the task because it was never granted authority commensurate with its responsibility. It is one commentator's view[75] that ICAO: "*...cannot provide leadership on the critical issues affecting the future of air transport, and its voice is too faint to be heard... .*"

The major challenges facing the Organization will come as a result of the gradual breakdown of the regulatory system. Global issues in air transport can no longer be dealt with on a bilateral level. ICAO, therefore remains, the only viable institutional framework in which States can work out new rules. While ICAO does not have a specific mandate to regulate the economic aspects of air transport, nothing in the Chicago Convention prevents it from assuming such a role. ICAO's mandate, according to Article 44 is to, *inter alia*: "[i]*nsure the safe and orderly growth of international civil aviation throughout the world;* [m]*eet the needs of the peoples of the world for safe, regular, efficient and economical air transport.*"

Based on a broad interpretation of these objectives, the Organization cannot fulfil its mission without addressing the economic and regulatory issues which stand in the way of the efficient and economical use of air transport.[76] Some see that the role of ICAO being challenged in today's environment, and within the open skies policy.[77]

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[75] Sochor, ***supra***, General Introduction, note 13, at 223.

[76] ***Ibid.***, at 222*ff*.

[77] Oudin D., "Air Traffic Congestion in Europe: ICAO's Initiatives for Remedial Actions" [January 1989] ***ICAO Bulletin*** 15 at 15.

Under the provisions of Chapter XVIII of the Chicago Convention, the ICAO Council is specifically charged with adjudicating disputes between States over the interpretation or applicability of the terms of the Convention and its annexes. This was the first postwar mechanism for the peaceful settlement of disputes incorporated in an international arena, and this instrument was hailed as a significant innovation in international law.[78]

Specifically, as a *quasi-judicial* institution under Articles 84-88, the Council is empowered to adjudicate disputes between contracting States which cannot be settled by negotiation. The Council, under Article 66, also assumed judicial functions, including the settlement of differences and the hearing of complaints with respect to the International Air Services Transit and Air Transport Agreements.

When Chapter XVIII was drafted in 1944, the participants in the Chicago Conference visualized the Council becoming a tribunal composed of impartial judges to settle disputes between States. This was an unrealistic expectation because Council representatives do not act on their individual capacity but only as spokesmen for their respective governments. As M. Milde has pointed out: "*the Council cannot be considered to be a true judicial body composed of judges who would be deciding strictly and exclusively on the basis of respect for law.*"[79]

Short of invoking the judicial machinery of Chapter XVIII, States can rely on other provisions in the Chicago Convention to air their grievances before the Council. Under Article 54, it is incumbent on the Council to report to contracting States any infraction of the Convention, and to report to the Assembly any case where in a State has failed to take appropriate action within a reasonable time after notice of the infraction. In the same Article, Paragraph (n), the Council must: "*consider any matter relating to*

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[78] Schenkman J., ***International Civil Aviation Organization*** (Geneva: H. Studer, 1955) at 376.

[79] Milde M., "Dispute Settlement in the Framework of the International Civil Aviation Organization(ICAO)" in Bockstiegel K.-H., *ed.*, ***Settlement of Space Law Disputes*** (Koln: Carl Heymanns, 1979) at 91; Milde, ***supra***, note 74, at 126; see also, Fitzgerald G. F., "The Judgement of the International Court of Justice in the Appeal Relating to the Jurisdiction of the ICAO Council"(1974)12 ***The Canadian Yearbook Int'l L.*** 153 at 169.

the Convention [to] *which any contracting State refers.*" The latter provision is so broadly worded as to invite any type of grievance ranging from the strictly technical or legal to those with obvious political implications;[80] however, this provision has a practical limitation: the Council is obliged to consider any such matter but is not obliged legally to decide.

Today the major challenges facing civil aviation are technological, economic, social and legal;[81] this raises the question of whether some basic rules embodied in the Chicago Convention should be reexamined.[82] Advocates of deregulation emphasize the need to update some primary rules included in the Convention that are, in their views, barriers for free trade of international air services. On the other hand, there is another view which feels that, while many amendments appear desirable, no change of the Convention rules is required urgently.[83]

2. Present and Future Mandate

(a) Overview

The ICAO 29*th* Session of the Assembly, rather than the Strategic Action Plan prepared by the Council, was predicated on a necessity for leadership by a powerful and effective ICAO to face, *inter alia*, the increasing involvement of non-aviation sectors (for example, satellites and communication in civil aviation), and the increasingly extreme economic, political, environmental and other social tensions affecting civil aviation policy or operations. This would be specifically on a national or regional basis, it would include

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80 Sochor, *supra*, General Introduction, note 13, at 111.

81 Matte N. M., "The Chicago Convention - Where From and Where to, ICAO?"(1994)XIX *AASL* 371 at 382 *ff.*

82 Sekiguchi M., "The Use of Airspace and Outer Space For All Mankind in the 21st Century" (Address to the International Conference on Air Transport and Space Application in a New World, Tokyo, Japan, June 2, 1993); see also, Matte, *ibid.*, at 393.

83 Milde M., "The Chicago Convention - Are Major Amendments Necessary or Desirable 50 Years Later?"(1994)XIX *AASL* 401 at 446.

swift transitional changes in socio-economic systems in some regions which have global consequences.

Implementation of the CNS/ATM systems presents States with many challenges. Consequently, the 29*th* Session of the ICAO Assembly emphasized the importance of the ICAO capacity to assist States with regard to the technical, financial, managerial, legal, institutional and cooperative aspects that the CNS/ATM systems' implementation may involve. Also relevant is the commitment of ICAO, reaffirmed by the 29*th* Session of the Assembly, to provide information and guidance to States performing their own CNS/ATM systems' cost-effectiveness or cost-benefit analysis. In this context, it is particularly important to organize regional seminars, symposia and workshops[84] to assist States and interested international organizations in the formulation of the best CNS/ATM implementation options and scenarios.[85]

ICAO, continues to update not only the norms governing international air navigation, but also the techniques used for their development. In this way law is acquiring a greater social orientation and in the future will be less a tool for imposing solutions of the powerful on the weak, and more a vehicle for reconciling a broad range of conflicting interests.

At present, it is hard to predict the prospect of alternatives to the use of satellite based CNS/ATM systems. It is critical to refrain from the elaboration of any type of provision of aircraft servicing by satellite without proper agreement and coordination. And ICAO should assume charge to ensure that the use of the new systems are on universally agreed and non-discriminatory conditions.[86] Therefore, in the following, ICAO and INMARSAT cooperation, and finally ICAO's responsibility for SARPs are addressed.

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[84] For example, "*Future Air Navigation Systems Workshop*" (held by Singapore Aviation Academy in Singapore, August 24-26, 1992).

[85] Rochat Ph., "States have Critical Role to Play in the Implementation of ICAO CNS/ATM Systems"[January/February 1993] *ICAO J.* 7 at 7.

[86] *Infra*, Chapter VII, at P. 303*ff*.

(b) ICAO and INMARSAT Cooperation

The INMARSAT Conference of 1976, which led to the creation of the organization, endorsed the program of inquiring into the possibility of furnishing an aeronautical mobile satellite service capability.[87] Subsequent studies were conducted[88] as to the requirements of the international aeronautical community for satellite communication, and this in order to eliminate the shortcomings[89] of the present aeronautical communication system. Finally, the INMARSAT Assembly of 1983 requested that the Director General study the amendments that might be necessary for the provision of aeronautical mobile satellite communication.[90] The INMARSAT Convention was amended at its Fourth Session Assembly of 1985 to give it institutional jurisdiction to provide services to the aviation community.

Nevertheless, some of these amendments caused jurisdictional overlaps between the INMARSAT and ICAO, and some disputes did arise regarding the ICAO's exclusive jurisdiction in aeronautical communication.[91] The conflict was in the new Article 3(1) of the INMARSAT Convention which reads as follows:

> *"[t]he purpose of the Organization is to make provision for the space segment necessary for improving maritime communications and, as practicable, aeronautical communications, thereby assisting in improving communications for distress and safety of life, communications for air traffic services, the efficiency and management of ships and aircraft, maritime and aeronautical public correspondence services and radiodetermination capabilities."*

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[87] ***MARSAT/CONF/WP.14***, at 1; Final Act of the International Conference on the Establishment of an International Maritime Satellite System, Intergovernmental Maritime Consultative Organization, London 1976, at 69.

[88] Kuranov V. P. & Iovenko Y. A., " Design Concepts of CNS Satellite Systems"[March 1987] ***ICAO Bulletin***, at 22.

[89] ***Supra***, General Introduction, at P. 5.

[90] The INMARSAT Third Session in October 1983, ***Assembly/3/7***.

[91] Von Noorden W. D., "Space Communications to Aircraft: A New Development in International Space Law (Part II)"(1987)15:2 ***J. Space L.*** 147 at 150*ff*; see also Magdelenat J.-L., "INMARSAT and the Satellite for Air Navigation Services"(1987)XII ***Air L.*** 266 at 277.

It was felt[92] that by adding the word *practicable* this affirmed that aeronautical services were to be provided on an elective basis. Furthermore, in the amended Article 8(1) of the INMARSAT Convention:

> *"[a] Party shall notify the Organization in the event that it or any person within its jurisdiction intends to make provision for, or initiate the use of, individually or jointly, separate space segment facilities to meet any or all of the maritime purposes of the INMARSAT space segment,... ."*

In comparison with the original text of the same Article one can see that the word *maritime* was added. This signifies the diverse nature of the maritime and aeronautical communication services furnished by the Organization, and it also distinguishes its protection against competition.

In order for ICAO to achieve its objectives under Article 44 (c)(d)(h) of the Chicago Convention, the Organization has the capability to adopt the relevant SARPs as in Article 37. This was contrary to the amended Article, 15(a), of the INMARSAT Convention, which clearly gives the INMARSAT Council the right to:

> *"(a) Determination of maritime and aeronautical satellite telecommunications requirements and adoption of policies, plans, programmes, procedures and measures for the design, development, construction, establishment, ..."*

As M. Midle explained that the ICAO Council was of the view that any decision of AMSS telecommunication is subject to the restrictive prerogative of ICAO.[93] This was also confirmed by the ICAO Assembly *Resolution* A22-20 of 1977, which stated:

> *"ICAO is responsible for developing the position of international civil aviation on all matters related to the study of questions involving the use of space technology for air navigation purposes, including the determination of international civil aviation's particular requirements in respect of the application of space technology."*[94]

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[92] Von Noorden, *id.*

[93] For details see, Milde M., "Amendments to the Convention on the International Maritime Satellite Organization"(1985)X *Air L.* 306 at 306*ff.*

[94] *ICAO Doc. 9215 (A22-Res).*

Considering ICAO competence in aeronautical communication matters and related issues as in Article 37 of the Chicago Convention, the INMARSAT Convention Article 27 was amended as follows:

> *"[t]he Organization shall co-operate with the United Nations and its bodies dealing with the Peaceful Uses of Outer Space and Ocean Area,... . In particular the Organization shall take into account the relevant international standards, regulations, resolutions, procedures and recommendations of... the International Civil Aviation Organization... ."*

In the opinion of some,[95] using the word *shall* is in harmony with the contents of the Chicago Convention Articles 37, 38, 54(l), which authorize ICAO to produce SARPs. On the other hand, ICAO supported an amendment which required INMARSAT to comply with applicable ICAO SARPs and not only to take them *into account*;[96] there was authentic concern that any other formula might reduce the authority of ICAO's SARPs.[97] On June 27, 1989, ICAO and INMARSAT signed an agreement[98] to establish and maintain close cooperation in matters relating to aeronautical mobile satellite communication services. Its Preamble said: "[a.]... *ICAO has the exclusive competence to establish International Standards, Recommended Practices and Procedures in the field of aeronautical communications....*"

This implies that INMARSAT agrees to ICAO's mastery respecting aeronautical communication technical standards. As a commentator[99] stated:

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95 Van Traa-Engleman H. L., ***Commercial Utilization of Outer Space: Law and Practice*** (The Netherlands: Kluwer Academic Publishers, 1993) at 149; see also, Von Noorden, ***supra***, note 91, at 155.

96 ***ICAO C-WP/7941***, at 4-5; ***INMARSAT Doc. COUNCIL/20/6/ADD/1/Attachment 2***.

97 Milde M., "ICAO"(1984)X *AASL* 479 at 483.

98 Agreement of Cooperation between the International Civil Aviation Organization (ICAO) and the International Maritime Satellite Organization (INMARSAT), ***ICAO Reg. no. B467***. Signed at Montreal 27 June 1989.

99 Matte N. M., "The Role of Communications Satellite in Preserving Peace" in Mcwhinney E. *et al., eds.*, ***From Coexistence to Cooperation: International Law and Organization in the Post-Cold War Era*** (The Netherlands: Martinus Nijhoff Publishers, 1991" 197 at 204*ff*.

"[t]he Agreement accomplished several objectives: the recognition of the exclusive competence of ICAO in the field of aeronautical communications; extension of legal and technical recognition to INMARSAT as a supplier of mobile services via satellite in the aeronautical sector; provision for close, if not exclusive, cooperation between the two organizations; and, lastly, creation of a consensus for the use, by INMARSAT, of the electromagnetic frequency bands reserved for civil aviation and currently not operated."

Under Article 2 of the cooperation agreement both organizations have a duty to inform each other of meetings dealing with AMSS and to be represented as observers, both are entitled to propose the inclusion of items on the agenda, and to participate, without a vote, in discussions. Nonetheless, ICAO is the sole body able to institute technical standards for global aeronautical communication and surveillance services. This was also confirmed by the FANS Committee's conclusion.[100] In one commentator's[101] view INMARSAT proposed the modification when it realized ICAO's role and relevance in establishing aviation standards, and aimed to collaborate with ICAO and adhere to the applicable ICAO SARPs. INMARSAT recognizes the ICAO's role in regulatory matters affecting air safety.

Sharing or leasing the space segment of another satellite service seems to be a very promising option since ICAO has obtained an opportunity for civil aviation to acquire experience in the use of satellite communication by its cooperation with INMARSAT. Furthermore, the INMARSAT Council has responded to the initiative which was taken by the ICAO Council, and has decided to include an aeronautical capability in the generation of maritime mobile satellites that were expected in 1988.[102] There are many factors which favour cooperation between the maritime and aeronautical communities, *inter alia*, the opportunity to use an established system, thus permitting the early introduction of aeronautical services for satellite development; the avoidance of

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[100] ***ICAO Doc.*** 9503 (FANS/3 Report).

[101] Ryan F., "Satellite in Civil Aviation"(March 1986)1 ***IFALPA Quarterly Review*** 16 at 17.

[102] ***ICAO FANS I-WP/7***, at 2; see also, Sochor, ***supra***, General Introduction, note 13, at 27.

major capital investment for satellite development and launch costs, and so on; the proximity of frequency bands which provides the opportunity to use common satellite facilities and similar technology. Also, an aeronautical satellite system should be subject to international accountability and support which INMARSAT is uniquely placed to do.[103]

(c) ICAO's Responsibility for CNS/ATM SARPs

ICAO's major task has been to set the basic international standards which are now contained in eighteen Annexes to the Chicago Convention. These Annexes have been constantly updated to meet successive advances in technology since they affect flight operations, airworthiness, rules of the air, the transport of dangerous goods, personnel licensing, airports, aeronautical communication and environmental protection.[104]

One of the primary objectives of the Chicago Convention is, as stated in the preamble, to agree on: "*...certain principles and arrangements in order that international civil aviation may be developed in a safe and orderly manner...* ." The Paris Convention of 1919, included technical annexes to guarantee uniform regulations. The critical difficulty behind the deliberations at the Chicago Conference was how to maintain international uniformity of flight regulations without encroaching on the constitutional procedures of those States which require formal ratification of treaty amendments.

As a *quasi-legislative*[105] organ, the Council is empowered to adopt SARPs, which for convenience are designated as Annexes to the Chicago Convention. These SARPs provided the basis for the unification and harmonization of technical rules of international air transportation. From the functional point of view, the adoption of such standardization and uniformity has created the regulatory basis for international air

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[103] Ryan F., "Satellites for Civil Aviation"[October 1986] *ITA Magazine* 15 at 15.

[104] Sochor, *supra*, General Introduction, note 13, at 23.

[105] Chicago Convention, *supra*, General Introduction, note 5, Articles 37, 54(1) and 90.

navigation, and this has certainly avoided negotiating a complex framework of bilateral agreements.[106]

It was understood at the Chicago Conference, and is apparent from the text of the Convention, that the Annexes when adopted do not become part of the convention and do not possess the same legal binding force as the convention; however, in practice, a broad uniformity of regulations has resulted.

Although Air Navigation Commission (ANC) recognized that the low ratio of notification by States[107] of differences in conformity with Article 38 of the Convention between their national rules, practices and the provision of ICAO SARPs; this does not mean that States do not conform with ICAO SARPs or indicate a difficulty in the achievement of such SARPs.[108] In any event, it is a legal duty of the contracting States, under Article 38, to notify ICAO if their practices depart from international standards. The level of implementation of the SARPs by the ICAO's contracting States is a matter of grave concern and doubt.[109] The 29*th* ICAO Assembly noted that while globalization in the international civil aviation operation was gaining momentum, the harmonization of national rules for the application of ICAO Standards was not. Harmonization of rules by States, bilaterally and multilaterally, in cooperation with ICAO, could lead to better consistency in implementation of standards. The Assembly *Resolution* A29-3: "*global rule harmonization*",[110] emphasizes that the interdependence of international civil aviation makes aviation a prime candidate for the benefits to be derived from the concept of globalization. The global harmonization of national rules for the application of ICAO standards is an important element; although was unanimously adopted, it has no binding

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106 Naveau, ***supra***, note 73, at 54.

107 ***ICAO C-WP/9779***, June 7, 1993, Paragraph 2:9, at 4.

108 ***ICAO C-WP/9939***, 15 February 1994, at 2.

109 It should be clear that the States silence defiantly leads to devastating lack of information endangering the flight safety, see for more details, Milde, ***supra***, note 83, at 426.

110 ***ICAO Doc. 9602***, at 1-37-38; see also, ICAO, ***supra***, note 107, at 1-11.

force on the contracting States. The SARPs may be unfounded in real life if the quasi-legislative function of ICAO is not effectively translated into the practice of States. It is this writer's view this will be the norm unless a way can be found to give them more needy force.[111] The ANC urged ICAO to focus on how to assist contracting States in implementation of SARPs, which in itself will foster the CNS/ATM implementation. Consequent to the aims, definitions and objectives of ICAO (as in Article 44 of the Chicago Convention) the CNS/ATM systems are fully within the mandate of ICAO not only as the only regulatory body competent to adopt SARPs, but as the most appropriate body with regard to institutional and legal arrangements. In fact the ICAO Council in 1992 considered the establishment of an Aeronautical Telecommunications Network (ATN) and SARPs to implement the new systems and assist in its transition.[112]

In view of the above one can identify the fact that ICAO does not have a sufficient legal basis to force contracting States to implement the new systems and comply with its SARPs.[113] Consequently the CNS/ATM systems' implementation would not have a chance in the present legal framework which could hinder the entire CNS/ATM concept.

A practical solution to ensure the applicability of the SARPs to the new CNS/ATM systems' providers, is that all service providers should obtain certification from ICAO, and as a condition for certification they would have to satisfy ICAO requirements with respect to the new system guidelines recommended by the Legal Committee.[114]

Furthermore, if the SARPs could be adopted and amendments can be drafted in such a way that the collectivity of States can be made to comply with them, they can be made part of the regional agreements and the international cross-regional agreements.

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[111] See also, Milde, ***supra***, note 83, at 427.

[112] ***ICAO C-WP/9546***, 7/5/92, at 4

[113] Khan, ***supra***, General Introduction, note 28, at 47.

[114] ***ICAO LC/29-WP/3-1, Annex I***, at *9ff*.

Any State entering into that agreement, will then have to comply with SARPs by virtue of an intentional treaty law since the SARPs will have become provisions of the agreement itself.[115] This would be another solution that would greatly enhance the legal power of SARPs for CNS/ATM services and strengthen their relevance for the new systems.

The future SARPs scheme must consider the ANC's verdict with reference to its assignment on the General Review of ICAO Annexes, and also consider how ICAO could be more responsive to the needs of its contracting States and the global aviation community. The new systems and their operation will be based on universal standards and practices, as characterized by ICAO's SARPs, and be mandatory on States according to the Chicago Convention (as in Chapters IV, VI).[116] The 4*th* meeting of the FANS(II) has postulated a recommendation, 4/1: "*Timely production of procedures, specification and standards and recommended practices (SARPs).*"[117] In this writer's opinion, ICAO must play a central role in establishing technical standards for the new systems. Also, States should continue to be responsible for the authorization, certification, or the provision of these service in their territory for which they are chargeable. Standards will be useful only if they are practical and do not show a preference for a particular State's approach or for a single technology that one day might prove to be a stumbling block to future progress; therefore one can anticipate that the SARPs will promote the earliest feasible achievement and utilization of the new services before the next century.

B. Impact of Management and Organization on Safety Aspects

IATA statistics indicate that 70 to 80 percent of aviation accidents are caused by human factors.[118] While the number of accidents has been reduced due to improved

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[115] Khan, *supra*, General Introduction, note 28, at 50.

[116] *ICAO*, *supra*, Chapter II, note 80, at 5-6.

[117] *ICAO Doc.*, *supra*, General Introduction, note 26, at 4-25.

[118] Butler J., "Human Factors in Aviation"[3/1993] *IATA Review* 17 at 17.

aircraft design, maintenance and technology, human inadequacy is increasingly the principal cause of accidents. Flight safety and crew capability can be connected to management and its policies and practices regarding employees or organization.[119]

The main responsibility for safety in any organization must rest with management because management controls the allotment of resources. However, there is a more complex relationship between management and safety because management designs the organizational plan and its perspectives are significant elements in clarifying the organization's growth.[120] Human decisions, relationships and solutions which management attempts to develop are influenced by the corporate organization and the culture.[121] For example pilots, controllers and other operational staff observe the policies and practices of their organization, which exercises a strong influence on how safely they perform. It is the management's obligation to develop quality control measures which guarantee that practices in the operational climate do not vary from established procedures. Currently ICAO's member States are devoted to the entire technical and managerial analysis of the globe's air navigation and control system's structure. However the organization of airspace is never completed; it is complicated, and restricted by limitations.[122]

Concluding Remarks

Apart from the foregoing there are a number of factors that generate the need for action. Future growth in air travel dictates more accurate flying and the highest demands for reliability in order to maintain separation and prevent collisions between aircraft. The performance standards deserve a significant improvement to compensate for the increase

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[119] *Id.*

[120] Maurino D., "Corporate Culture Imposes Significant Influence on Safety"[April 1992] *ICAO J.* 16 at 16.

[121] *Id.*

[122] Breuil P & Richard Ph., "The Management of Airspace"[December 1990] *ITA Magazine* 9 at 11.

in accidents associated with the expanding traffic. Runway capacity is limited and operations will have to be performed under high time pressure. Ground ATC systems will also be progressively automated and the future *flight-deck* will be different as a consequence. Also the performance standards deserve a significant improvements.

The new CNS/ATM systems must develop from today's system so as to satisfy user needs and to implement the new system. However, specific complex factors must be met. Human factor improvements will be fundamental to enhance the safety of the aviation system.[123] The new CNS system supported by ICAO will achieve a broad range of ATM advantages that will enhance safety and system flexibility, reduce delays and operating costs, and increase capacity. Cooperation between service users and providers is crucial in order to enhance the CNS/ATM systems' implementation.

The ICAO role is a very critical one, and the Organization must take the lead to facilitate the new systems' implementation. Therefore, ICAO must persist in adjusting itself to the fast developing technical, environmental, economic, political, legal, and institutional actuality in order to maintain and restore the Chicago Convention to govern and regulate the twenty-first century's global navigation; the harmonization of rules by States on bilateral or multilateral basis in cooperation with ICAO would lead to consistency in the implementation of systems standards. This will be achieved partly through the adoption of the SARPs. It ensures a steadily higher degree of uniformity of national regulation and practices so as to contribute to enhanced safety of flight and efficiency of operation. However, one of ICAO's greatest challenges is the implementation of the Annexes and the safeguarding of the regulatory function of the Chicago Convention itself, including the standards and all instruments of international air law. In other words, ICAO should play a central role in creating international rules binding upon space activities, and at the same time participate as a global authority in international civil aviation.

[123] ***ICAO CIRCULAR 243-AN/146***, at 29*ff*.

Chapter IV: Costs and Economic Impact of CNS/ATM Systems

Introduction

A cost-benefit analysis is an assessment of a potential project's worth. It comprises an evaluation of the economic advantages of a project and the profits versus the cost that it will generate over a period of years or over the economic life of an investment. It is one of several planning techniques that answers the need for a systematic decision-making process in deciding whether or not to proceed with a project. Generally the cost-benefit analysis of any project takes a long term view.[1]

With the exploration and use of outer space losing its novelty and magic, and as fewer financial resources are available, prestigious projects are gradually being replaced by activities with assured economic benefits. Satellite operators will also have to compete with respect to efficiency, cost-effectiveness and value of products and services marketed.[2] Additionally, as more nations participate in the space applications market, and in particular the new CNS/ATM systems, competition will increase and this will have a positive effect on new system capabilities. This competition need not be detrimental to systems operators and could well be beneficial for users. It may force operators to consider what products and services offer the best deal. Furthermore, it enables users to shop around for services that suit them best, and at the most attractive prices. Therefore, it is important that there be competition in order to insure that systems are available at affordable prices.

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[1] Jussawalla M. & Cheah C.-W., "Cost-Benefit Analysis" in Middleton J. & Wedemeyer D. J., *eds.*, ***Methods of Communication Planning*** (France: Unesco, 1985) at 268*ff.*

[2] In some view there is great opportunity to reduce operating cost by proposing a five to ten percent savings in fuel costs; see more details, Lyon M., "Satellites Could Lower International Flight Costs by 10 Percent"[February 1991] ***Airline Executive Int'l*** 15 at 15.

The full economic benefits of aviation can only be realized if the industry is able to meet the demand for its services; this requires major capital investment. Civil aviation has been caught up in a process of rapid change driven by emerging technology.[3]

The cost of ATC system delays to the airlines and commercial aviation users is about $10 billion annually.[4] The cost of an inadequate infrastructure are now well known, but the benefits of air transport to the economies of the world are still not fully appreciated. In spite of the fact that the cost of failure to provide for growth has been high, the economic prosperity of millions may depend on immediate action and investment.[5]

The adoption of the CNS/ATM systems has major economic and financial implications for the civil aviation community, including the providers of air navigation services and the airspace users. It has been demonstrated that, in global terms, all the benefits flowing from the new systems far outweigh the total of the costs of its adoption. Cost effectiveness and cost benefit studies at the State or regional level are essential in order to further assess the economic viability of the new systems, to generate support for implementation and to determine the impact on airspace users and service providers.

A clear international CNS/ATM systems cost recovery policy would assist States in obtaining financing for the CNS/ATM systems implementation.[6] Cost effectiveness studies may also provide a basis for helping States to choose the most appropriate implementation option. In particular, these studies will help States to see the benefits of joining forces with neighbouring States, or joining in other multinational efforts to provide communication services.[7] In another words, it is advantageous to join

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3 Sochor, ***supra***, General Introduction, note 13, at 33.

4 "Aerospace Industry Ready to Help Implement Global Solution"[December 1991] ***ICAO J.*** 14 at 15.

5 Meredith, ***supra***, General Introductions, note 9, at 46.

6 Rochat, ***supra***, Chapter III, note 85, at 7.

7 ***Id.***

international or regional systems where the space segment could be leased, or its cost shared between several States. The ground installation cost will be carried by the country served. It is expected that as a result of the systems' standardization and the free competition between the service providers, the anticipated technical development, and the greater production due to higher demand, will result in a reduction in cost for, *inter alia*, ground segment devices.[8]

As stated by the Chief of Communications Services, Transport Canada Aviation: "*[t]he satellite has proven to be a more flexible and cost-effective way for us to distribute our data information than any terrestrial method.*"[9]

USA legislation obliges satellite operators to pay for utilizing radio spectrum[10] in order to increase revenue. This could hamper the emerging mobile satellite services in general, and in fact increase the cost of developing a mobile phone systems.[11] In particular, the CNS/ATM systems' implementation may be hindered, and this cost could lay a dangerous universal precedent if other nations emulate the USA.[12]

The ICAO Secretary General's paper, which was presented to the Council's 141*st* Session,[13] emphasized that the CNS/ATM services costs must be sensible and neither inhibit nor discourage the use of the satellite-based safety systems. There is a need for an equitable mechanism to recover costs, and for providers to be held accountable for

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8 ***Supra***, Chapter III, note 19, at 16*ff*.

9 ***Supra***, Chapter II, note 313, at 2.

10 It is the portion of the electromagnetic spectrum that includes frequencies for cellular phones, satellite transmissions, AM and FM radio, television broadcasting and other users.

11 Seitz P., "Mobile Satellite Firms Brace for Spectrum Auction Law"(July 12-18, 1993)4:27 ***Space News*** 1 at 1.

12 For the private enterprises which are planning to use mobile satellite systems phone in LEO, that could be a financial burden on their already expensive systems.

13 ***ICAO C-WP/9902, Appendix B.***

the required level of service.[14] In the FANS Committee's[15] view, the present cost recovery method, in which aircraft operators are charged for the services provided when passing through a State's FIRs, is not expected to change. Air traffic service providers could also operate collectively with neighbouring States, as is presently the case in various regions, and cost recovery systems could be amended accordingly. One State could collect on behalf of another, a multi-State entity could be instituted, or the ICAO itself might perform a coordinating or administrative role in cost sharing arrangements. Although such techniques are now in place, one has to realize that national authorities currently operate air navigation facilities and that this may not be so with the new systems' implementation. That will result in an income loss to such States, and may affect their economy.[16] The purpose of this Chapter is not intended to be exhaustive, but is meant to underscore the pervasive available funding for the new systems' users. These include the airlines and service providers such as States, regional, international or private entities in Section I, and in Section II, selected charge reimbursement scenarios are illustrated.

Section I: Available Methods and Sources of Financing

Traditionally, global fund markets are mainly banks, trust and insurance companies, pension funds, venture capital, and the general public either through public or private advances. Each participant has its own way of doing business. For the purposes of this thesis it is enough to mention that there are several risks which any

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[14] *COMSAT* did lower its rate for mobile communication for digital transmissions. The *COMSAT* provides mobile satellite transmissions capacity as the USA's signatory to the *INMARSAT*; see, "Comsat Trims Rate for Mobile Communication"[May 11/17, 1992] *Space News* 25 at 25.

[15] *ICAO, supra*, Chapter II, note 80, at 8B-43.

[16] *ICAO FANS(II)/2-WP/71.*

financier will consider before financing aerospace equipment.[17] International lending institutions have also participated in financing telecommunications projects,[18] and today the need to find substantial sources of funding is massive.

There are several air navigation financing options, such as internal government financing, external financing and grants from other States or international organizations and institutions. Certainly the methods of financing the new CNS/ATM systems will vary according to the borrower's characteristics as users or service providers. The funds which are available to one State do not have to be available to another, and this for various reasons, *inter alia*, whether the funds are public or private, national or international, and for reasons of financial risk. In practice, ICAO did recommend a user fee as a method of financing.

A. For the Service Users

1. Equity Financing

Airlines are often able to raise capital by the offering of new equity such as stock, either through a private or public offering of common shares. It is an external method of financing because the funds acquired in such a manner do come from an influx of new investment into the company. The new common shareholders are investors who ultimately take part in the profits or the losses.[19]

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[17] Such as *cash flow risk, equipment risk, political risk and hull risk and public liability*; see for details, Bunker D. H., ***The Law of Aerospace Finance in Canada*** (Montreal: ICASL McGill University, 1988) at 76*ff.*

[18] *"The Missing Link"*, Report on the Independent Commission for Worldwide Telecommunications Development (The Maitland Commission Report, Geneva, ITU, 1984) at 121; see also, World Bank Telecommunications Loans and Credits, December 1986.

[19] Bunker, ***supra***, note 17, at 2*ff.*

2. Self-Financing Method

Cash flow from operation or self-financing is a very attractive method of paying for equipment purchases because it avoids interest charges incurred when borrowing from outside sources. For airlines, self-financing could be an efficient way to finance its avionics. However, due to traditionally low profits that have been further aggravated by the recession and other factors,[20] self-financing may be inadequate to pay for the needed avionics on routes which have low traffic. Even with the implementation of yield management[21] and harsh cost-cutting measures, the airlines must rely on other sources of funding to supplement their cash flow from operation efforts. This is where external sources of funding will be needed the most. This applies mainly to LDC's airlines.

B. Shared Available Funding for Users and Service Providers

1. Debt Financing

If equity financing is unavailable for any reason, then airlines must borrow from financial institutions. In practice, increasing debt-equity ratios and occasional bankruptcies have led to a shift towards asset-based financing in the airline industry. In USA the debt market is large, where insurance companies and pension funds have strong cash assets to place. Lenders do not want to shoulder risk by lending money to a corporation whose debt-to-equity ratio is not in proper balance.[22]

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[20] "Fleet Renewal and Investment in Airport Infrastructure", *ICAO A27-WP/48-EC/6-7/7/89*, at 2-3.

[21] "Airlines Prosper Under Tight Management; Leasing Transforms Commercial Transport" [May 29, 1989] *AW&ST* 90 at 90*ff*.

[22] Bunker, *supra*, note 17, at 3; see also, Johnston D. I., *Legal Aspects of Aircraft Finance* (LL.M. Thesis, McGill University, 1961) at 8.

(a) Export Banks

International sales benefit from the support of debt financing by export credit schemes. In the last three decades, the export market has created an arrangement of official financial support by governments basically for sales to LDCs to inspire and support worldwide trade.[23] Most industrialized countries have a specific government department or agency, responsible for developing, promoting and financing export sales of that nation's products.[24] This method of finance could be available to airlines and service providers.

By methods of financing such as loans, insurance and guarantee programs, the export credit agencies attempt to assure credit to potential buyers. However, access to external modes of financing, such as borrowing, does not constitute the only means of finance at their disposal. In 1988 the FANS Committee reported that on a global basis, the new systems would not cost more than today's systems and would provide annual savings of $5 billion. In general, the competition between developed countries in their export credit terms have developed a multilateral effort to narrow the quantity of such assistance, although it is still an available option for CNS/ATM systems' financing. Hence, export credit is likely to remain a significant feature in financing airlines fleet.

(b) The World Bank

Loans for service providers and users could be provided by the World Bank. Proposed Multilateral Investment Guaranty Authority (MIGA) scheme would make it easier for LDCs by granting them better insurance against political risks. This will improve their credit and give them better chance for foreign funding.

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[23] Ghonaim, *supra*, Chapter I, note 27, at 120*ff*.

[24] For example, the Canadian Export Development Corporation, the Export-Import Bank (*Eximbank*) of USA and Japan, and the French Foreign Trade Bank.

(c) Commercial Banks

Commercial banks are another possible source of funds to finance the new CNS/ATM avionics equipment on board aircraft. The commercial banks and other financial institutions[25] must fulfil the credit demand of businesses and retain assets that are liquid. This should be adequate enough to secure the depositors' and financial community's concerns. In managing their funds they require profit, liquidity, credit and safety. Consequently, government-owned airlines will have difficulty borrowing; this is the case in many LDCs, where the financial conditions of the airlines are usually weak, and their ability to raise capital is limited. The participation of commercial banks in financing will continue to be difficult unless a way can be found to provide guarantees to foreign and national banks that they will recover their investment free of any domestic risk,[26] especially in the case of financing the State's ground segment for private entities.

2. State Support

Customarily States are responsible for financing and implementing ATC programs, usually with funds from their general budget, although currently the ATC in some countries is provided by private agencies. Financing private ATC programs in some countries will require government support. This is also the case for State-owned airlines where the States are responsible to provide for its financial needs. For example in the Russian Federation, CNS/ATM implementation will be based on the State budget, to be refunded from the air navigation user charges for air traffic services to domestic and international flights.[27] There are also basic sources of capital such as self-financing,

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[25] Such as insurance companies, trust companies, and pension funds.

[26] Bradley F. W. Jr., "Financing Fleets of the Future: A Banker's View "(September 1986)37 ***Int'l Transport Aviation Magazine*** 15 at 15.

[27] ***ICAO CASITAF/1, Priorities Paper no. 4***, May 24/26, 1994, at 4.

equity[28] and external modes of financing.[29] There are various sources of funds available to service providers. In an ICAO symposium of September 1991 on the future global CNS systems it was mentioned that financing through the United Nations Development Programme (UNDP) is an option in assisting States to finance their programme of implementing the new CNS/ATM systems.[30] However, the apparent worldwide trend is to let the user pay, to curtail government financing or subsides and to let the ATC services be governed by market forces.

3. The Manufacturers' Support

Traditionally manufacturers finance aerospace only when the sales are low and competition forces them to take risks which they would normally avoid.[31] The manufacturers grant support to their customers through various means, including the arrangement or provision of equity financing, purchase of stock options and guarantees to financial institutions for debt financing. In this writer's opinion, the current impact of the foreseeable competition between CNS/ATM service providers and manufacturers for market share will force manufacturers to take a variety of financial risks which will benefit the users, such as airlines or ATC service providers.

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[28] Either through a private or public offering of common shares. This is an external method of financing, although it differs from other sources for many reasons such as that the funds are acquired without any obligation to pay interest or dividends; see more details, Johnston, ***supra***, note 22, at 9; see also, Bunker, ***supra***, note 17, at 9.

[29] ***ICAO A27-WP/48-EC/6-7/7/89*** (*Fleet Renewal and Investment in Airport Infrastructure*), at 2; see also, Nelms D. W., "Airframe Industry and Market Shifts"[October 1989] ***Airline Executive*** 14 at 14*ff*.

[30] *SYM-IP/1*, ***supra***, Chapter I, note 15, at 4.3-1*ff*; see also, ***ICAO CASITAF/1 Background Paper no. 2***, on May 24-26, 1994, at 4.

[31] Bunker, ***supra***, note 17, at 128.

Section II: Selected Possible Charge Reimbursement Scenarios

To ensure that there is no discrimination between user States, and that prices are based directly on the services supplied with a fair allotment between all users in case of service sharing with other users, charges should be determined and subject to the guidelines established by the ICAO Council. In this writer's opinion, any of the mechanisms selected must confirm that only those costs related to civil aviation are charged and that there be fairness between civil aviation charges and other civil or military users such as air, maritime and land users. In the following, the end-user charges, cost reimbursement, an INMARSAT type solution, registration/license fees and Regional mechanism option, are briefly discussed.

A. End-User Charges

From the early seventies many States have adopted this method by charging the users of their national airspace for the air navigation services they provide. ICAO decided to support this option, in retaining the philosophy on which the Chicago Convention, Article 15 is based. This method has the merit of facilitating the implementation of the new systems.[32] It is based on reclaiming the total costs of the space segment by charges based on chargeable time/conversation period, and charged to the end-user. In one commentator's[33] view the *User Charges* mechanism is reasonable, and its idea of *User Charges* is more global in character; the scheme will also generate surplus funds to support further development of the systems and enhancement of ground

[32] Varloud Ph., "The Financing of Air Navigation"[January/February 1987] *ITA Magazine* 27 at 27.

[33] In his proposal the global civil aviation community has to charge one dollar for every passenger for the period of (1995 to 2005), according to his figures the saving will be fifteen billion dollars in total. That will allow the new systems to be in operation by the year 2010, see, Al-Ghamdi, *supra*, Chapter I, note 14, at 20.

facilities.[34] However, the INMARSAT Council expressed the belief that using end-user charges was unreasonable and very likely unworkable.[35]

IATA's financial activities also include the monitoring of *User Charges*, the costs to airlines of using en route navigation, and airport facilities. It has proposed the concept of *User Charges* as a feasible source of revenue to finance the new systems implementation.

ICAO should establish the criteria for the determination of user charges. In order to acquire a reasonable cost sharing between users, any recovery of costs for the new CNS/ATM services should be in accordance with Article 15 of the Chicago Convention. Also, it should be based on the principles set forth in the *Statements by the ICAO Council to Contracting States on Charges for Airports and Air Navigation Services*.[36] States may distinguish between users either on the basis of air navigation services furnished or according to more common categories customarily utilized in air transport for statistical objectives in economic analysis: "*national/international, commercial/non-commercial, and civil/military*".[37]

Airlines, as the airspace users, will benefit most by the CNS/ATM growth. Accordingly, it is to their benefit to assure that these charges are kept to a minimum, and any investment is repaid with the utmost operational benefit.[38] They will also pass these charges on to their passengers.

In this writer's view, the *User Charges* method could be used to repay the loans and the cost of maintaining the systems. Furthermore, the writer suggests that States would be the perfect agents to collect *User Charges* from airlines as users, and pay the service provider such as UK performing in DEN/ICE financing administration. This

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[34] *Id.*

[35] *INMARSAT Council*/14/33, at 3; *Council*/14/SR/Final, at 46.

[36] *ICAO Doc.* 9082.

[37] Varloud, *supra*, note 32, at 30.

[38] Saunders, *supra*, Chapter II, note 29, at 110.

method will ease the airlines' and service providers' tasks. ICAO should ensure that *User Charges* are cost-justified and equitably applied.

B. Cost Reimbursement

This method of recovering service costs is carried out by yearly charges levied by the suitable national or international bodies who decide whether and how much end-users will pay. Under this scenario the service providers could institute an arrangement with ICAO such as in the DEN/ICE scheme[39] for the new CNS/ATN systems' services; ICAO member States, acting under the auspices of ICAO, jointly declare their willingness to meet the costs involved in providing such services. Acceptable institutional arrangements could be formulated.

The variation of this scenario would be to apportion cost, in the form of imposed space segment charges, amongst all member States, in percentage, to their actual use of the service. In this writer's view, this method has the advantage of being simple and inexpensive to administer, and makes the implicit assumption that a State's obligations will be under the supervision of ICAO. This will prohibit any discrimination or abuse of the charges for unjustified reasons.

C. INMARSAT Type Solution

INMARSAT is financed by its Signatories' capital contributions as investment shares.[40] Every Signatory that has an investment share is now determined annually, or when a new member joins the Organization, or when there is withdrawal or termination of membership of a Signatory in accordance with article V(5)(a)(b)(c) of the Operating Agreement. The investment shares are recalculated on the basis of the previous year's use of the Organization space segment. The rate of compensation is to be fixed according to world market costs, considering the investment risk factor. The purpose of utilization

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[39] There are "*User Charges*" since 1983 and States pay only for the "surplus".

[40] INMARSAT Operating Agreement, *supra*, Chapter II, note 33, Article III.

charges is to earn sufficient revenue from user charges to cover the organization's operational expenses, including the repayment and compensation for use of capital, as the Council considers appropriate, according to the Convention and the Operating Agreement. INMARSAT has to operate on a sound economic and financial basis in order to recover its operating costs and the cost of new satellites; it is not for profit but it must acquire adequate revenues to cover its costs and to repay debts.[41] All Signatories are charged the same rate for the same type of utilization.[42] Non-Signatories are charged on an equal basis as the Signatories at the rate for each type of use.[43] Although the Council can set different rates for non-Signatories. The precedent set by the INMARSAT type solution is one where users are charged and the profits distributed to the State where the transmission originates.

It is a model of what global cooperation can accomplish when political will exists. This way provider States would get their money. It should be kept in mind that INMARSAT income goes to the Signatories' communication services and not party States. Furthermore, an INTELSAT type mechanism might also provide a good model for income distribution.

D. Regional Mechanism Option

This is a feasible choice and can be established through regional organizations and agencies such as ASECNA,[44] COCESNA[45] and EUROCONTROL.[46] For example, EUROCONTROL, on behalf of its member States, collects service charges for redistribution to its members. The method, in place since 1971, is based on a standard

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[41] *ICAO FANS/3-WP/3*, 3.3 and 3.5.

[42] INMARSAT Convention, *supra*, Chapter II, note 32, Article 19(2).

[43] *Ibid.*, Article 19(3).

[44] *Supra*, Chapter II, at P. 50.

[45] *Supra*, Chapter II, at P. 51.

[46] *Supra*, Chapter II, at P. 53.

unit rate calculated on the basis of aircraft weight and the distance it flies through the organization's responsibility zone. This technique was not favoured by the dominant European or USA airlines operating wide-bodied aircraft. A new technique based on the distance and time an aircraft needs to cross a controlled airspace (*distance of flight*) and the final charge structure will be in place in the year 2000.[47] That option, if combined with the ICAO mechanism in the current DEN/ICE Agreement, could be an alternative highly cost-effective mechanism.

E. Registration/License Fees

License fees are a method for reclaiming expenses from users in the form of yearly registration fees payable for each actual service offered by the providers. It may be appropriate for airline owners/operators to pay an annual user fee. That yearly fee could be paid by the airline's owner which may be its State, or through the appropriate national bodies in charge, such as civil aviation authorities, in the case of a State-owned airlines, or by the airline itself. It could ultimately be paid by the actual operator as a consequence of the lease, charter or interchange of aircraft. This method was used by INMARSAT for its search and rescue satellite system, and its Council expressed the view that this method was not practicable.[48] The Director General of INMARSAT regarded this proposal as neither practicable nor desirable.[49]

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[47] Tigner B., "Eurocontrol Mulls Air Traffic Control Hike"[October 4-10, 1993] ***Commercial Aviation News*** 6 at 6.

[48] ***INMARSAT Council /14/SR/FINAL***, at 45.

[49] ***INMARSAT Council*** /14/33, at 4.

Concluding Remarks

The CNS/ATM systems demand massive investment, and the availability of investment funds from internal and governmental sources is finite. The air transport industry will also have to look for external sources of finance in an environment of reduced global credit as a result of other demands for financing. Certain problems will be confronted in various LDCs as a consequence of national economic situations, and the LDCs' ability to deal with foreign currency commitments. Access to loans and their costs are problematic for LDCs carriers as State-owned airlines, or to States themselves.

While financial support for such projects through bilateral or multilateral financing agencies is important for ground equipment, countries should attempt to pay part of the funds required themselves through the government budget, which is derived from taxes and duties. Furthermore, the capital investment needed for equipment and maintenance of the new CNS/ATM systems will continue to be the responsibility of States, service providers and airspace users. It is customary to charge aircraft operators for services furnished when they pass through a State's airspace in order to recover the air navigation facilities' operating costs. Nothing in the ICAO CNS/ATM systems concept changes the technique of FIRs, nor does it demand changes in revenue collection systems. It is in the hands of ATC service' providers to collect their charges.

The *User Charge* mechanism, in this writer's opinion, must be supervised if it is chosen as the preferred form of reimbursement. This could be done by ICAO continuing its supervision by setting standards, guidelines, principles and other requirements which are to be observed in the *Service Agreements* between the providers and users. ICAO and other user communities could assess costs to States by an equitable usage formula, and the States would recover those charges using established means such as route charges for services to aviation, and perhaps licence fees for other users.

In this writer's view, the advantages of the ICAO CNS/ATM systems will count on, *inter alia*, the political desire of States to invest in ground infrastructure, to implement global standards, to change operating procedures and above all, to develop a timely payback system for investors. The implementation of the new CNS/ATM systems will eventually open major economic and social advantages to the world's economy, and significant financial and operational savings for the airlines. This writer also believes that the full advantage of the CNS/ATM systems will only be accomplished through their complete implementation at the global level; and the elimination of the costs of existing systems and related equipment which could be a major saving for providers and users.

Part III

The Legal Obstacles and the Institutional Aspects

Chapter V: Aeronautical Air-Ground Safety and Non-Safety Communications and their Legal Problems

Introduction

In the early years, before radios in aircraft were common, communication was limited to pilots' ground telephone calls to their destination airports, checking on the weather. As the number of air routes increased, the need became critical for reliable communication between ground and air. With the establishment of coast-to-coast air transport routes, long-distance communication was needed, and the only answer was radio. Radio proved to be invaluable in the scheduling and routing of flights.[1] As early as 1919, the Europeans developed the first operational air-ground radiotelephone voice system for passenger air transport between London and Paris. That early system was limited in range and impractical for the state-of-the-art aircraft of the late 1920s.[2] Currently this type of communication is provided through terrestrial systems, functioning mainly in the VHF and HF bands.

Advances in mobile satellite service is increasing at a dramatic rate.[3] The political events in Europe, and the former Soviet Union, and economic evolution in Asia and Latin America are generating modern markets for satellite communication.[4] New satellite communication provide direct links for voice/data to and from aircraft on a global basis.[5] Commercial airlines are looking for new ways to attract business, such as

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1 *The ARINC Story*, *supra*, Chapter II, note 17, at *5ff.*

2 *Id.*

3 Rothblatt M. A., "New Satellite Technology, Allocation of Global Resources, and the International Telecommunication Union"(1985)24:37 *Columbia J. Transnational L.* 37 at 45.

4 Lawler A., "Political, Economic Changes Draw New Markets"[January 27/February 2, 1992] *Space News* 6 at 6.

5 Stuart A. & Woodfine R., "Skyphone Aeronautical Satellite Communications"[1992] *World Aerospace Technology* 167 at 167; "Aeronautical Satellite Communications Takes Off" (IX/1991)58 *Telecommunication J.* 649 at 949.

offering better facilities, state of the art services and air-ground passenger communication.[6] There are likely to be some legal obstacles in the introduction of the air-ground non-safety communication. This could create fundamental barriers in the implementation and growth of the new CNS/ATM systems. Therefore, it is important to identify these obstacles and find a solution.

In 1988 the FANS Committee recommended that the ICAO study the impact of Article 30(a)(b) of the Chicago Convention on non-safety communication.[7] It recommended that the legal aspects of air-ground communication be included as a priority subject in the work programme of the ICAO Legal Committee. At the 27*th*[8] and 28*th*[9] Session of the Legal Committee, and pursuant to Rule 17 of the Rules of Procedure of the Legal Committee, the Chairman appointed a Rapporteur to study this subject. Below in Section I, we will analyze the aeronautical air-ground communication, in Section II, their legal aspects and in Section III, we will examine the practical legal solutions for non-safety communication.

Section I: Aeronautical Air-Ground Communication

Until recently, the use of on-board phones was rare. Nowadays, as satellite communication increasingly becomes routine in the airline industry, it is a well-known feature in the passenger cabin.

The principal users of air-ground communication are likely to be corporate aircraft operators and general aviation. Aeronautical communication would be offered on a domestic, regional or global basis, or a combination of these schemes. This would provide air-ground, ground-air, air-air communication, and would furnish voice,

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6 Guest, *supra*, Chapter II, note 14, at 164.

7 *ICAO* FANS/3-WP/III, recommendation 6/1 "Enabling of Non-Safety Air-Ground Communications on a Global Basis", at 6-4.

8 *ICAO Doc. 9556 - LC/187, Agenda Item 6.*

9 *ICAO Doc.*, *supra*, General Introduction, note 23, Agenda Item 4.

facsimile and data communication for the airline crew, the passengers and air traffic services.[10] In the following, the accessible assets for the flight crew and airline passengers, the satellite communication need for airlines, the airlines passengers and for the air traffic services, then the forecast developments will be examine.

A. The Accessible Assets

1. For Flight Crew

As previously pointed out,[11] the aircraft operational communication and the air traffic services phone communication using the HF or VHF networks, has its shortcomings. With the introduction of the current technology, specifically data links, which offer greater efficiency, it is possible to meet the present demand. However, the suitable frequencies within the electromagnetic spectrum represent a finite natural resource, and their allocations must be subject to international control.

2. For Airline Passengers

For the public correspondence for aircraft, the estimated total need of frequencies is a spectrum of 10 *MHz*, to be allocated on a global basis to foster coordination between systems and to decrease the cost of equipment. The *L-band* is now used for this service by the USA and Japan. The introduction of a global public correspondence system on board aircraft also competes, from a spectrum point of view, with the more complex LEO communication.[12]

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[10] Guest, *supra*, Chapter II, note 14, at 165.

[11] *Supra*, Chapter I, at P. 29*ff*.

[12] "WARC-1992, Spectrum Allocation Conference"(III/1992)59 *Telecommunication J.* 107 at 109.

B. The Needs

Satellite communication will not only help in achieving safer and more economical operation of an aircraft, but it will also provide additional service and convenience to the passengers, and will decrease the workload of both the airline and the ATS.[13]

1. For Airlines

The primary purpose of aircraft operational communication for airlines is to improve flight regularity. The airlines are also looking to enhance commercial service on their flights, by changing passenger flight bookings and providing other *en route* services. These needs can be handled with greater efficiency by data transfer than by verbal communication. Additionally, more reliable and timely data will enhance maintenance and solve mechanical problems which will then be recognized before they become critical or costly.

2. For Airline Passengers

Passenger communication, which are called *non-safety communication* or *public communication*, is the latest in airline equipment. Passengers will be in touch with their ground base at all times during a flight by using voice, fax and electronic mail, *etc.*, for private correspondence, arranging subsequent travel and accommodation, as well as other matters.[14] Technology exists for the whole range of inflight communication services such as facsimile, and personal computer link-up with ground-based computer systems; this will allow for a host of services such as real-time flight confirmation, hotel booking, airport transfers and car rentals, even the latest stock market quotes will be available.[15]

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[13] Ryan F., "Satellite Communications on Aircraft - An Illustrative Future Scenario"(June 1987)6 ***IFALPA Quarterly Review*** 8 at 12.

[14] "First Airline Passenger Phone Calls Via Inmarsat"[December 1989] ***The Controller*** 19 at 19.

[15] Tay C., "Satellite Communications - Pleasing the Passengers" (Address to the Inmarsat Worldwide Aeronautical Satellite Communications Conference, Montreal, 13-15 July, 1992).

3. For Air Traffic Services

Since each State is responsible to assure aircraft safety in its air flight zone, the need for reliable communication between the ATC and the aircraft is self evident.[16] An ACAS is now being developed which will indicate to the pilot the proximity of adjacent traffic and caution him against making any manoeuvres which would conflict with that traffic, or advise him to take collision avoidance measures.[17]

C. The Forecast Developments

1. Frequency Assignment

The universal problem of frequencies for aeronautical operational communication is a recurring one which reflects the shortage of frequencies as well as the competition among all mobile frequency users such as land, maritime and aeronautical, for the limited spectrum available. The frequencies are needed to enable aircraft operating entities to meet the obligations prescribed in ICAO Annex 6, Part I.[18] Customarily, frequencies have been reserved by the ITU to aeronautical communication on an exclusive basis.[19] This allowed ICAO to plan the utilization of these frequency bands for the greatest operational benefit and flexibility; this action can be justified since aircraft operate in a dangerous milieu, and communication is directly involved with flight safety which facilitate safe flight and enable the control of separation between aircraft in flight to be maintained at a safe and expedient level. The aviation community failed to utilize the frequencies allocated to it two decades ago because of the heavy capital investment

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[16] In order to know the aircraft position, and to give their instructions or authorization, if required.

[17] Leonard D., "European ATC Requirements"(June 1990)18 *IFALPA Quarterly Review* 10 at 11.

[18] Specification which will ensure a level of safety above a prescribed minimum in similar operations throughout the world; see, *Annex 6, "Operation of Aircraft" Part I - International Commercial Air Transport - Aeroplanes, 5th ed.*, July 1990; to the Chicago Convention.

[19] The only unused spectrum at *L-band* (1545-1559 *MHz* and 1645.5-1660.5 *MHz*) has been allocated to the AMS"R"S.

required to launch its civil dedicated satellite system.[20] The FANS Committee concluded that these high costs could be avoided if the aviation community shared satellites with other users, like land and/or maritime satellite systems;[21] although this does not mean that aviation was willing to share frequencies.[22] The assurance of availability of radio frequencies is an essential prerequisite for the timely and cost-beneficial implementation of the new CNS/ATM systems concept.

ICAO, at the 28*th* Session of the Assembly in October 1992, recommended to the Council that it should invite the Assembly to adopt a *Resolution*[23] which reflected the recommendation of the legal committee. This was that ICAO member States should insure that the non-safety related air-ground radio transmissions be allowed, subject to conditions which include compliance with licensing, frequency and other operating and technical constraints.[24] There are no frequencies specifically allocated to aeronautical non-safety communication. The most favourable solution is for passenger communication to be carried on frequencies reserved for land and maritime mobile services. This writer favours this solution.[25] The frequency bands available for AMS"R"S were reduced in the 1987-WARC, and according to the FANS committee what remains is not enough for AMS"R"S requirements.[26] Any reduction of the AMS"R"S frequencies will make it more difficult to ensure airline safety. The AMS"R"S possibility for frequency coordination have been referred to the ICAO Aeronautical Mobile Communication Panel (AMCP) which is responsible for promoting the draft SARPs for the AMSS. While it is acknowledged that this matter is within the ITU field, ICAO should be directly involved

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[20] That was the *AEROSAT* project of the 1970s.

[21] King K., "Fighting for Frequencies"(June 1987)26:2 ***The Controller*** 31 at 31.

[22] ***Infra***, Chapter VII, at P. 273.

[23] ICAO Doc., ***supra***, General Introduction, note 23, at 4-5.

[24] Van Dam R. D., "International Civil Aviation Organization"(1993)XVIII:I *AASL* 408 at 418.

[25] ***Infra***, Chapter VII, at P. 277.

[26] ***ICAO Doc.*** 9524, FANS/4, 2.3.3.1.1.

in any decisions which could be made by the ITU in order to maintain and safeguard the flight safety as much as possible.[27]

2. The Future Benefits Concept

In the future, the AMSS should overcome the limitations of today's communication system,[28] and furnish global communication and surveillance coverage. Furthermore, the AMSS will eventually provide several service categories such as Aeronautical Operational Control (AOC) and ATC, and for the non-safety services such as Aeronautical Administrative Communication (AAC) and Aeronautical Public Correspondence (APC). It is foreseeable that the AMSS will allow direct digital data exchange between air and ground which should increase air traffic services capacity and enhance airspace utilization. The start of the Automatic Dependent Surveillance (ADS), SSR and direct pilot-controller data link communication in the high density continental areas will ultimately permit the integrity of the navigational system to be monitored, increase the ability to track aircraft, *etc.*[29]

To conclude, the movement towards using satellite communication for aeronautical safety is being achieved through the ICAO Aeronautical Mobile Satellite Service Panel's (AMSSP) guidance material and its SARPs. This panel has confirmed the system defined in the ARINC Characteristic 741 and the INMARSAT System Definition Manual which, it is anticipated, will be continuously modified as SARPs develop.

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[27] ICAO Doc., *supra*, Chapter II, note 6, at 4-3.

[28] *Supra*, Chapter I, at P. 32*ff.*

[29] *ICAO* FANS II/2-WP/70, at 2*ff.*

Section II: Legal Considerations

A. For General Mobile Communication

Mobile communication is the most diverse and rapidly changing segment of the telecommunication industry. They are also becoming increasingly important in business,[30] search and rescue, and recreation. Global mobile communication and navigation services for maritime, aeronautical and land mobile platforms are most effectively served using satellite transponders.[31] The annual revenue from fixed and mobile satellite services in the USA for example, jumped to almost $1.5 billion in 1992, an increase of 25 percent over 1991 and is likely to be $3 billion by 1995.[32] From a legal point of view, mobile communication does not differ substantially from point-to-point satellite communication. They are governed by the national and international regulations that control the transmission and reception of radio signals. Generally speaking, they must comply with the limits prescribed for man's activities in space. Although for the purpose of this thesis it is adequate to state that there are some differences: *inter alia*, it is essential to allocate certain frequencies to them, and some institutional solutions must be developed. At the 1987-WARC, separate allocations were made for land, maritime and aeronautical mobile satellite services. Although each State is sovereign in creating domestic assignments and to permit non-complying uses of the spectrum, each must ensure that this does not generate harmful interference to other users.[33]

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30 Kaiser S. A., "Will the WARC'92 Threaten ICAO's Future Air Navigation Systems?" (1992) XVII:1 *Air L.* 17 at 17.

31 Beach M. A., Mattos P. G. & Chau M., "Integrated Communications and Navigation Terminal"(January 1991)44:1 *J. Navigation* 67 at 67; see also, Thomas J. D., "The Struggle of LMSS 1982-1990: International Aspects of Land Mobile-Satellite Service"(I/1991)58 *Telecommunication J.* 40 at 40*ff.*

32 Seitz P., "Short, Sharp Increase in Launch Activity Expected in 1995"[March 15/21, 1993] *Space News* 18 at 18.

33 Smith M. L., "Events of Interest: Mobile Satellite Communications - Issues for the 1990's" (1990)18:2 *J. Space L.* 147 at 149.

The telephone mobile services will face serious regulatory and financial obstacles in the future. The critical difficulty will be the demand for more frequencies to allow for more users.[34] The 1992-WARC success was the first major step in a long path leading to global mobile telephone services in the 1990s. Mobile communication will be an economic boom for satellite telecommunications.[35]

B. For Aeronautical Safety and Non-Safety Communications

In the use of satellite communication by aviation there are two types of communication: one is for safety and the usual aircraft operations, and this is known as *safety communication;* and the second can be called air passenger communication or *non-safety communication*. The access to public networks was always obtainable through conventional communication networks, which are now complemented by point-to-point satellite communication systems. With regard to maritime communication, one of the INMARSAT aims in Convention Article 3(1) is to provide "*...maritime public correspondence services and radiodetermination capabilities.*" INMARSAT users have access to various types of communication, like telephone, telex and data transmission, *inter alia*, concerning aeronautical communication, the INMARSAT Convention's amendments[36] authorized the Organization to furnish such services as mentioned above to airline passengers.

The safety air-ground communication from on board aircraft in flight does not raise any legal problems when made according to the appropriate ICAO SARPs, specifically those set forth in Annex 10 to the Chicago Convention.[37] Also, non-safety

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[34] The communication providers will run out of accessible *L-band* frequency, and will require *S-band* frequency to increase service, although it will not be available until 2005, as was decided in the 1992-WARC; see, Seitz, ***supra***, Chapter II, note 254, at 8.

[35] Commentary, "Small Satellite, Big Victory"[March 9/15, 1992] ***Space News*** 14 at 14.

[36] ***Supra***, Chapter III, at P. 119*ff*.

[37] ***Annex 10***, *"Aeronautical Telecommunications"*, *vol.* I, Part I - Equipment and Systems; Part II - Radio Frequencies, *4th ed.*, 1985; to the Chicago Conventions.

air-ground communication from aircraft over territory not subject to the sovereignty of any State, or from aircraft in flight in the sovereign airspace of the State of Registry of that aircraft (*or the State of the operator in terms of Article 83 bis of the Chicago Convention when it enters into force*), have not led to any legal problems. However, the non-safety' air-ground communication from on board aircraft in flight over a territory of a foreign State can indeed lead to legal problems. The existing customary international law, the codified international law and the general trends of the various national legal systems must be taken into consideration in this case.

The general international law recognized in Article 1 of the Chicago Convention stipulates that all States have complete and exclusive sovereignty over their airspace. That principle is also acknowledged in the Preamble of the ITU Constitution,[38] in that each State has the exclusive right to regulate its domestic telecommunication, meaning that there is no freedom in this field to allow anyone within the sovereign territory of a State to operate any means of telecommunication. States retaining complete and exclusive sovereignty in the field of telecommunication, as discussed later, are for economic and security reasons. This rule of law is restated in Article 30 of the Chicago Convention. In Article 30(a) first sentence states:

> *"[a]ircraft of each contracting State may, in or over the territory of other contracting States, carry radio transmitting apparatus only if a license to install and operate such apparatus has been issued by the appropriate authorities of the State in which the aircraft is registered."*

A literal interpretation is that there is a need for a licence from the appropriate authorities to operate radio equipment. Although that licence does not necessarily deal

[38] Adopted at Nairobi in 1982, with Annexes I and II, opened for signature on November 6, 1982; entered into force on January 1, 1984, *BGBl.* 1985 II at 433 [hereinafter Nairobi Convention]. This Convention replaces the Malaga-Torremolinos Convention of 1973, *T.I.A.S.* 8572; the Nice Plenipotentiary Conference of 1989 decided to separate the Nairobi Convention into two legal documents, one is the International Telecommunication Constitutions and the International Telecommunication Convention. Final Acts of the Additional Plenipotentiary Conference, Geneva, 1992. Constitution and Convention of the International Telecommunication Union, *Geneva: ITU, 1992.* Entered into force on 1 July 1994 [hereinafter ITU Constitution and/or ITU Convention].

with actual use of the radio transmissions,[39] it is covered by the second sentence of the same Article which states: *"[t]he use of radio transmitting apparatus in the territory of the contracting State whose territory is flown over shall be in accordance with the regulations prescribed by that State."* This indicates that the actual transmission must be carried out in accordance with the regulation determined by the State overflown. Therefore, any limitations, conditions, or prohibitions of the national authority must be respected. These restrictions in Article 30(a) which are laid down by the State which is overflown may hamper the aeronautical communication growth for purposes other than those specifically needed for aeronautical mobile safety services.[40] Article 30, paragraph (b) states:

> *"[r]adio transmitting apparatus may be used only by members of the flight crew who are provided with a special license for the purpose, issued by the appropriate authorities of the State in which the aircraft is registered."*

ICAO contracting States, according to this paragraph, may prevent persons other than licensed crew members, specifically aircraft passengers, from making radio transmissions via either existing terrestrial systems or satellite aeronautical mobile public correspondence facilities.

As M. Milde[41] has stated, such interpretation is not rational. On the other hand, and according to the Vienna Convention on the Law of Treaties[42] Article 31(1), the interpretation of the treaty should be carried out in light of its object and purpose, in other words in a purposeful manner.

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[39] Poonoosamy V., "Report of the Rapporteur on the Legal Aspects of the Global Air-Ground Communications", ***ICAO LC/28-WP/4-1***, at 4.

[40] Bourely M., "Legal Problems: Posed by Satellite Communications with Mobiles"(1989)32 ***Collo. L. Outer Space*** 206 at 211.

[41] Milde M., "Legal Aspects of the Global Air-Ground Communication" in Baccelli G. R., *ed.*, ***Liber Amicorum. Honouring Nicolas Mateessco Matte*** (Paris: Editions A. Pedone, 1989)214 at 220.

[42] *Vienna Convention on the Law of Treaties;* ***UNGAOR. A/CONF. 39/11/Add. 2.*** Opened for Signature 23 May 1969; entered into force 27 January 1980 **[hereinafter Vienna Convention]**.

As stated in the Preamble of the Chicago Convention, contracting States: "*...agreed on certain principles and arrangements in order that international civil aviation may be developed in a safe and orderly manner...* ." Also, the aims and objectives of ICAO, as in Article 44(h)(i), are to advance the safety of worldwide aviation and foster global civil aviation. Some views[43] state that non-safety communication does not require any specific technical skill. Airborne telephone users, such as cabin staff and passengers, are not required to select frequencies when using fully automated communication facilities. Additionally, the radio-telephone system itself will still continue to be under the control of a crew member or an automatic airborne control unit. Consequently, Article 30(a)(b) of the Chicago Convention does not represent any legal obstacle to the implementation of non-safety communication services, or with the radio regulations of the State overflown. This is completely justified and supported by Article 44 of the ITU Radio Regulations *no.* 3393 and 3394 which authorize the use by anybody of radio telephones on board aircraft and aircraft earth stations, provided the station itself is managed by a licensed operator.[44] As stated in the rapporteur's report[45] to the ICAO Legal Committee, the relevant provisions of the Chicago Convention, particularly Article 30 regarding aircraft radio transmission, is intended to insure that international aviation operations are performed safely, and ought not to be an obstacle to developments which could threaten the safe operations of such services. The problem can be settled by teleological interpretation and there is no need for any new legal instrument or for modifying Article 30 of the Chicago Convention.[46] The 28*th* Session[47] of the ICAO Legal Committee recommended:

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[43] Poonoosamy, ***supra***, note 39, at 5; see also, Stoffel W., ***Legal Aspects of Aeronautical Mobile Satellite Services*** (LL.M. Thesis, McGill University, 1992) [unpublished] at 78*ff*.

[44] Milde, ***supra***, note 41, at 220.

[45] Poonoosamy, ***supra***, note 39, at 6.

[46] Guldimann W. & Kaiser S., ***Future Air Navigation Systems: Legal and Institutional Aspects*** (The Netherlands: Kluwer Academic Publishers, 1993) at 222.

[47] ICAO Doc., ***supra***, General Introduction, note 23.

"*i.* *that nothing in Article 30(b) of the Chicago Convention shall be taken to preclude the use by unlicensed persons of the radio transmitting apparatus installed upon an aircraft where that use is for non-safety related air-ground radio transmissions;*

ii. *that all Member States should ensure that such use of such apparatus shall not be prohibited in their airspace; and*

iii. *that such use of such apparatus shall be subject to the conditions set out in the Annex hereto.*"

If the verdict concerning Article 30 of the Chicago Convention stands the basic legal barriers to implementing private correspondence services persists. In practice INMARSAT dealt with a comparable problem with the use of INMARSAT ship earth stations within the territorial sea and ports.[48] As pointed out by M. Milde:[49] "[t]*he INMARSAT summary confirms that there is no a priori freedom to operate radio transmitters in the sovereign territory of a foreign State.*" The solution to this problem came about in October 1985 when a multilateral agreement was concluded in the INMARSAT framework,[50] which authorizes maritime mobile-satellite operations which are subject to ITU radio regulations in the territorial seas and ports of contracting States. Although it is not yet in force,[51] as expressed further by M. Milde:[52] "... *the present state of law would require a similar arrangement to enable non-safety air-ground radio transmission from aircraft in flight over the sovereign territory of a foreign State.*"

Consequently, this writer does not agree with the resolution that has been developed by the ICAO Legal Committee because it settles the problem by avoiding the fact that the current legal regime of telecommunication, as already pointed out, is based

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[48] They do have the same legal status as sovereign airspace, and any radio transmissions from the territorial sea or from ports initiating from ship earth stations would be governed by the same rules and limitations as transmissions from an aircraft overflowing in foreign territory.

[49] Milde, ***supra***, note 41, at 221.

[50] International Agreement on the Use on INMARSAT Ship Earth Stations Within the Territorial Sea and Ports of 1985. Adopted by INMARSAT Assembly 4*th* Session on October 1985, entered into force on September 12, 1993.

[51] "Comments of the Director General of INMARSAT", ***ICAO LC/28-WP/4-3***, at 3.

[52] Milde, ***supra***, note 41, at 222.

on the principle of absolute and complete sovereignty of States to regulate their domestic telecommunication services.[53] Furthermore, that resolution is not legally binding on ICAO contracting States. As a result, this writer believes that the situation will continue to inhibit implementation of the growth of aeronautical satellite communication generally, and the public correspondence specifically. This will continue unless there is a binding legal instrument to permit such service and create unity in dealing with the airborne public correspondence.

Section III: Non-Safety Communication: Practical Legal Solutions

A. Overview

In view of the previous analysis of the non-safety aeronautical communication in foreign airspace, a legal solution is required to permit the introduction of such communication on a worldwide basis. As previously pointed out and explained by M. Milde,[54] any legal solution to the above problem must take into account that the majority of States do not anticipate relinquishing domestic communication from their sovereignty. This is because ICAO's member States are concerned not only with security within their sovereign domain, but also with the economic reality that results from retaining the financial benefits of the commercial communication. Therefore, any planned answer must consider that every country regards communication introduced in their territory to be a prerogative of the local authority. The solution must also ensure the absolute priority of communication related to the flight safety in accordance with priorities set out in the ITU Radio Regulations Article 51.[55] We will examine the bilateral, unilateral and multilateral actions, also the possible amendment to the Chicago

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[53] However, this is subject to various views; see more, *infra*, Chapter VI, at P. 176.

[54] Milde M., "Legal Aspects of Future Navigation Systems"(1987)XII *AASL* 87 at 95.

[55] *Infra*, Chapter VII, at P. 277*ff*.

Convention, as potential answers which were suggested by the ICAO Secretariat and discussed by the 27*th* Session[56] of the ICAO Legal Committee.

B. The Practical Solutions

1. Bilateral Action

In practice, ICAO has successfully adopted effective model clauses such as in 1986 concerning aviation security, which has already been included in a number of bilateral agreements.[57] This writer favours the idea of inserting a model clause, to be drafted by the ICAO Secretariat, and to be submitted for the next Assembly meeting for approval. This can then be included in all the bilateral service agreements between any service providers and user States. The advantage of such an approach is that it can be done much more rapidly since the time consuming multilateral drafting and ratification process can be avoided. A model clause is attractive because it promotes uniformity and expediency. It also provides for a faster and more flexible implementation. In addition, this will create unity in solving the matter, and may ease the tension of the LDCs concerning it. The rapporteur to the ICAO Legal Committee suggested an acceptable model clause.[58] That solution is acceptable because of the fast and effective results; however, this writer is concerned that this solution might require a time consuming process to become effective on a large scale. The United Kingdom in its paper addressed to the 28*th* Session of the ICAO Legal Committee[59] did not endorse this solution

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[56] *ICAO Doc.*, *supra*, note 8. Agenda Item 6 (Legal Aspects of the Global Air-Ground Communications).

[57] For example, *Air Transport Agreement between Saudi Arabia and USA* (Jeddah, 1993); ***ICAO Reg. no. 3868***; *Agreement for Air Services between Jordan and Japan* (Amman, 1994), ***ICAO Reg. no. 3883***; *Agreement for Air Transport between Mexico and Malaysia* (Kuala Lumpur, 1992), ***ICAO Reg. no. 3884.***; see Appendix to the Resolution, ICAO Doc. 9486 -C/1095, C - Min. 118/17; see also, Thaker J. S., "Model Clause on Aviation Security for Bilateral Air Transport Agreements"(1992)XVII:II *AASL* at 403.

[58] Poonoosamy, *supra*, note 39, Annex on (Draft Model Clause on Public Correspondence) at 11.

[59] *ICAO* LC/28-WP/4-4.

because, in its view, it would require a long time before such a solution could be incorporated into all of the ICAO contracting States' bilateral agreements.

2. Unilateral Action

Unilateral acts of States in relation to air transport are those acts which create the rights and obligations of States in their juridical relationships with other subjects of international law. Acts and conduct of governments may not be aimed towards the formation of agreements that create legal consequences in any way. The formation of customary rules and the law of recognition are two of the more obvious categories concerned with the unilateral acts of States. A State may show a clear intention to accept obligations *vis-à-vis* specific other States by a public statement which is not a proposition, or dependent on mutual undertakings from the State interested.[60]

This solution is acceptable because the States could unilaterally authorize non-safety communication under specified condition, either to aircraft of all States or on the basis of reciprocity. The model clause for bilateral action could also be used as a basis for unilateral action. As has been asserted, the advantage of this action is the achievement of fast and effective results;[61] although this writer supports this view, he is still concerned that in some States this solution could be a time consuming process because of the long and complicated procedures to be followed in order to change or modify the national legislations.

3. Multilateral Action

In one commentator's view[62] the only answer to this contentious problem is to conclude a multilateral convention in order to achieve a worldwide solution for air services to prevail over national concerns. ICAO has a very impressive tradition with

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[60] Brownlie I., ***Principles of Public International Law***, *4ed*. (USA: Oxford University Press, 1990) at 637*ff*.

[61] Milde, ***supra***, note 41, at 224.

[62] Beurely, ***supra***, note 40, at 211.

regards to the drafting and adoption of international agreements dealing with all kinds of issues relating to civil aviation.

Nevertheless, this solution does not seem to promise quick success[63] because it requires considerable preparatory work and time. Therefore, it has been dismissed by the ICAO Legal Committee.[64] Although, as INMARSAT presents in its paper to the 28*th* Session of the ICAO Legal Committee, this solution could be considered appropriate as a long-term solution.[65]

4. Amendment of the Chicago Convention

Amendment to a multilateral instrument of nearly global character is becoming more and more complex in practice, notwithstanding that adaptation to political, economic, and technological events has consistently required amendments to the Chicago Convention.[66] The Convention could be amended in order to remove any existing obstacles to such type of communication, or to expressly authorize them. This action is neither realistic nor effective because the procedures for adopting an amendment and for its entry into force are governed by the international law of treaties in general, and specifically by Article 94 of the Chicago Convention. Since any amendment requires that two-thirds of all contracting States ratify the amendment before it can come into force, it is a very difficult and rather uncertain procedure, and most importantly it can frustrate rapid action because it is a complex and time consuming process. The continued increase in the number of contracting States will simply exacerbate the problem.[67]

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63 As the INMARSAT Ship Earth Stations within the Territorial Sea and Ports Agreement, *supra*, note 50.

64 ICAO Doc., *supra*, General Introduction, note 23, at 4-2.

65 *ICAO* LC/28-WP/4-3, at 3.

66 Milde M., "Chicago Convention - 45 Years Later: A Note on Amendments"(1989) XIV *AASL* 203 at 204.

67 Van Dam R. D., "Regulating International Civil Aviation: An ICAO Perspective" in Masson-Zwaan T. L. & Mendes De Leon P. M.J., *eds.*, ***Air and Space Law: De Lege Ferenda, Essays*** (continued...)

In reality ICAO did not need to amend the Convention in order to deal with the vast spectrum of problems which have arisen since 1944, *inter alia*, computer reservation systems;[68] environmental protection;[69] technical assistance; and the aviation security which necessitated protection of civil aviation against criminal acts, and which were not foreseen at the time of drafting the Chicago Convention. In some views it is not necessary or practicable to amend the convention because it is time consuming.[70] Also, most ICAO member States believed that Article 30(b) did not constitute an obstacle to the introduction of such communication. Therefore this solution was dismissed by a majority of the delegations at the 28*th* Session of the ICAO Legal Committee.[71]

Although this writer sees that amending Article 30 has its merit and could be a viable and acceptable solution for the *long-term*; he strongly supports the view that in practice the expressed consent for non-safety communication in the *Service Agreements* between service providers and users will be reliable quick settlement.

Concluding Remarks

The aeronautical safety communication will have a hard time competing with economically more attractive services. Prospective frequency reductions in the restricted AMS"R"S cannot be compensated with message priority strategies. Therefore, this writer strongly supports the view that the frequencies required for the aeronautical safety communication should be reserved exclusively for civil aviation and should be managed by ICAO. That would insure flight safety and accelerate global access to such services.

(...continued)
in Honour of Henri A. Wassenbergh (The Netherlands: Martinus Nijhoff Publishers, 1992) 11 at 19.

[68] "*Policy and Guidance Material on the Regulation of International Air transport*", ***ICAO Doc. 9587, Part IE***, first *ed.*, 1992.

[69] Annex 16, ***supra***, Chapter I, note 28.

[70] Milde, ***supra***, note 66, at 215; Poonossamy, ***supra***, note 39, at 7.

[71] ICAO Doc., ***supra***, General Introduction, note 23, at 4-3.

The present state of the law indicates various obstacles and uncertainties with respect to the development, on a global basis, of non-safety aeronautical communication. One has to bear in mind that the mechanism of consensus which permitted nations to accept ambiguous language by not voting against it, and then including their interpretation of the meaning may create as many problems as it solves. For this reason, and as illustrated before, this writer favours that by expressly permitting non-safety communication in all *Service Agreements* between the providers and their users, it will create unification worldwide.

Chapter VI: CNS/ATM Systems and Current Applicable Law

Introduction

The commercial use of outer space and its importance to civil aviation in the future challenge the current framework of telecommunications law, air law, and international space law. An analysis of their relevance is required as well as insight into their applicability to the new CNS/ATM systems.[1] As cooperative space ventures among nations increase, the international legal community must coordinate legislative attempts to deal with this new environment. It must prevent any legal conflicts among nations.[2]

Commercial utilization of outer space is imminent with respect to civil aviation. Therefore, improvement of the existing international law, telecommunications law and space law is essential in order to guarantee that such activities are conducted in a fair, just and orderly manner. Efforts must be made to assist LDCs in using this new technology.[3] The need for the establishment of a special, detailed legal regime to govern the applicability of the new CNS/ATM systems is appealing, and for this purpose, it is necessary to examine its basic legal nature.

The following deliberations briefly address international telecommunications law, public international air law and the law of outer space, leaving national laws outside the scope of this thesis. Our considerations will deal only with CNS/ATM systems and attention will be given to the main points and changes that may be foreseen in the current laws. Also, their possible impact on the new CNS/ATM systems will be commented upon.

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1 Van Traa-Engelman, *supra*, Chapter III, note 95, at 417.

2 Almond Jr. H. H., "Space: The Final Legal Frontier"[November 2-8, 1992] *Space News* 20 at 20.

3 Supancana I. B. R., "Commercial Utilization of Outer Space and Its Legal Formulation Developing Countries Perspectives"(October 5-11, 1991)34 *Collo. L. Outer Space* 348 at 354*ff.*

Section I: International Telecommunications Law

Communication satellites use two global *res communis* resources: the geostationary orbit and the radio frequency spectrum. Productive orbit and spectrum utilization relies on reliable technology and skilful management. Access to an orbital position and related radio frequency depends on the cooperation of every State. Today, the ITU Constitution and Radio Regulations represent the institutionalization of rules and rights concerning the cooperative use regime for these *res communis* resources. Since the middle of the last century, telecommunications has existed within the framework of the regulations of international law, and agreed upon rules and principles.[4] The Outer Space Treaty (OST),[5] in Article I paragraph 2, and Article III, refers to the principle of conformity of space activities with international law, and this includes the UN Charter.[6] One of the by-products of new satellite technologies and services is a movement toward changing the international regulation on satellite communications.

Over the last two decades, ITU members, especially LDCs, have brought about substantial change in its objectives, and ways of achieving improved and more rational use of equitable *res communis* resources.[7] The following is a brief overview of the ITU regime, selected telecommunication principles, space orbit uses and limitations, and finally, the impact of the new CNS/ATM systems.

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[4] Evensen J., "Aspects of International Law Relating to Modern Radio Communications"(1965 II)115 ***Recueil des Cours*** at 524*ff.*

[5] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies (the Outer Space Treaty); **610 *U.N.T.S.* 205**. Opened for signature 27 January 1967; entered into force 10 October 1967 **[hereinafter OST]**.

[6] Charter of the United Nations and Statute of the International Court of Justice; **16 *U.S.T.* 1134**. Signed on 26 June 1945; entered into force 24 October 1945 **[hereinafter UN Charter]**.

[7] ITU Constitution, ***supra***, Chapter V, note 38, Article 1.

A. ITU Functions

1. Overview

In the last few decades, use of radio waves has increased exponentially. One of the primary ITU responsibilities is to prevent frequency interference.[8] It is a matter of international interest that the radio frequency spectrum be used as efficiently as possible, with a minimum of interference from current outer space commercial activities. In addition, there is the need to facilitate CNS/ATM operations in the future to insure aircraft flight safety.

The ITU offers the experience of about one and a half centuries in international communications regulation.[9] Throughout its existence the basic document of the Union has been the various incarnations of the Convention.[10] The Convention was complemented by Administrative Regulations, including the Telephone Regulations, Telegraph Regulations, and, most importantly for the subject of this thesis, Radio Regulations which were binding on all the ITU members.[11] Radio Regulations deal with the use of the radio spectrum and the geostationary orbit, frequency *assignment*, notification and registration, coordination between various systems, and other related technical matters. They are adopted and revised by the World Administrative Radio Conferences (**WARC**s) and Regional Administrative Radio Conferences (**RARC**s).

At present, the basic documentation is divided into a Constitution and a Convention.[12] The Constitution is intended to comprise constitutional provisions less

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[8] The differentiation of various types of satellite services also forms the basis of the primary task of the ITU, ***ibid***, Article 1, paragraph 2(a).

[9] For more details on the ITU history see, Lyall, ***supra***, Chapter II, note 244, at 311*ff*.

[10] ***Supra***, Chapter V, note 38.

[11] **Nairobi Convention, *ibid.***, Article 42(1); both instruments were binding the countries that have agreed on them; see, Mili M., "International Jurisdiction in Telecommunication Affairs" (1973)40 ***Telecommunication J.*** 122 at 122.

[12] ***Supra***, Chapter V, note 38.

likely to be amended by successive Plenipotentiary Conferences. The Convention contains other governmental provisions more likely to change.

For the purpose of this thesis it will suffice to mentione that the permanent organs under the Nairobi Convention of the ITU were:[13]

i. the International Frequency Registration Board (**IFRB**);[14]
ii. the International Radio Consultative Committee (**CCIR**);[15]
iii. the International Telegraph and Telephone Consultative Committee (**CCITT**);
iv. the General Secretariat;[16]
v. the Plenipotentiary Conference;[17]
vi. the Administrative Conferences (WARC/RARC);[18] and
vii. the Administrative Council.

At the Geneva Conference of 1992 a series of revisions replaced the major former organs (the Consultative Committee and the IFRB) by three other organs:[19]

i. the Telecommunications Development Sector;
ii. the Telecommunications Standardisation Sector; and
iii. the Radiocommunications Sector.

These are each headed by a Director, and they call for close cooperation as in Articles 12(2), 17(2) and 21(2). The main purposes of the ITU are defined in Article 1 of the ITU Constitution. The ITU has particular powers[20] with which to achieve its purposes. Because of these powers, the ITU is essential for the successful implementation and operation of the new CNS/ATM systems.

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[13] Nairobi Convention, ***supra,*** Chapter V, note 38, Article 7.

[14] ***Ibid.***, Article 10.

[15] ***Ibid.***, Article 11.

[16] ***Ibid.***, Article 9.

[17] ***Ibid.***, Article 6.

[18] ***Ibid.***, Article 7.

[19] ITU Constitution, ***supra***, Chapter V, note 38, Article 7.

[20] ***Ibid.***, Article 1(2).

The ITU has specific functions. Firstly, it has a *regulatory* function to eliminate harmful interference[21] between radio stations of various countries and to make the utilization of the radio frequency spectrum and the geostationary orbit more efficient. So as to keep the rates for services provided by member States as low as possible.[22] The regulatory function includes technical procedures for coordination, notification, frequency recording and orbital *assignments*. The ITU regulatory regime provides the requisite stability needed in order for satellite communication to increase. To achieve this objective, the regulations must be regularly revised, taking into consideration the continuous development of new technology and services.[23]

Secondly the *distributive* function of the ITU consists of ensuring equitable access for all countries to the radio frequency spectrum and the geostationary orbit;[24] basically the *allocation* of the spectrum and orbit between its member States. The distributive function creates potential conflict among its members, as the number and technical level of members increases. The legitimacy of the distributive function will be strained as member States explore their sovereignty.[25] Such attitudes may make governments more protective of their rights, and consequently international agreement on distribution may become more difficult to accomplish.

The third aspect is the *development* function which is concerned with fostering the progress of technical facilities and the advancement of telecommunication networks in LDCs. These countries are dealing with modifications which are essential in maturing

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[21] ***Ibid.***, Articles 34, 37.

[22] Segal B., "ITU Plenipotentiary Conference and Beyond: A Case for Serious Foreign Policy" (December 1983)7:4 ***Telecommunications Policy*** 326 at 329*ff*.

[23] Tarjanne P., "New Approaches to Frequency Management"(1991)58:XII ***Telecommunication J.*** 869 at 869.

[24] See for details, Sarkar S. K., "Criteria of Equitable Access to Geostationary Orbit and Frequency Spectrum"(1983)26 ***Collo. L. Outer Space*** at 39; see also, Smith M. L., ***International Regulation of Satellite Communication*** (Dodrecht: Martinus Nijhoff Publishers, 1990) at 77*ff*.

[25] ***Infra***, at P. 220*ff*.

and enhancing their telecommunication facilities and infrastructures, in order to deal with inequities in global tariffs, and to guarantee suitable transfer of technology to LDCs.[26] On the other hand, industrialized countries, while generally recognizing in principle the LDCs' needs, have entered into no agreement about the technical, financial or institutional achievement of them. In short, with respect to satellite communication, there are three principal functions of the ITU: first, it has a role in the use of the geostationary orbit by certain satellites, second, it has a role in rate-setting for telecommunication, as well as standard setting for international equipment, and finally, it has a regulatory function, dealing with radio spectrum use. Radio frequency *allocation, allotment,* and *assignment*[27] on a global basis is governed by the ITU framework.

The ITU, through its conferences, provides an institutionalized process for international negotiation and adjustment with respect to radio frequencies. The space WARC-1989 was the most important conference in the history of space telecommunications, and resulted in significant changes that will affect satellite communication well into the next century. The ITU's High Level Committee,[28] which was established to review the structure and functioning of the ITU, has suggested the discontinuance of the now large WARCs, and prefers rather to hold a small Radio Conference every two years. These Conferences will be of shorter duration and have smaller agendas. Nonetheless, the new Geneva Conference structure of 1992 may fail in the momentous expansion in administration tasks, since in most frequency bands the radiocommunication services are complex.[29] As always, any changes within the ITU will reflect not only technological advances, but also political and economic forces.

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[26] ***Infra***, Chapter VII, at P. 299*ff*.

[27] For definitions see, **ITU Radio Regulations, Article 1, Section II,** ***Geneva: ITU***, 1982.

[28] Its creation was driven in large part by the demands of the LDCs and the private sector, as a result of a Resolution of the "*Final Acts of the Plenipotentiary Conference*", ***Nice: ITU***, June 30, 1989.

[29] Block G. F. ***et al.***, "The World Administrative Radio Conference 1992 and Its Impact on ESA's Programmes"(August 1992)71 ***ESA Bulletin*** 56 at 63.

In recent years more private entities have joined to provide various communication services. However, under the 1992 Constitution, ITU membership remains open only to States. It was suggested that Organizations with global responsibilities such as INMARSAT and INTELSAT, and even organizations with limited responsibilities such as PALAPA and ARABSAT, should be given at least associate member status.[30]

This writer believes that in order for ICAO to pursue its purposes as well as cope with the new challenging responsibilities for the new CNS/ATM systems, it should be given full membership status to the Union. As F. Lyall stated: "*I remain disappointed that the new documents do not permit these organizations* [such as INMARSAT, INTELSAT] *to be members of the restructured Union.*"[31]

2. Radio Resource Use and Management

(a) Overview

The radio spectrum is public property and, as stated above, the ITU is the responsible organ regulating its use for the public interest. This is with a view toward maximizing the spectrum's efficient utilization, and preventing any harmful interference or orbit/spectrum capacity congestion in the future.[32] Under Article 34 of the ITU Constitution and Article 6 *no.* 341 of the Radio Regulations, the radio frequency and geostationary orbital position's earliest user has the right to utilize that frequency and orbital place without fear of harmful interference from late comers; this is the *first-come, first-served* rule which established the avoidance of harmful interference principle. Under

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[30] Lyall, *supra*, Chapter II, note 246, at 179*ff.*

[31] Lyall F., "The International Telecommunication Union Reconstructed"(1993)36 *Collo. L. Outer Space* 78 at 79*ff.*

[32] In one commentator's view, there are three principles to ease the orbit/spectrum congestion which are: "[t]*o increase the bandwidth allocated to the services in congestion*; [t]*o use orbit and spectrum more efficiently, so making room for more satellites and more information transmission per satellite*; [t]*o base the regulation of access on accurate forecasts of requirements.*"; see, Withers D., "Freedom of Access to the Radio Spectrum for Satellite Communications"(July 1985)9:2 *Telecommunications Policy* 109 at 113.

this rule any country which is planning to launch a communication satellite must inform other countries of the technical specifications of the system. Up to the present time the system has been able to accommodate everyone's needs and this is known as the *late-come, always-served* rule.[33] This rule has come under criticism from LDCs[34] because it favours the developed States and restricts access by latecomers to satellite communication. LDCs therefore endorse the *a priori* approach to allocation, with assignments made in advance of demonstrated need.

It must be kept in mind also that the issue of the allocation of satellite parking slots is analogous to the issue of allocation of frequency. The number of available positions for satellites in the Geostationary Satellite Orbit (GSO) is limited, but difficulty of crowding is likely to be ameliorated by technological advances.

The radio frequencies and the geostationary orbit are finite natural resources, and therefore must be utilized efficiently and economically. The ITU Constitution in Article 33, paragraph 2, includes the general legal principles regarding the distribution of the GSO positions and the radio frequencies between ITU members.[35] Effective operation of radiocommunication relies on the States collaboration through the ITU. The characteristics of early satellite systems have brought about further reappraisals of the basic premises of radio resource use and management, and sweeping changes are forecast for the future. This may eventually give rise to more frequency management, *e.g.*,

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[33] Smith M. L., ***Legal Aspects of Implementing International Telecommunication Links*** (dodrecht: Nijhoff Publishers, 1992) at 129.

[34] In particular Indonesia and India.

[35] Without entering a deep discussion or a historical background, it is fair enough to say that the ITU Constitution Article 33 was added by the 1973 plenipotentiary conference; then revised by the 1982 plenipotentiary conference on the initiative of LDCs. The latest amendment resulted in profound adjustment in the concept of *"equitable access"*. While there is no definition of that concept, the economy and efficiency considerations remain relevant to equitable access, see for details, Smith, ***supra***, note 33, at *77ff*; Williams S. M., "The Exploitation and Use of Natural Resources in the New Law of the Sea and the Law of Outer Space" (1986)29 ***Collo. L. Outer Space*** 198 at 202; Gorove S., "Principles of Equity in International Space Law"(1983)26 ***Collo. L. Outer Space*** 17 at 18; see also, Christor C. Q., "National Claims for the Using/Sharing of the Orbit/Spectrum Resource"(1982)25 ***Collo. L. Outer Space*** 295 at 298.

administrative procedures by which radio systems and services will be authorized to utilize specific oscillation frequencies. As electronic flow of information and services grow at an explosive global rate, there is an inherent competition for a limited resource that is nearly full.[36]

The use of radio stations for aeronautical purposes and the aeronautical radionavigation services allocations was the subject of ITU deliberations. The allocation for AMSS was recognized at the WARC-Space Telecommunications of 1971.[37] The MSS spectrum is shared among a growing number of systems.[38] Unfortunately, during the late seventies and the eighties,[39] the spectrum allocated for aviation purposes decreased. The successive reduction for aviation satellite frequency bands was justified by the ITU principle of efficient and economic use of frequencies; consequently, the arguments based on future aviation requirements were not persuasive. Today, with the introduction of satellite services in the aviation industry, the frequency bandwidth allocated for AMSS is not sufficient. The above mentioned services present difficulties in the issues relating to their need for frequency spectrum, and the coordination with other services[40]

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[36] Poskett P. & McDougal P., "WARC 92: The Case for Mobile Satellites"[October 1990] ***Telecommunications Policy*** 355 at 355.

[37] Final Acts of the WARC-ST, Resolution subparagraph 2-1, ***Geneva: ITU***, 1971.

[38] During the 1980s, INMARSAT was the only commercial mobile satellite system, and has been the driving force behind the development of the mobile satellite industry; in the 1990s we are seeing an unprecedented surge in growth in the INMARSAT system, and also at least ten other potential operators, under construction or in the developmental stage; see more details of sharing concept, ***infra***, Chapter VII, at P. 310*ff*.

[39] At the 1979 ITU General WARC the aeronautical radionavigation sub-band exclusive allocation was reduced. In 1979, 1987 WARC-MSS decreased the bands again.

[40] ***Infra***, Chapter VII, at P. 315.

(b) The 1992-WARC[41]

Prior to the 1992-WARC, MSS was able to operate globally in only the 63 *MHz* frequency, divided into two bands. After that WARC, 33*MHz* of global spectrum became available to MSS instantly. An additional 80*MHz*, and another 70*MHz* will become available after the year 2005.[42]

In view of the many service prospects proposed by modern technology, the Nice Conference of 1989[43] decided to hold the 1992-WARC for allocating specific parts of the spectrum.[44] In other words, the 1992-WARC decided to consider the changing telecommunication milieu, and to secure the regularity and stability of radiocommunication growth. That is, *inter alia*, the use of radio spectrum by two types of small satellite constellations in LEO, one for wireless telephone calls and one for data messaging services.[45] During the 1992-WARC mediation over the spectrum for the LEO systems which will provide telephone services, the Russian objection was that these systems will interrupt the Russian GLONASS system's signals.[46] This is based on the opinion that LEO satellite communication and its transition to the signal adjacent to the 1.6*GHz* band could interfere with the GLONASS system transition.[47]

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41 The World Administrative Radio Conference, was held in Malaga-Torremolinos between February 3, to March 3, 1992.

42 Events, "WARC Maps Satcom Future"[April 1992] ***Ocean Voice*** 8 at 8.

43 ***Supar***, note 28; see also, Jakhu R. S., "Plenipot Decisions on Key Legal Issues" (August/September 1989)XII:7 ***Transnational Data and Communications Report*** at 15.

44 Van Traa-Engelman, ***supra***, Chapter III, note 95, at 89 ; see also, Tarjanne P., "WARC-92" (1991)IX:58 ***Telecommunication J.*** 551 at 551.

45 Marcus D. J., "Commercial Space Sees Growth, Problems"[December 14-20, 1992]] ***Space News*** 8 at 8.

46 In J. Neer the *Iridium* Program Director view's that: "[t]*he Iridium filing was from 1616 to 1626.5 megahertz. By that request it does not interfere with GLONASS. GLONASS is approved on a worldwide basis up to 1616 megahertz and therefore from an Iridium point of view, it does not interfere.*" as indicated in the, "Newsmaker Forum"[April 13/19, 1992] ***Space News*** 23 at 23.

47 Garrion K., "Global Positioning: Help From Above"[December 1992] ***Air Line Pilot*** 18 at 20.

This technology needs suitable frequency allocations, in particular the new mobile satellite, including aeronautical, maritime and land mobile services, and various kinds of safety and broadcasting services. *Resolution no.* 208 of WARC-Mobile of 1987, which stipulates the revision of the 1-3*GHz* band with a view to allocating additional bandwidth to the mobile and mobile satellite services, was one of the main reasons for the holding the 1992-WARC. The agenda of WARC included three fundamental issues relevant to space telecommunications: first, the authorization of satellite sound broadcasting; second, the permissibility of LEO satellite communication, and third the creation of new frequency allocations for space commercialization.[48] (The latter is of special importance to the new CNS/ATM systems). The conference was characterized by active arguments and eventual settlement on new rules of law in each of the above areas.

Some basic difficulties that faced the 1992-WARC were, *inter alia*, the matter of whether the modification of frequency bands would have an economic effect on existing service users and providers, as well as on new services. The part of the spectrum in question is technically best suited for MSS, and it is assumed the adjustment of some services will be regarded as harmful to others.[49] Most of the WARC attention was centred on the advantages of LEO for global, cellular phone and vehicle tracking utilization. INMARSAT and many other countries succeeded in reaching a Resolution which requires that the LEO systems share their frequency band with other satellite systems. Also, to alleviate spectrum inadequacies, significant new frequency allocations which are expensive to use, were given to MSS at higher bands.[50] Finally, it was agreed to create large blocks of new frequency bands for space application services.[51]

The 1992-WARC recognized that MSS frequencies will have to be shared with existing and future satellite and terrestrial users, requiring coordination to prevent

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[48] Rothblatt, *supra*, Chapter V, note 3, at 39.

[49] *Supra*, Chapter V, note 12, at 107.

[50] The bands are around 1.9*GHz* to 2.6*GHz*; see, *INMARSAT News nr. 92\10\FILE*.

[51] These services include, *inter alia*, Space Station Communication, Mars-Moon-Earth Communication links.

interference.[52] However, because there was no global consensus, due to differences in views between the USA and Europe on the issue of a generic allocation[53] to the MSS, there were different allocations in various regions.[54] It was a rather disappointing result given the ITU's efforts to simplify the Radio Regulations. Therefore, in some views[55] the overall results of 1992-WARC, apart from the allocation to the LEOs, have fallen short of even modest expectations. More important for the purposes of the subject matter, 1992-WARC decided against opening up aeronautical bands, as had been proposed by the non-aviation users.[56]

In the final analysis, the 1992-WARC has proved to be a practical mechanism for amending international space communication law to adapt to changing technology.[57] Also it was clear that for the first time LDCs played a crucial, decisive role in favour of implementing new technology. Once again the subject of frequencies for aeronautical satellite services is on the agenda for the next ITU WARC scheduled for October/ November 1995.

B. Selected Telecommunication Principles

In order to operate in any State, the new CNS/ATM systems will need licenses which will depend on each jurisdiction; also, since every State is internationally responsible if it causes harmful interference to other States, the *States' Jurisdiction* principle, and the *States' Responsibility* principle will be examined; this will be followed by the dispute settlement method under the ITU Convention.

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[52] ***Infra***, Chapter VII, at P. 315*ff*.

[53] In theory, generic allocation would permit access to the band by all MSS, instead of a segmentation into maritime, aeronautical and land mobile satellite bands.

[54] Regions 1 and 3 (Europe, Africa, Asia and Australia), and in Region 2 (the Americas).

[55] Block, ***supra***, note 29, at 60.

[56] Primarily from North America, Mexico and Australia, see, "Aviation Retains Spectrum at WARC"[2/1992] ***IATA Review*** 22 at 22.

[57] Rothblatt, ***supra***, Chapter II, note 250, at 41.

1. States' Jurisdiction

In the Preamble of the ITU Constitution[58] the principle of State sovereignty in regulating its own telecommunication is expressly recognized. Furthermore, under the principles of international law on State sovereignty and territorial jurisdiction, States have exclusive rights to control and regulate their national telecommunications.[59] As M. Milde has stated:[60] *"[t]here is no freedom in the field of telecommunication which would automatically permit anybody, within a sovereign territory of a State, to operate a wireless transmitter or any other means of telecommunications."*

Due to the recognized right of States to regulate and control their internal and external telecommunication systems, prior consent or agreement of the concerned States by multilateral, bilateral, or unilateral action is mandatory. Consequently, the legal and structural framework of the various national telecommunication networks deviate considerably.[61] It is also recognized in Article 27 of the Convention on Diplomatic Relations,[62] that foreign diplomatic missions may install and use wireless transmitters only with the authorization of the host State. Many States control all forms of telecommunication; even in other countries where communication is privatized, there is a powerful regulatory influence by State authorities. However, States are still reluctant to liberalize established national telecommunication systems. In this writer's view, this principle could have serious impact on the implementation of the new CNS/ATM systems, unless a way can be found to harmonize national jurisdiction with the aim of international cooperation in the field of telecommunications.

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[58] ***Supra***, Chapter V, note 38.

[59] Hondius F. W., "International Control of Broadcasting Programs in Western Europe" in McWhinney E., *ed.*, ***The International Law of Communications*** (Leyden: A.W. Sijthoff, 1971) 69 at 76*ff*.

[60] Milde, ***supra***, Chapter V, note 41, at 218.

[61] Rapp L., "Deregulation: The Cases of Telecommunications and the European Communities Court of Justice"[September 1985] ***ITA Magazine*** 14 at 14.

[62] Vienna Convention on Diplomatic Relations of 1961; **500 *U.N.T.S.* 95**. Entered into force in 1964.

2. States' Responsibility

The above mentioned principle of *States' jurisdiction* to regulate its internal telecommunication system correlates, on a global level, with certain State responsibilities. Under the ITU rules States are internationally responsible if the assigned frequency causes harmful interference to other licensing States. In Article 33 of the ITU Constitution States are urged to use the frequency spectrum and the geostationary satellite orbit in an efficient, economic and equitable manner. Article 26 of the ITU Constitution guarantees the secrecy of telecommunication by obliging member States to take all feasible measures compatible with the system of telecommunication operated to ensure the secrecy of international correspondence.[63] Nonetheless, under Article 25 of the ITU Constitution, member States are not responsible to international telecommunication services users, in particular with regard to claims for damages. This primarily concerns the private law of responsibility towards private parties.[64] States which are ITU members are under obligation to act in conformity with the ITU Constitution and Convention, and the regulations adopted pursuant to it.

3. Disputes Settlement Method

The ITU Constitution provides some techniques for dispute settlement. Settlement of disputes is governed by Article 45 under which a member State may settle any dispute on questions relating to interpretation or application of the Constitution, Convention or administrative regulations[65] through diplomatic channels or any technique jointly recognized[66] or arbitration.[67] States may settle their disputes on telegraph, the

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[63] ***Infra***, at P. 256.

[64] Matte, ***supra***, Chapter II, note 1, at 143.

[65] As in ITU Constitution, ***supra***, Chapter V, note 38, Article 43, the administrative regulations complete the provisions of the Convention and regulate the use of telecommunication.

[66] ***Ibid.***, Article 45(1).

[67] ***Ibid.***, Article 45(2).

telephone and the radio regulations interpretation. The arbitration procedures are set out in Article 34 of the ITU Convention. Certain modalities are also outlined in the Optional Additional Protocol to the Constitution and Convention, on the Compulsory Settlement of Disputes dealing with disputes between the ITU members who sign and ratify the Protocol; the Protocol is distinct from the Constitution and Convention and legally is a separate agreement.[68]

The fact that the ITU has functioned effectively without the need for recourse to the established arbitration regime is evidence of the high level of cooperation and mutual understanding among its members. Consequently, the dispute resolution mechanism has yet to be used. A further reason for the lack of recourse to the dispute settlement procedure as regards space communication may be due to the existence of the IFRB.[69] Therefore, the ITU should take stronger steps to support its present system, while developing a system to settle future conflicts.[70]

[68] "*Optional Protocol on the Compulsory Settlement of Disputes Relating to the Constitution of the International Telecommunication Union, to the Convention of the International Telecommunication Union and to the Administrative Regulations*", in the Final Acts, ***Geneva: ITU***, 1992, at 121.

[69] Ickowitz A. H., "The Role of the International Telecommunication Union in the Settlement of Harmful Interference Disputes"(1974)13 ***Columbia J. Transnational L.*** at 82; the International Registration of frequency assignments for space telecommunication is carried out by the Radiocommunication Bureau, in accordance with the Radio Regulations drawn up by competent ITU WARCs form the date of publication of the ITU 32 Report; see the 33 Report by the *ITU on Telecommunication and the Peaceful Uses of Outer Space*; ***Geneva: ITU***, 1994, at 3.

[70] "Make ITU a Stronger Referee"[January 24/30, 1994] ***Space News*** 20 at 20; see also, Seitz P., "Officials Call for ITU to Beef up Regulations"[January 24/30, 1994] ***Space News*** 3 at 3.

C. Space Orbits' Uses and Limitations

1. The Geostationary Orbit

As a general rule, the higher the satellite moves in its outer space orbit, the longer the orbit.[71] The GSO is the perfect location for communication satellites. The benefits of using such orbit is, *inter alia*, that one satellite can continuously observe one third of the globe or broadcast to various zones of the globe.[72] Also, a GSO satellite is preferable to a random-orbit satellite system mainly because it requires fewer satellites for full global coverage and reduces the complexity and scheduling problems of earth stations.

The GSO Conference (**ORB-88**)[73] was particularly important because of its goal of improving the efficient use of that orbit and the spectrum resources allocated to it. As stated by R. Jakhu:

> "*[f]rom both the legal and factual points of view, the geostationary orbit is a limited resource...* [which] *can accommodate only a finite number of satellites, without mutual harmful interference.*"[74]

Furthermore, use of the GSO is subject to definite limitations of a technological and physical nature.[75] One of the main limitations of the GSO is that from around March 21 to September 23 every year a satellite can lose power for about 70 minutes,

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71 Reijnen G. C. M. & de Graaff W., ***The Pollution of Outer Space, in Particular of the Geostationary Orbit*** (London: Martinus Nijhoff, 1989) at 13.

72 Vitt E., "Questions of International Liability in the Case of Collisions Suffered by Satellites in the Geostationary Orbit"[January 1988] ***ZLW*** 46 at 46.

73 The first session of WARC ORB-85/88 was held in Geneva, August/September 1985, the second session "ORB-88" took place in Geneva, August/September 1988. The mission of the last two sessions was to guarantee in practice equitable access to the geostationary orbit and the allocated frequency bands; see ***WARC-79, Res. no.*** 3.2.

74 Jakhu R. S., "Space Debris in the Geostationary Orbit: A Major Challenge for Space Law" (1992)XVII:1 ***AASL*** 313 at 314.

75 Kopal V., "The Geostationary Orbit: A Limited Natural Resource or a Precious Part of Outer Space?"(1983)26 ***Collo. L. Outer Space*** 27 at 27.

for a six week period.[76] Consequently, either transmissions will have to be temporarily switched to a satellite at another longitude, or batteries will have to be used to overcome this problem. Also, unless technical innovation becomes available to relieve the congestion, problems which are highly likely as a consequence of current commercial outer space activities, such activities will be determined by congestion and its solutions.[77] The necessity for ensuring the most effective economics in using this orbit has become important.[78] Effective use of the GSO requires that satellite communication be protected from the harmful interference of other satellites, which can be caused by radio and physical interference. The effective use of the GSO implies some limitations on the freedom of that use as has been worded in Article 34 of the ITU Constitution. The main reason that communication satellites reside in GSO is that they continue stationary in relation to the earth. This does not mean, however, that GSO is the perfect orbit for all communication satellites.

2. The Low Earth Orbit

The LEO[79] is the easiest zone of outer space to reach from earth, and it offers continuous commercial,[80] and scientific opportunities.[81] It is an alternative to the GSO

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[76] Reijnen & de Graaff, *supra*, note 71, at 24.

[77] In the sixties technical considerations such as transmission power, signal bandwidth and ground-coverage area, were dominant. In the seventies, when congestion problems began to be felt, political considerations took over, and led to the establishment of international regulation systems as discussed above.

[78] Recently the vast increase in the GSO utilization, specifically in the telecommunication domain, and this is why many countries worry of absorb GSO and the frequency bands that can be utilized for communication in that orbit; see, Kopal, *supra*, note 75, at 28*ff*.

[79] It is at about 200 to 4,000*km*. above the earth.

[80] There are five corporations which have applied to the USA Federal Communications Commission to launch constellations of LEO satellites for global communications systems, including *Motorola, Satellite Communications of Chandler, ARIZ, and LORAL Qualcomm Satellite Services of Palo Alto*; see, Seitz, *supra*, Chapter IV, note 11, at 1.

for communication satellites. In some views[82] the *Iridium* plan for the MSS system in LEO in addition to the already existing systems in the GSO is an indication of the increasing importance of the MSS. In the 1992-WARC, regarding LEO use, the CCIR reported that a common global allocation in the 1-3*GHz* band would be preferable for all mobile satellite services, from operational and cost perspectives. Providing spectrum for voice communication for LEO constellations generated heated opposition from the Russian delegates at the WARC, because the satellite signals in LEO will risk safety by interfering with the ability of aircraft to receive GLONASS satellite positioning data.[83]

The LEO system's advantages are, *inter alia*, lower launch expense, greater modularity, much less costly user terminals, global service capability, and improved system characteristics for mobile communication.[84] It is not clear, for example, whether satellite operations will demand separate frequency allocations or whether it can share other satellite service spectrums. Furthermore, it is not clear how equitable access to LEO frequencies can be accommodated since each system has global coverage, making the regime of sharing spectrum by national geography problematic.[85] LEO already hosts a multiplicity of space activities, such as research, military and commercial telecommunication.

There are some views that LEO systems might introduce sharing difficulties with existing terrestrial domestic communication.[86] According to the USA Office of Technology Assessment report issued on October 11, 1990, the activity in LEO is

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[81] National Commission on Space, ***Pioneering the Space Frontier*** (N.Y.: Bantam books, 1986) at 81.

[82] Poskett P. I. & Wright D., "WARC-92 and Mobile Satellite Finding New Spectrum" (1991)58:IX ***Telecommunication J.*** 603 at 604.

[83] Marcus D. J., "Slow Progress at WARC"[March 2-8, 1992] ***Space News*** 1 at 28.

[84] Bulloch C., "Russia Bets on Satcoms"[August 1993] ***Interavia Aerospace World*** 53 at 54.

[85] Rothblatt M. A., "New Regulatory Ideas and Concepts in Space Telecommunications" (1992)20:1 ***J. Space L.*** 27 at 31.

[86] ***Supra***, Chapter V, note 12, at 108.

increasingly used for MSS systems and will face significant danger from space debris.[87] Nonetheless, the commercial feasibility of LEO satellite communication has been proven. Also, the international legal regime for the low earth orbit satellites can be restricted to technical regulation, or could demand the active consent of every country being serviced. The LEO is becoming a limited and valuable natural resource and its continued expansion and additional activities in that orbit can make certain other activities worthless, perhaps more difficult and hence more expensive.[88]

D. The Impact of the Current International Telecommunication Law on the New CNS/ATM Systems

The regulatory regime for satellite communication that has been established within the ITU serves a very important function. Development of satellite communication depends on the existence of a stable legal regime that will provide adequate international protection for the large investments required to establish a satellite communication systems; the CNS/ATM systems are subject to the regime established by ITU. Therefore, a stable satellite communication's legal regime is the back-bone for the efficient implementation of the CNS/ATM systems.

ITU member States are internationally responsible for the allocated frequencies to be used in accordance with the registration in the Master Registry, as well as for protection against any harmful interference to other users which are registered by the Union. As the electromagnetic spectrum has becomes more utilized, the possibility for harmful interference to satellite navigation and supporting communication has increased. As emphasised by ICAO FANS Committee, it is appropriate to guarantee the capability of securing navigation signals and supporting communication signals from harmful

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87 "Debris Said to Threaten Space Activities, Including MSS Programs"[October 19, 1990] ***Mobile Satellite Reports*** 4 at 4.

88 Collins P., "Implications of Reduced Launch Costs for Commercial Space Law" in Tatsuzawa, ***supra***, Chapter II, note 221, 139 at 141.

interference.[89] Therefore, there are necessities to ensure that non-aviation users comply with the critical conditions imposed by the safety requirements of the civil aviation community. Also, there is a need for continuing coordination, research, application and regulatory enforcement to retain established safety standards. Any changes in international telecommunication policy must be driven by advances in technology and the evolution of the telecommunication market. Also as the spectrum becomes more crowded and the possibility of interference escalates, the ITU must act more quickly and carefully to achieve fair allocation of frequencies on the one hand between developed and less developed countries and between the aeronautical, maritime and land mobile communication on the other hand. These allocations must be such as to prevent, or minimize, the possibility of interference and insure air navigation safety.

Section II: Public International Air Law

As international air law is a part of general international law, the sources enumerated in Article 38, paragraph 1, of the Statute of the ICJ are a relevant source of public international air law. International treaty law is of particular importance in the regulation of multilateral and bilateral relationships of air transportation between two or more sovereign powers.

The rules of international law are created in international political processes and reflect the political will of States. The process of forming norms of international law is a process of the coordination of the wills of sovereign States and other subjects of international law. The harmony of the wills of States respecting the acceptance of a usage as a norm of International Law occurs not at once, but as a means of gradual increase in the belief that the usage in question has already become lawfully binding.[90] In the following part we will deal with selected basic international air law principles which the

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[89] ICAO FANS, *supra*, Chapter II, note 80, at 4-17.

[90] Tunkin G. I., "International Politics and International Law in the Nuclear Age" in McWhinney *et al.*, *supra*, Chapter III, note 99, 9 at 11.

framework for all activities related to civil aviation and their impact on the new CNS/ATM systems.

A. Selected International Air Law Principles

1. ATC Legal Regime

Although the liability of the carrier has been regulated by the "Warsaw" instruments, which are not adequate,[91] there is no similar convention governing ATC. In most countries ATC is provided by the State, or State-controlled agencies; and in most States the principles of law with regard to State liability apply. This means that currently ATC liability is governed by national law. Thus again State can be held liable in negligence for damage caused by an act or omission of ATC. As a consequence, the negligent ATC can be held responsible too. Although, when death or injuries are involved, it is not impossible that the air traffic controller will have to face criminal prosecution.[92]

With regard to State liability, national laws are deeply divergent, ranging from liability without limit to complete immunity from liability. Air traffic services are substantially fragmented along national lines. Different rules apply in different nations and by different means. Before the appearance of the *jet* aircraft in 1958, the duty of ATCs was limited to providing some assistance or advice to pilots who were basically, if not exclusively, responsible for aircraft operation.[93] With the introduction of high speed *jet* aircraft and the increase in air traffic, the role of ATCs has become increasingly important. In the 1970s, wide-bodied aircraft, radar technology and the use

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[91] Milde M., "Warsaw System and Limits of Liability - Yet Another Crossroad?"(1993)XVII, Part I *AASL* at 201; see also, Guldimann W., "A Future System of Liability in Air Carriage" (1991)XVI *AASL* at 93.

[92] Geut H., "The Pilot and the Air Traffic Controller - Division of Responsibilities"[March 1990] *IFALPA Quarterly Review* 6 at 11.

[93] Levy S. J., "The Expanding Liability of the Government Air Traffic Controller"(1967/68)34 *Forham Law Review* at 402.

of computerized equipment were gradually introduced. Consequently, pilots[94] now rely more on directions and instructions of the ATC. As the importance of the ATC in aviation increased, so did the tension under which the controllers operate.

Furthermore, the ATC process has been faced with highly automated procedures governing air navigation, involving the use of, *inter alia*, air-ground data interchange systems with a minimum of human intervention, and communication and meteorological satellites. In the new CNS/ATM systems these problems could be compounded by the fact that satellites may be operated by a single State, a group of States, a mixed body composed of States and a national company, or an international organization. In this event, the question of who would be liable in the case of an air accident becomes pertinent. In the same way that air traffic rules gradually had to be defined in order to assure the protection of aircraft and the safety of passengers, there is a pressing need to coordinate air traffic services in order to better utilize airspace and to ensure uniformly high standards of safety regionally and globally. One could question whether or not, with the implementation of the CNS/ATM systems, the current general practice of providing ATC services primarily on a national level will be able to respond to the new systems' needs.

There is no doubt that ATC service is international in nature when an aircraft is in an FIR over the high seas, a territory of undetermined sovereignty or in delegated airspace;[95] Also, there is a growing need for international rules in view of current global harmonization of the civil aviation industry. This will result from the introduction of the new CNS/ATM systems.

There is a view that has been expressed that ICAO member States should adopt an agreement containing a solution for all States concerning the provision of aeronautical

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[94] The practice generally in the early cases was held, that the pilot in command was directly and primarily responsible for the safe operation of the aircraft. That principle was known as the "*pilot-in-command concept*" is found in *Annex 2 and 6* to the Chicago Convention; although, over the last few decades the courts tended to increase the ATCs responsibility and have diluted and weakened the forgoing concept; see details, Geut H., "The Law: The Pilot and the Air Traffic Controller-Dision of Responsibilities"(1988)XIII:6 *Air L.* at 257.

[95] Mohmed A.-K., *Air Traffic Control Liability* (LL.M. Thesis, McGill University, 1987) at 7.

navigation systems by the new CNS/ATM systems in international airspace beyond the territory of any particular State.[96] However, in early 1960s the ICAO began to study the question of ATC liability and the necessity of a new international convention to regulate the matter.[97] The aviation community in the seventies and eighties could not agree on whether a new international instrument was desirable or not.[98] Attempts to have an international regulation on the subject have always failed. This has been for various reasons,[99] *inter alia*, if States do ratify an ATC International Liability Convention, they will automatically infringe upon their sovereignty, and they do not desire to lose their authority and immunity over ATC liability.

For the purposes of this thesis it is fair to assert that a new and different approach for ATC is required, and that this became apparent to ICAO member States in the early 1980s through their agreement to form the FANS Committee which has noted the increasing diversity and complexity of governing ATC by national law. Hence, a solution is needed to consolidate the operational performance of ATC, or at least the development of a compromise conducive to this aim. The 29*th* Session of the ICAO Legal Committee has attempted to draft a Memorandum of Understanding, wherein the subject of air traffic services liability was pictured.[100]

It is expected that the current movement toward privatization, commercialization, and liberalization methods[101] will weaken the absolute sovereignty rights of States as well as their immunity. Consequently, the new CNS/ATM systems' implementation and

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[96] Khan, ***supra***, General Introduction, note 28, at 50*ff.*

[97] See, Larsen P. B., "Air Traffic Control: A Recommendation for a Proof of Fault System without a Limitation on Liability"(1966)32 ***J. Air L. & Comm.*** at 3.

[98] For more details on ICAO work on ATC liability problem; see, Sasseville H., ***The Liability of Air Traffic Control Agencies*** (LL.M. Thesis, McGill University, 1985) [unpublished] at 115*ff.*

[99] Marn P., ***Comparative Liability of Air Traffic Services*** (LL.M. Thesis, McGill University, 1981) at 5.

[100] ***ICAO LC/29-WP/11-1***, July 1994.

[101] ***Infra***, Chapter VII, at P. 286*ff.*

operation will be facilitated by this movement, and it may be that the notion of adopting a new international or regional instrument will be more acceptable than before.

On the other hand, when a plane crash occurs, the recovery of the damages is doubtful due to the various national legislations. At present conflicts of law count on the law where the damages take place. This law will determine whether the claimant will be recompensed, and will govern its range, if it may be delayed, and whether the claimant loses his claim. Furthermore, the ATC liability relies on that of the national State which could be contractual or tort liability. If it is contractual, the law of the place where the contract was signed will apply, and in case of tort, the law of the place where the damage takes place will apply. The effects for the claimant are of dissimilar nature.[102] Additionally, under the sovereign immunity doctrine, which protects governments from any legal actions, the expressed consent of a sovereign government is necessary in order to be sued.[103] Giving the present development of the implementation of the CNS/ATM systems, it is likely that incidents which include foreign parties will increase in the future. Accordingly, solution is urgently required and this writer is in favour of adopting a uniform liability strategy in the form of an international convention, or other alternative arrangements such as model laws, guidance material, a new Annex to the Chicago Convention or regional agreements. This would ensure safety standards and would be very useful to States which do not yet have enacted legislation governing these subjects.[104]

As has been stated by a commentator,[105] in practice it will be necessary to develop certain legal specifications concerning the transfer of liability from one ATC

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[102] Dahal C. S., ***Air Traffic Control Liability in Norway and From A View Point of International Unification*** (LL.M. Thesis, McGill University, 1973) at 71*ff*.

[103] *Eastern Airlines Inc. vs. Union Trust Co.* **21F2d 62 (DC 1955)**, where the USA Government was held liable for the negligence of its ATC agency for damages of one million dollars, but damages were never awarded.

[104] ICAO Doc., *supra*, General Introduction, note 26, (Executive Summary) at 1*ff*.

[105] Bordunov, *supra*, Chapter III, note 11, at 284.

agent to another with regard to the actual monitoring and controlling of aircraft in adjacent flight information regions. In view of the diversity of national liability systems, the drafting of an international convention would, no doubt, meet with many barriers; and so for the time being it appears that the ATC liability will continue to be governed by national law. However, this writer' vision on ATC liability is given in Chapter VIII.

2. Aircraft Nationality

Under international law the State maintains control over its citizens even when they are out of its territory. Nationals and their possessions continue to receive the State's protection when they are abroad *vis-à-vis* other countries to whose jurisdiction they may be subject.[106]

At the first international aviation conference held in Paris in 1910 it was agreed in substance that aircraft should have the maritime law characteristics of nationality and the principle has since been accepted.[107] The Chicago Convention confirms a well established rule of customary international law by attaching aircraft to the jurisdiction of the State of registry as provided in Article 17, which is identical to Article 6 of the Paris Convention of 1919. As a consequence, the State of registry is globally responsible for managing aircraft and for conformity with regulations of civil aviation with respect to, *inter alia*, compliance with the rules of the air,[108] airworthiness,[109] licensing of crews.[110] In other words, the State of registry is responsible internationally for the

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[106] Cheng B., "Nationality for Spacecraft?" in Masson-Zwaan & Mendes de Leon, *supra*, General Introduction, note 28, 203 at 203*ff*.

[107] In the ILA conference in Paris in 1910, it was recognized that the aircraft should show nationality in a way parallel to that of ships; Slatter R. T., "Nationality Marks should Comply with ICAO Annex 7 Specifications"(October 1992) *ICAO J.* 13 at 13.

[108] Chicago Convention, *supra*, General Introduction, note 5, Article 12.

[109] *Ibid.*, Article 31.

[110] *Ibid.*, Article 32.

regulation and enforcement of air safety.[111] Registration does not provide nationality but rather confirmation thereof.

The current framework of international air law does not present any obstacle to the creation of joint operating agencies in international air transport. Under Article 77 of the Chicago Convention, joint organizations or operating agencies are subject to all provisions of the Chicago Convention. In the 1963 Conference on International Air Law held in Tokyo, the notion of aircraft nationality was significant for the draft convention which was proposed. Compromise was confirmed in Article 18 of the 1963 Tokyo Convention[112] which recognized that in case of joint air transport operating organizations or agencies:

> "*...[its] States shall, according to the circumstances of the case, designate the State among them which, for the purposes of this Convention, shall be considered as the State of registration... .*"

Identical solutions were embodied later in The 1970 Hague Convention,[113] and the 1971 Montreal Convention.[114] However, in 1967 the ICAO Council adopted a resolution requiring a constitution of a joint register for the purposes of Chicago Convention Article 77. And it also required the designation of a State as recipient of representation from third States.[115] As M. Milde[116] has noted, the creation of joint

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[111] Van Dam R. D. & Howie E. I., "Facilitating the Lease and Interchange of Civil Aircraft" [February 1989] *ICAO Bulletin* 9 at 9.

[112] Convention on Offences and Certain Acts Committed on Board Aircraft; *ICAO Doc.* 8364. Entered into force on December 4, 1969 [hereinafter Tokyo Convention].

[113] In its Article 5, Convention for the Unlawful Seizure of Aircraft; *ICAO Doc.* 8920. Entered into force on September 14, 1971 [hereinafter Hague Convention].

[114] In its Article 9, Convention for Suppression of Unlawful Acts Against the Safety of Civil Aircraft; *ICAO Doc.* 8966. Entered into force January 6, 1973 [hereinafter Montreal Convention].

[115] Resolution on Nationality and Registration of Aircraft Operated by International Operating Agencies, *ICAO Doc.* 8722-C/976. That resolution applies only when all States forming the international operating agency are and continue to be parties to the Chicago Convention; but it does not apply in the case of aircraft which is registered on a national basis.

air transport operating organizations or agencies are a practical and effective technique for many LDCs. This will also be important in the current movement toward internationalization, globalization, mega-carrier, and the emerging new multilateral era of air transport. Generally speaking, this will have a positive impact on the CNS/ATM systems' implementation and operation.

The growing incidence of lease, charter or interchange of aircraft creates a tremendous burden on the State of registry, because these types of aircraft are often out of State of registry for long periods of time. An aircraft registered in one State and operated by another State calls for a need for more flexible and economical commercial use of today's costly equipment. After recognizing the problem in a study by an ICAO Panel of Experts, the ICAO Legal committee, in 1978, prepared a draft amendment to the Chicago Convention. The Chicago Convention does not adequately specify the rights and obligations of the State of an aircraft's lessee since the Convention attaches all important functions and responsibilities to the State of registry. At the 23*rd* Session of the ICAO Assembly in September/October 1980, the amendment, Article 83*bis*,[117] was adopted. Until the amendment comes in to force, a State will not be able to avoid its conventional obligations under the Chicago Convention with regard to the regulation of aircraft registered in that State. Once the amendment comes into force, there are other privileges which will be obtained, such as, States having the flexibility to join agreements with other States that provide for the transfer of all or some of its obligations; and also the State's resources will be more practically consumed in regulating the operations and licences regarding aircraft whose operators are within that State.[118] That will have a profound impact on facilitating the implementation of the new CNS/ATM systems.

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[116] For more analysis see, Milde M., "Nationality and Registration of Aircraft Operated by Joint Air Transport Operating Organizations or International Operating Agencies"(1985)X *AASL* 133.

[117] As to September 1, 1994, 83 States have ratified the provision according to ICAO record.

[118] For details see, Van Dam & Howie, *supra*, note 111, at 10.

3. International Cooperation

In general terms, the scientific and technological revolution has opened the way for unprecedented progress in society while at the same time creating global problems endangering its existence. There are the dangers of, *inter alia*, a nuclear war, a conventional war and other violent conflicts of interests. These problems cannot be solved by the efforts of individual States.

LDCs are not able to construct global cooperative enterprises, for many reasons, particularly, their shortage of financial resources. Consequently, they are embarking upon what is known as *self-help* mechanism by insisting on constant sovereignty above their national natural resources, and demanding equitable access to global natural resources, *inter alia*, the radio spectrum, and natural resources of outer space.[119] This situation requires a greater degree of international cooperation, new forms of this cooperation, a new orientation of national policies, new relations between international policies and international law, and an updated role for global organizations.[120]

Article 1(3) of the UN Charter list, as one of its main objectives, international cooperation as a means of resolving various international problems.[121] The use of space was seen by the UN as a means by which the world could be united,[122] by expanding the spirit of world cooperation into outer space. A series of UNGA *Resolutions* followed the flight of Sputnik 1, reflecting the optimism of the UN.[123] As has been stated:

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[119] See in general, Jakhu R. S., "Developing Countries and the Fundamental Principles of International Space Law" (Document prepared by the CRASL, McGill University, 1982).

[120] Tunkin G. I., "International Politics and International Law in the Nuclear Age" in Mcwhinney *et al.*, *supra*, Chapter III, note 99, 9 at 9.

[121] *Supra*, note 6.

[122] Moylan J., "The Role of the International Telecommunications Union for the Promotion of Pace through Communication Satellites"(1971)4 *Case Western Reserve J. Int'l L.* 61 at 62.

[123] See *UNGA Resolution* 1348 (XIII) of 13 December 1958; *UNGA Resolution* 1472 (XIV) of 12 December 1959; *UNGA Resolution* 1802 (XVII) of 14 December 1962.

"[s]pace science and technology have brought more international cooperation than any other single influence and have offered nations an opportunity to create an atmosphere of mutual trust."[124]

In the Chicago Convention the principle of cooperation finds expression in various provisions. One of the major issues in this context is the international standardization of rules and regulations relating to civil aviation. This will have profound impact on the CNS/ATM systems. The guideline I-3, approved by the FANS Committee and applicable to all CNS systems, states:

"[a]rrangements must preserve, facilitate and not inhibit ICAO responsibility for the establishment of appropriate Standards, Recommended Practices and Procedures in accordance with Article 37 of the... [Chicago Convention]."[125]

This is indicate that cooperation is the milestone for ICAO in order to establish the new systems' related SARPs.

4. Airspace Sovereignty Concept

The principle of sovereignty over airspace has been accepted as a customary principle of international law. It has been the subject of many papers with different points of view as the starting point of analysis. In international law the State is sovereign, and has exclusive sovereign rights over its territory and airspace above. Consequently, in order to engage in any activities, State consent is essential.[126] State sovereignty over airspace was accepted as early as the Paris International Air Navigation Conference of 1910,[127] since then international air transport agreements have followed this idea.[128]

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[124] Matte, *supra*, Chapter III, note 99, at 200*ff.*

[125] *ICAO Doc.*, *supra*, General Introduction, note 26 (Appendix A to the Report on Agenda Item 8), at 8A-24.

[126] Henaku B. D. K., ***Regionalism in International Air Transport Regulation*** (The Netherlands: Koma Publishers Foundation, 1993) at 4.

[127] The concept of "Freedom of the Air" and the States' control over their airspace arose as early as the 1910 Paris Conference at which time the tendency was already to favour State sovereignty (continued...)

This concept was expressed in the Chicago Convention, Article 1; Articles 5, and 6 confirm Article 1 by requiring a State's permission for a scheduled flight. The airspace sovereignty concept is not limited by the right of innocent passage of a foreign aircraft. The terminology used in Article 1 of the Chicago Convention includes, among others, the terms "territory", "airspace" and "complete and exclusive". The Chicago Convention never clarifies the term "airspace". It seems that the interpretation is left to the States concerned.

For the purpose of this thesis it is sufficient enough to state that although State sovereignty is a political and legal principle, it has significant economic impact. In that, each State has complete and exclusive rights to open, close or limit its airspace to commerce with other States.[129] As a result of this principle, a State can determine its own rules governing that region and the use thereof. The consequence of this declaration of a State's sovereignty principle is that in order to make international civil aviation feasible, exchanging commercial aviation rights in the form of bilateral or multilateral agreements between States is essential.

The international system which evolved from the Chicago Convention and was institutionalized in ICAO was meant to protect the sovereign rights of States and assure the safety, regularity and the orderly development of civil aviation on the basis of equal opportunity.[130] The principle of national sovereignty over the airspace is important in the economic regulatory context because it is at the heart of the regime governing the bilateral negotiation of traffic rights between States. As has been asserted, the principle

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(...continued)
concept; Cooper J. C., "The International Air Navigation Conference, Paris 1910"(Winter 1952)19:1 ***J. Air L. & Comm.*** 127 at 127*ff*.

[128] Henaku, ***supra***, note 126, at 5.

[129] Koo G. F., ***Foreign Equity Participation in United States Airlines*** (LL.M. Thesis, McGill University, 1989) [unpublished] at 9.

[130] The concept of equality of opportunity originated in historical sequence from the achievement of individual liberty to independence by new States and logically progressed to liberal egalitarianism being applied to the emergent world society; for details see in general, Kubalkova V. & Cruickshank A. A., ***International Inequality*** (N. Y.: St. Martin's Press, 1981).

ensures wide participation in international air commerce as States seize the opportunity to develop air services which complement their national aspirations and their commercial needs.[131]

The only means of limiting this sovereignty is to enter into international agreements. However, international agreements on matters interfering with, or curtailing, the sovereignty of States are invariably only ratified if enough loopholes are built in to enable the signatories to act as they will.[132] Furthermore, States give up their sovereignty only when it is in their interest; the combination of self-interest, technological progress, and geopolitical factors may deteriorate State autonomy.

The State sovereignty concept has done nothing to create a self-sufficient State. Furthermore, over the years it has been necessary for States to engage in trading goods and services as defined by the General Agreement on Tariffs and Trade (GATT).[133] Consequently, there are growing inter-State relationships. It is one Commentator's[134] view that:

> "*...international civil aviation could have been better developed if it had not been squelched by an overemphasis on the place of the concept of State sovereignty over airspace... .*"

Nevertheless, as previously stated, the current efficiency, necessity and cooperation principles weaken the absolute sovereignty rights of States; one can remark that the absolute sovereignty concept is likely to vanish in the modern era of globalization and telecommunication which governs the aeronautical industry. Accordingly, more

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[131] Bickley R., "World Air Transport Development - 40 Years of Continuous Growth" [November, 1984] *ICAO Bulletin* 16 at 16*ff*.

[132] Vermeulen H. M., "ICAO and the KAL-007 Tragedy"(June 1986)2 *IFALPA Quarterly Review* 4 at 6.

[133] See in general, Jackson J. H., *The World Trading System: Law and Policy of International Economic Relations* (England: The Massachusetts Institute of Technology, 1989); Jackson J. H., *Restructuring the GATT System* (N.Y.: The Royal Institute of International Affairs, 1990); "GATT What it is, What it Does" (GATT Centre William Rappard, Geneva, 1992).

[134] Henaku, *supra*, note 126, at x.

suitably practical approaches based on equity and economic objectives are emerging, and gradually resulting in an interdependence for common interests in international relations.

This writer believes this will cause commercial space activities to develop, and consequently this will promote the introduction of space-based resources to the aviation industry, and facilitate the implementation of the new CNS/ATM systems. As stressed by N. Matte:[135]

> *"sovereignty must meet the challenge brought about by the Open Skies initiative which is a reflection of a new era of international relations. Indeed, States are now willing to cooperate in order to establish a stable international order."*

In one commentator's[136] words: *"[i]f mankind is to change the present course of history, airspace sovereignty has to be given a different form and shape."* This view's also supported by Shawcross and Beaumont's view that even in the absence of any treaty provision, a State may enjoy rights or privileges in the airspace of another State.[137] The current global cooperation and sharing of benefits and resources of outer space would be a continuation of cooperation in airspace. With the approach of the twenty-first century, the collapse of the USSR, and the appearance of many new nations, there is a need for more cooperation and understanding between nations.[138] Consequently, the concept of airspace sovereignty is viewed as a matter of variance of national existence in a united universal system. This permits us to see the sovereignty concept as an

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[135] Matte N. M., "The Open Skies Initiative: Sovereignty and Legal Implications" in Matte N. M., ***Arms Control and Disarmament in Outer Space: Towards a New Order of Survival**, vol.* IV, *ed.* (Montreal: CRASL McGill University, 1991)123 at 169*ff.*

[136] Bhatt S., "Contribution of Aerospace Law to the Evolution of Man and Global Society" (1980)V *AASL* 309 at 316*ff.*

[137] Martin P. *et al., eds., vol. 1, 3ed ed.,* ***Shawcross & Beaumont on Air Law*** (London: Butterworths, 1966) at 190.

[138] See for details, Al-Ghamdi S. A., ***Towards Globalization in the 21st Century: Trend Analysis for Civil Aviation*** (Master of Arts Thesis, Concordia University, 1993) at 75*ff.*

appropriate and basic element rather than just a principle of restrictive State control.[139] This writer believes that could have a profound impact on facilitating the implementation of the new CNS/ATM systems.

5. Arbitration and Adjudication Provisions

Considering the interrelations and similarities between air and space law, those methods for mandatory settlement of conflicts found in international air law are of particular interest and relevance for feasible subsequent space law development.

In the view of K.-H. Bocktiegel,[140] the Chicago Convention and the two companion agreements,[141] establish a relatively complex dispute settlement system. In addition, a host of international aeronautical agreements, both multilateral and bilateral, confer arbitral jurisdiction on the ICAO Council or some other body established by the organization.

Any member State may apply to the ICAO Council,[142] and its decision is based on procedures which are approved by the Council[143] and in the above mentioned Conventions.[144] Any State party to the dispute may appeal the Council decision either to an *ad hoc*, arbitral tribunal or to the ICJ. If the ICJ Statute is not accepted by one of

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[139] Bhatt, *supra*, note 136, at 316*ff*.

[140] Bockstiegel K.-H., "Arbitration and Adjudication Regarding Activities in Outer Space" (1978) 6:1 *J. Space L.* 3 at 9.

[141] *Chicago Convention*, *supra*, General Introduction, note 5, Articles 84-88; the International Air Transport Agreement, *US Dept. of State Publication 2282*. Signed at Chicago, on December 7, 1944, Article IV, section 3 [hereinafter Transport Agreement]; the International Air Services Transit Agreement, *ICAO Doc.* 7500. Signed at Chicago, on December 7, 1944, Article II, section 2 [hereinafter Transit Agreement].

[142] Chicago Convention, *id.*, Article 84; for more details see, Buergenthal T., *Law-Making in the International Civil Aviation Organization* (N.Y.: Syracuse University Press, 1969) at 123*ff*.

[143] Rules for the Settlement of Differences, Second *ed.*, 1975; reprinted in 1986, *ICAO Doc. 7782/2*.

[144] *Supra*, note 141, Chicago Convention, Articles 84-88; the Transport Agreement, Article IV, section 3 and the Transit Agreement, Article II, section 2.

the party, the appeal will automatically be decided by arbitration. Furthermore, if the parties in dispute agree, the arbitral tribunal will be decided by a three member arbitral tribunal to which the Council President shall name an umpire if the arbitrators cannot agree on an umpire.[145] The decisions on the appeal either by the ICJ or by the arbitral tribunal are final and binding for the parties.[146] It is a prevailing view that the ICAO:

> *"[d]ispute-settling machinery established by the Convention and the Transit and Transport Agreements is by no means a model of legal draftsmanship. It leaves too many important questions unresolved, and these uncertainties may well have discouraged some States form resorting to it, lest they find themselves embroiled in lengthy litigation costlier that the object of the dispute."*[147]

As noted by the first President of the ICAO Council, Dr. Edward Warner:

> *"[n]o international agency composed of representatives of States could be expected to bring judicial detachment to the consideration of particular cases in which large national interests were involved... The Council as a whole can hardly be expected to function judicially."*[148]

In practice, the ICAO system of dispute settlement has not proven itself to be efficient; only three cases have been submitted to the Council for formal resolution between 1947 to 1971 and more thereafter; the first involved a dispute between India and Pakistan in 1952, where India complained that Pakistan was in breach of the Chicago Convention by not permitting Indian aircraft to overfly Pakistani airspace on their way to Afghanistan; the second was a complaint filed by the UK against Spain in 1969, alleging the violation by Spain of the Chicago Convention by the establishment of a prohibited zone adjacent to Gibraltar; and the third case was a complaint by Pakistan

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[145] Chicago Convention, *ibid.*, Article 85.

[146] *Ibid.*, Article 86.

[147] Buergenthal, *supra*, note 142, at 124.

[148] As cited in Milde, *supra*, Chapter III, note 79, at 93.

against India in 1971, concerning a hijacking of Indian aircraft which landed in Pakistan.[149] In the first case the complaint was amicably resolved by the parties, the second was deferred by the parties, and the third case was withdrown after the formation of the State of Bangladesh in 1972. Hence in none of them did the Council reach a decision on the substance. As explained earlier in Chapter III that the dispute settlement method adopted by the Chicago Convention lacks the judicial detachment, independence and expertise necessary to adjudicate a dispute with the required impartiality, also it is doubtful that Chapter XVIII of the Chicago Convention could be meaningful in the context of CNS/ATM systems.

It is sufficient to note that most bilateral and multilateral agreements on air services provide compulsory arbitration.[150] That mechanism of compulsory arbitration is in this writer's opinion needed to facilitate the implementations of the new CNS/ATM systems. History has proven that States are quite unwilling to resort to arbitral or judicial dispute resolution and prefer to rely on unilateral remedies if consultations are ineffectual[151].

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[149] See for more details, Milde M., "Dispute Settlement in the Framework of the International Civil Aviation Organization (ICAO)" in ***Studies in Air and Space Law*** (Koln: Carl Heymanns, 1979) at 91; Dempsey P. S., ***Law and Foreign Policy in International Aviation*** (N. Y.: Transnational Publishers *Inc.*, Dobbs Ferry , 1987) at 302.

[150] See those agreements not making arbitration compulsory such as between Federal Republic of Germany and Mexico, ***BGBL***. 1969 II, 194; Ghana and Rumania, 567 ***U.N.T.S.*** 443; Guinea and Sweden 465 ***U.N.T.S.*** 235.

[151] Zoller E., ***Peacetime Unilateral Remedies: An Analysis of Countermeasures*** (New York: Transnational Publishers, 1984) at 4. In air transport matters States undoubtedly attempt to settle their conflicts through consultation before they choose any unilateral measures of require enforcement. States may decide to enter a special agreement *(compromise)* after a dispute arises in order to establish an *ad hoc* tribunal; they normally do so on their own free will; see further details, Bradley M., "International Air Cargo Services: The Haly-USA Air Transport Agreement Arbitration"(1966)12 ***McGill L. J.*** 312 at 3122*ff*.

6. Special Limitation on Flight of State Aircraft

The Chicago Convention never completely defined the term "aircraft", except in Article 3 which classifies aircraft into State and civil aircraft. State aircraft are for example military, customs and police aircraft. The general nature of the wording of Article 3(b) gives rise to a number of problems of interpretation. As there is no conformity of opinion concerning this, different interpretations arise which are based on each country's personal interest. That resulting uncertainty concerning the applicability of the Chicago Convention and its Annexes, as well as a number of post-Chicago international air law instruments.[152]

During the eighth meeting of its 140*th* Session on 23 of November 1993, the ICAO Council consider the Secretariat study on the subject. The Secretariat submitted that a proper interpretation of Article 3(b) would show that no aircraft used in military, customs or police service should be considered to be civilian under the Convention. Conversely, all aircraft used on other than the specified government services should be so regarded. It is also suggested that the Council should adopt an interpretation of Article 3(b) for the guidance of contracting States, and that consideration be given to amending the ICAO Model Flight Plans Form, the Procedures for Air Navigation Services-Rules of the Air and Air Traffic Services (**PANS-RAC**) and certain Annexes.[153] Although, the Chicago Convention is not applicable to State aircraft as stated in Article 3(a), the States are obliged, when issuing regulations for their State aircraft, to take into consideration the safety of navigation for civil aircraft, Article 3(d). State aircraft also need prior authorization to fly over or onto land in a territory of another contracting State, as in Article 3(c), and the use of its CNS facilities will have be an explicit or implicit part of it. Therefore, it is the duty of the Parties to the Chicago Convention to regulate their State aircraft in such a manner that they regard the safety of navigation of

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[152] As example, the Convention on the International Recognition of Rights in Aircraft, adopted at Geneva on June 19, 1948, *ICAO Doc.* 7620; Tokyo Convention, *supra*, note 112; The Hague Convention, *supra*, note 113.

[153] *ICAO LC/29-WP/2-1, Attachment 1.*

civil aircraft. Contracting States are under no obligation to notify ICAO of the differences under Article 38 of the Chicago Convention when State aircraft are not complying with international standards established by ICAO. State aircraft in oceanic or polar regions outside of any State's sovereign airspace will use the CNS facilities as well, at least in order to protect civil aviation from the risk of collision. Any liability or rights that arise from the operation of State aircraft will be subject to the applicable national law and to general international law since the State of nationality is responsible for its State aircraft.

In this writer's view, State aircraft issue should not cause any substantial legal problems for the legal framework of the CNS/ATM systems, although the enforcement of such State responsibility may require the development of specific procedures. However, in the case of drafting an international agreement regarding ATC and CNS/ATM service providers' liability, it should solve problems arising from aerial collisions. Also, it might be practical to extend the scope of such agreement to all aircraft and specifically to military, governmental aircraft, *etc.* since in some countries ATC agencies may provide services and information to State and civil aircraft.

7. Freedom of Flight and the 1982 UN Law of the Sea Convention

The sea covers over seventy percent of the Earth's surface; the law of the sea is one of the earliest divisions of international law. Customary law has long been and will remain a principal foundation of the law of the sea. The first practical steps in the codification of modern law of the sea were achieved by the First UN Conference on the Law of the Sea, gathered at Geneva in 1958. It adopted four international conventions dealing with the territorial sea, continental shelf, the high seas and the fishing and conservation of living resources.[154]

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[154] Convention on the Territorial Sea and the contiguous Zone, *U.N.T.S., vol. 516*, at 205. Intered into force on September 10, 1964 [hereinafter Territorial Sea Convention]; Convention on the Continental Shelf, *U.N.T.S., vol. 499*, at 311. Intered into force on June 10, 1964 [hereinafter Continental Shelf Convention]; Convention of the High Seas, *U.N.T.S., vol. 450*, at 11. Intered into force on September 30, 1962 [hereinafter High Seas Convention]; Convention on (continued...)

On April 30, 1982 the Third UN Conference on the Law of the Sea adopted the current UN Convention on the Law of the Sea.[155] There are particular provisions in the Law of the Sea Convention that relate to the principle of airspace superjacent to various jurisdictional areas and zones of the sea. The Law of the Sea Convention affirmed in its Preamble, *inter alia*, "*matters not regulated by this Convention continue to be governed by the rules and principles of general international law.*" Therefore, the general international air law continues its applicability. Additionally, the Preamble recognizes the desirability of establishing a legal order for the seas and oceans which will promote global communication. This provision is also relevant in the interpretation of rules regarding navigation, transit, overflight, *etc.* Generally speaking the *airspace* above territorial waters, zones, and the State's security and preservation zones have been completely settled by the Law of the Sea Convention.[156] Consequently, the developments of the international law of the sea are of great importance both for the application and interpretation of international instruments relating to air law in general, as noted in the 25*th* Session of the ICAO Legal Committee of 1983,[157] and to CNS/ATM systems implications specifically. It should be clear that the Chicago Convention does not deal with the freedom of the sea. Article 12 only stipulates the binding force of the Rules of the Air over the high seas.[158]

Therefore, for the purpose of this thesis, in the following some comments on the "*straits used for international navigation, archipelagic States and the Exclusive Economic*

(...continued)
Fishing and Conservation of the Living Resources of the High Seas, *U.N.T.S., vol. 559*, at 285. Intered into force on March 30, 1966 [hereinafter **Fishing and Living Resources Convention**].

155 The United Nations Convention on the Law of the Sea, *UN Doc. A/CONF. 62/122*. Opened for signature on December 10, 1982; Comes into force on November 16, 1994 [hereinafter **Law of the Sea Convention**].

156 For details see, Milde M., "United Nations Convention on the Law of the Sea - Possible Implications for International Air Law"(1983)VIII *AASL* at 167.

157 *ICAO Doc. 9397-LC/185*, at 4-8 Paragraph 4: 9.13

158 See, Annex 2, *supra*, General Introduction, note 4.

Zone (EEZ)" are given only with regard to their impact on international air law, in particular the freedom of flight.

(a) Archipelagic States

The archipelagic State means a State constituted entirely of one or more archipelagos and may include other islands.[159] The sovereignty of an archipelagic State is increased by the Law of the Sea Convention to the waters surrounded by the archipelagic baselines; this sovereignty extends to the airspace over the archipelagic waters, as well as to their bed, subsoil and resources.[160] The Law of the Sea Convention, in its Article 53, grants ships and aircraft of all States the right of passage through sea lanes and the airspace over them, designated by the archipelagic State; and also the right to pass through or over its archipelagic waters and the territorial sea adjacent thereto. The sovereignty of the archipelagic State over its archipelagic waters is restricted only by the *right of archipelagic sea lanes passage* enjoyed by ships and aircraft in the designated sea lanes and air routes.

(b) The Exclusive Economic Zone

The EEZ is an area of the sea which was given by the Law of the Sea Convention a specific legal regime.[161] Article 56 states the rights, jurisdiction and duties of the coastal State in the EEZ. In its paragraph (a), the coastal States are entitled to:

> "*sovereign rights for the purpose of exploring and exploiting, conserving and managing the natural resources, whether living or non-living, of the waters superjacent to the sea-bad and of the sea-bed and its subsoil, and with regard to other activities for the economic exploitation and exploration of the zone, such as the production of energy from the water, currents and winds.*"

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159 Law of the Sea Convention, *supra*, note 155, Article 46

160 *Ibid.*, Article 49.

161 *Ibid.*, Article 55.

This Article clearly specifies the costal State's rights in the EEZ but does not extend it to the airspace above the EEZ. Furthermore, Article 58.1 specifically refers to the airspace by stating: "..., *all States, ..., enjoy, subject to the relevant provisions of this Convention, the freedoms referred to in article 87 of navigation and overflight... .*" In examining Article 87.1, it specifies the freedom of overflight as one of the freedoms which all States can exercise over the high seas. This gives no doubt that the right of overflight over the EEZ has the same characteristics as high seas rights. This view is also supported by the Rapporteur to the 29*th* Session of the ICAO Legal Committee.[162]

On the other hand, the Convention has avoided a clear statement or whether the EEZ is still part of the high seas or not.[163] The problems of interpretation may arise not only with respect to the Chicago Convention, which refers in its Article 12 to *high seas* and its Annexes, but also with respect to other air law instruments[164] in which *high seas* are mentioned.

At the 26*th* Session of the ICAO Legal Committee in 1987, IATA expressed the view that it is desirable for ICAO member States to reach a consensus. They advise that the ICAO accept an interpretative determination that for the purpose of the Chicago Convention, its Annexes and other international air law instruments, the EEZ is deemed to have the same legal status as the high seas. At the same Session, IFALPA went even further and proposed amendment to the Chicago Convention by inserting "*and the Exclusive Economic Zone*" after the words *over the high seas* in the third sentence of Article 12 of the Chicago Convention.[165] This writer supports the view that it is desirable to clarify the matter and reach a consensus within the framework of ICAO by an interpretation in order to understand the possible implication of this profound

[162] ***ICAO, LC/29-WP/8-3, at 9.***

[163] Milde, ***supra***, note 154, at 192.

[164] Such as, the *Convention on Damage Caused by Foreign Aircraft to Third Parties on the Surface*; ***ICAO Doc. 7364***. Signed at Rome, on October 7, 1952 **[hereinafter Rome Convention]** Article 23(2); Tokyo Convention, ***supra***, note 112, Article 1, paragraph 2.

[165] ***ICAO LC/26-WP/5-40, at 2.***

development of international law of the sea for the instruments of international air law. Such interpretation along these lines could be as an amendment to the Annex 2 to the Chicago Convention. Also, this could result in stability of the EEZ legal regime with regard to air law on one hand, and will promote the CNS/ATM systems on the other.

(c) Straits Used for International Navigation

The international straits are areas of conflicting interest between States. They secure States' freedom of navigation and overflight through and over the straits without interference from coastal States bordering the straits; and the bordering States have an interest in securing their territorial waters and their security in these often strategically significant geographic locations. The Law of the Sea Convention for the first time sets out a new international legal regime for straits used for international navigation.[166] The extension of the territorial waters up to twelve nautical miles would close over a hundred international straits which are narrower than 24 nautical miles. Therefore, the importance of international navigation and aviation necessitates a special regime for the right of transit in such areas.

Ships and aircraft of all States are allowed unimpeded "transit passage".[167] That transit passage which means *freedom of overflight* for aircraft represent a new regime. The duties of ship's and aircraft's during transit passage are pointed out in Article 39 of the Law of the Sea Convention. It is duty of States bordering on straits not to hamper transit passage, and they have no right to suspend a passage.[168] States bordering Straits have the right to regulate navigation and other aspects of passage for, *inter alia*, reduction and control of pollution, with respect to fishing vessels and loading or unloading of any commodity, currency, person *etc.*[169]

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[166] Law of the Sea Convention, *supra*, note 155, Articles 34 to 45.

[167] *Ibid.*, Articles 37, 38.

[168] *Ibid.*, Article 44.

[169] *Ibid.*, Article 42.

B. The Impact of the Prevailing International Air Law on the New CNS/ATM Systems

The rules of international air law governing aircraft navigation as illustrated above are principles for ensuring the development of international civil aviation system. The use of space technology for the benefit of civil aviation requires changes in present international air law that would remove restrictions in the introduction of modern technology. Also, this would make it feasible to improve the safety of international air transport. Any function or obligation of a State to guarantee the continuity of the provision of the CNS/ATM systems and services beyond its territory, and to insure its non-discriminatory accessibility, can be made certain through a definite commitment of the State under unilateral obligation or bilateral or multilateral agreements.

The current mechanism of dispute settlement in the Chicago Convention is not adequate. In order to provide integrity to the CNS/ATM systems it is important that adequate machinery exists for the settlement of disputes. The disputes most likely to arise are, *inter alia*, disputes between service providers and users. In this writer's view, any CNS/ATM systems *Service Agreement* should contain a *safeguard clause* which describes mandatory means of dispute resolution at the disposal of the contracting parties regarding the interpretation and application of the agreement.

The present ATC legal regime is not sufficient enough to promote the CNS/ATM systems' implementation. This require taking into account various elements, *inter alia*, the relationship between the parties and implementation, and the type of service providers which fall into three categories: national authority, private entities and international or regional organizations.

Section III: Outer Space Law

A. Overview

The use of satellites for telecommunication, navigation and surveillance purposes is global in nature, and implies use of outer space and radio frequencies. Accordingly, the scope of these activities will require regulation by international law and outer space law.[170] This fact has important consequences since it applies even in cases where satellites are launched and/or operated by private entities.

Outer space law is driven by technological advancement. Increased commercial space activities encourage the development of law and require the assurance of public order to regulate potentially conflicting interests. Regulation of activity in space, mainly activity that consists of commerce, transit, and habitation, calls for a flexible set of standard terms and conditions.[171] As K.-H. Bockstiegel[172] pointed out, the global community gave its consensus[173] to space treaties, *inter alia*, the Liability Convention and OST, merely because they had little interest in outer space at that time. Currently, States are more interested in the economical and political concerns involved in the space activities and space law. Because of the varied interests of States, it is becoming more difficult to agree on specific aspects of space law. Furthermore, with the more States interested in space commercial activities, *inter alia*, mobile communication and remote sensing, conflicts are expected to increase and therefore solutions must be found. It is

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[170] Van Der Heyden M., Tuinder P. & De Vries W., "A Typical Transponder Lease; Peremptory Rights; Liability of Satellite Operators for Breakdowns" (Revised version of paper addressed to the 8*th*. Conference of Section on Business Law's Committee on Outer Space of the *IBA*, London 14/18 September 1987).

[171] Almond Jr. H. H., "Progress in the Law of Outer Space: Standardized Terms and Conditions" in Matte, *supra*, note 135, 1 at 3*ff*.

[172] Bockstiegel, *supra*, note 140, 3 at 3*ff*.

[173] He also sees that in the early days of the space activities States seemed not so much attentive of the military, economic, and political interests in the space activities. Or else, OST at least would not have been so significant in accomplishing its broad range of applicability or in being ratified by all principal space nations, Bockstiegel K.-H., "Commercial Space Activities: Their Growing Influence on Space Law"(1987)XII *AASL* 175 at 179.

further stated: "... *disputes on various aspects of space law can no longer be left open allowing each State to persist in its own view and act accordingly.*"[174]

This means that current and future space activities are in need of new agreements which could have a significant impact and influence on the new CNS/ATM systems' functions. In the following part we will briefly deal with some selected legal aspects of outer space law which have significant impact and influence on the new CNS/ATM systems.

B. Selected Principles

1. Outer Space Freedom

(a) Freedom of Use and Exploration

The freedom of use and exploration of outer space is comparable to long-established right of freedom of the high seas, an area which, like outer space, is not subject to claims of sovereignty. The first years of the space age were an era of exploration that was ruled by the two space powers. However, as space technology develops, commercialization causes outer space exploitation to be more common. Unless the interests and direct participation of the international community changes, there will be a demand for more specific rules to regulate space activities.[175] The principle of the freedom of exploration and use of outer space and celestial bodies is universally recognized.[176]

The exploration and use of outer space should be free of discrimination of any kind, and not subject to national appropriation,[177] in accordance with the Charter of the

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[174] Bockstiegel, *supra*, note 140, at 4.

[175] Jericho E. & McCracken D., "Space Law: Is it the Last Legal Frontier?"(1986)51 *J. Air L. & Comm.* 800 at 800.

[176] The outer space is basically free as confirmed in the OST Article I, paragraph 2; in its Article II it defines outer space as *res communis*, a place owned by no one and for the exploration and use of all.

[177] *OST, supra*, note 5, Article II.

UN[178] and international law.[179] The Moon Agreement of 1979,[180] in Article 4, lays down that the exploration and use of the moon shall be the province of all mankind, and shall be carried out for the benefit and interest of all countries irrespective of their degree of scientific or economic development. That freedom applies to all activities including, *inter alia*, satellite telecommunication. However, the OST contains certain limiting clauses with respect to the freedom of outer space, such as the non-appropriation,[181] the non-discrimination clause, and the equality clause,[182] the common benefit and interest clause,[183] and the responsibility and liability clause.[184] Furthermore, according to its Article IX, States Parties shall be guided by the principle of cooperation and mutual aid and shall carry out all their activities in outer space (concerning the exploration and use of outer space) with due respect to the corresponding concerns of other nations. Also, the ITU Constitution, in its Article 34(1), indicates limitations on the freedom of outer space use, as stated:

> *"[a]ll stations, whatever their purpose, must be established and operated in such a manner as not to cause harmful interference to the radio services or communications of other Members or of recognized private operating agencies, or of other duly authorized operating agencies which carry on radio service, and which operate in accordance with the provisions of the Radio Regulations."*

There has been no consensus in the UN Outer Space Committee on a clear distinction between the domain of space subject to free use, and the domain of air subject

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178 *Ibid.*, Article III.

179 *Ibid.*, Article I paragraph 2; Article III.

180 Agreement Governing the Activities of States on the Moon and Other Celestial Bodies; *UN GAOR, A/Res./34/68* (December 5, 1979). Opened for signature on December 18, 1979; entered into force on July 11, 1984 [hereinafter The Moon Agreement].

181 *OST*, *supra*, note 5, Article II.

182 *Ibid.*, Article I, paragraph 2.

183 *Ibid.*, Article 1, paragraph 1.

184 *Ibid.*, Articles VI and VII.

to national autonomy.[185] While a clear distinction will require a boundary between air and space, the issue has been discussed for many years without result. The solution to the problem of the boundary remains elusive, in reality this writer does not see any need for such distinction between air and space.

(b) The Impact on the New CNS/ATM Systems

The issue of freedom of use with respect to the new CNS/ATM systems is no different from the freedom principle i general. While there is a broad right of use, CNS/ATM service providers must bear in mind the considerations enunciated in OST Article 1, paragraph 1, which state:

> *"[t]he exploration and use of outer space, ..., shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind."*

These are the limitations placed on the absolute freedom of use, and must be kept in mind when considering the regulation of the new CNS/ATM systems.

2. The "Common Heritage" Principle

(a) Overview

Common benefit is a politico-legal concept. Also it is a philosophical statement of exploitation policy, which has great flexibility in actual human progress. This concept is expressed in many ways, particularly in Article 1, paragraph 1 of the OST which requires as a legally binding stipulation that the exploration and use of outer space shall be carried out for the benefit and in the interest of all countries. At an earlier stage, these principles were formulated in the Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space, 1963(4). The terms of Part D of *Resolution* 1721, of 1961(5) refers to the UN Assembly's beliefs that communication by means of satellite should be available to all countries of the world as

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[185] See, *e. g.*, Jasentuliyana N., "Keynote Address: Space Commerce on a Global Scale"(Winter 1990)5:1 ***Journal L. & Technology*** 1 at 2.

soon as practicable, and that this be on a global and non-discriminatory basis.[186] The *common heritage* notion stresses legitimacy and fairness, but its opponents assert that this would come at the cost of efficiency. Most concerns about the concept of common heritage require only that the sharing of resources be *equitable*, and that there is permission for access to common spaces.[187] Additionally, it was emphasized that any natural resources not under the control of any State are governed by the following:

> "[i.] *such areas are not subject to appropriation by states*; [ii.] *all states must share in the management of them*; [iii.] *there must be an active sharing of the benefits reaped from the exploitation of their resources*; *and* [iv.] *the areas must be dedicated exclusively to peaceful purposes*."[188]

It should be kept in mind that the *common heritage* concept gained immediate attention and recognition because of the increasing influence of the LDCs on the international front. As a result of treaties, the concept became connected with many geographical zones not only the outer space but also in the high seas, and Antarctica.[189]

(b) The Impact on the New CNS/ATM Systems

As the commercial utilization of space increases, it is expected that the common heritage concept will gain greater definition. Satellites, as a part of the space segment, will be a component of air navigation safety hardware. Consequently, once a user possesses the required on-board equipment, permitting him to utilize the CNS/ATM systems, the access to the space segment should not be precluded. The new CNS/ATM service providers must be dedicated to non-discriminatory service. It is interesting to note

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[186] Lyall F., "Space Telecommunications Organisations and the Developing Countries"(1989)32 ***Collo. L. Outer Space*** 242 at 242.

[187] Blaser A. W., "The Common Heritage in Its Infinite Variety: Space Law and the Moon in the 1990's"(Winter 1990)5:1 ***Journal L. & Technology*** 79 at 82.

[188] Larschan B. & Brennan B. C., "The Common Heritage of Mankind Principle in International Law"(1982/83)21 ***Columbia J. Transnational L.*** at 305.

[189] Fleming D. J. *et al.*, "State Sovereignty and the Effective Management of a Shared Universal Resource: Observation Drawn From Examining Developments in the International Regulation of Radiocommunication"(1985)X ***AASL*** 327 at 330*ff*.

that one of the fundamental principles underlying the ICAO philosophy which was developed by the FANS Committee is: "[u]*niversal accessibility to air navigation safety services must be available without discrimination.*"[190] Also, the statement of ICAO policy on CNS/ATM systems implementation and operation which approved by the Council on March 9, 1994 adopted the *universal accessibility* as the first principle.[191] In regulating the new CNS/ATM systems, the *common heritage* principle must be respected as an important foundation for outer space utilization.

3. Liability Principle for Commercial Space Activities

In international relationships as in other social relations, the infringement upon the legal interest of one subject of the law by another legal party generates responsibility in many forms determined by the particular legal system. Commonly, international responsibility is considered in relation to States as subjects of the law. As the commercialization of space increases, private entities will play a meaningful role in many domains, *inter alia*, space launch, telecommunications, and space transportation.

One can question whether organizations, private entities and individuals have the ability to bear responsibility for the risk that space activities represent for possible damage or injuries that could result from these activities, and for making claims on an international plane. Also, should States have to be responsible for a private entity's or a citizen's activities in space?

In order to answer the above questions, the following, which is a basic mechanism of liability concept for States, private persons/enterprises, and international organizations is discussed, followed by its impact on the new CNS/ATM systems.

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[190] *ICAO Doc.* 9623, FANS(II)/4, Appendix A to the Report on Agenda Item 8, at 8A-24.

[191] *ICAO Cir. 249-AN/149*, Appendix 1, at 33.

(a) The Basic Features of the Liability Concept

(i) The States' Liabilities

State responsibility and liability is not based upon delict in the meaning of municipal law, and international responsibility relates both to breaches of treaty and to other breaches of a judicial responsibility.[192] State responsibility can only be invoked if the act or omission can be attributed to a State. There is growing interest in commercial space activities, and a concern with State responsibility and liability for private enterprises relating to current space technology. It is Prof. Cheng's view that national activities should include all activities within the jurisdiction of a State, including its territorial jurisdiction, quasi-territorial jurisdiction and personal jurisdiction.[193] The OST already provides in its Article VI that:

> "*States... shall bear international responsibility for national activities in outer space, ..., whether such activities are carried on by governmental agencies or by non-governmental entities. ...*"

This mandates international responsibility for national activities in outer space and assures that States cannot avoid international responsibility for national activities in space merely because they are conducted by their non-governmental entities. Article VII also refers to the liability of States for damage towards other States' nationals and property. The consequences of this principle are also specified in this Article, which provides that a State which launches, or procures the launch, of an object into outer space and a State from whose territory or facility an object is launched, is globally liable for damage caused to any third-party by such object or its component parts. From the foregoing it is obvious that the OST was quite general in its provisions concerning the international liability of States.

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[192] Brownlie I., **Principles of Public International Law**, 4*ed*. (USA: Oxford University Press, 1990) at 434.

[193] Cheng B., "International Responsibility and Liability for National Activities in Outer Space, Especially by Non-Governmental Entities" in honour of Wang Tieya, Chapter 10 (The Netherlands: Martinus Nijhoff, 1993) 156 at 156*ff.*

In furtherance of this principle, the Liability Convention gives details of liability. Article II provides detailed rules for determining and enforcing the launching State's liability. *Strict liability* applies when damage is caused by a space object on the surface of the earth or to aircraft in flight, whether directly or indirectly, except where such damage has resulted due to the gross negligence or some act or omission done with intent to cause damage either on the part of the victim or on the part of claimant State to which he belongs. In Article III, when damage occurs in a place other than on the surface of the earth, *fault liability* of the launching State applies. The Convention recognises the principle of joint and several liability and in its Article V(1), which says that if States launch jointly a space object, they are liable for any damage it causes. The launching State as defined in Article 1(c) includes the State from whose territory or facility a space object is launched, without regard to whether it is launched by or for a private venture. Accordingly, this writer shares the view of K.-H. Bockstiegel,[194] that launching States shall be liable for space activities carried out by their agencies or non-government entities. Since national law remains outside the scope of this thesis, it is adequate to point out that Article XI(2) makes it clear that the damaged State, and its natural or juridical persons, are not prevented from pursuing a claim before the national courts or tribunals, on the basis of national law of the launching State.

The Moon Treaty in Article 14 reaffirms the principles contained in the OST and Liability Convention on the subject of the international responsibility of States for activities of their nationals on the moon. Overall, that principle has been unanimously approved by the UNGA *Resolution 1962.*[195] However, State responsibility for space activities of non-governmental enterprises are exempted from the general principle that States are not responsible for the conduct of private individuals.[196]

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[194] Bockstiegel, ***supra***, note 173, at 183.

[195] See UNGA *Res.* 1962, 18 UNGAOR *Supp.* 15, at 15, ***UN Doc.*** A/5515, 1963.

[196] Bittlinger H., "Private Space Activities: Question of International Responsibility"(1987)30 ***Collo. L. Outer Space*** 191 at 191.

(ii) The Liability of Private Persons/Enterprises

The individual has no common responsibility for violations of obligations imposed by the customary law of nations because most of these obligations can only rest on States and governments. Consequently, they cannot initiate international claims.[197] Customary international law still maintains that it is only the State which has the capacity to present international claims. The activity of a person or private/public enterprise is deemed to be within a State's jurisdiction if the State exercises that jurisdiction prescribing laws respecting that activity.[198]

Private enterprise that proposes a satellite venture should be aware that it may be held internationally liable for damage or injury caused by space objects to third-parties. This would be in a case where the satellite causes damage to foreign persons or property on the earth or to another space object in space, as stipulated in Article VII of the OST, and elaborated by the provisions of the Liability Convention.[199] In this case, the private entity may be asked to indemnify the State. This was embodied in the UNGA *Resolution*, 1962 (XVIII),[200] principles 5 and 8, although it has no legal binding force on the UN member States. The provision in Article VI of the OST makes no distinction between activities carried out by the States and those of private entities.[201] In other words, it

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197 Brownlie, *supra*, note 192, at 581.

198 See, *e. g.*, Gover K. M., "International Responsibility for Endangering the Space Commons: Focus on a Hypothetical Case"(1990)33 *Collo. L. Outer Space* 297 at 299.

199 Article II of the Liability Convention imposes absolute liability on a country whose space object, *e. g.*, satellite, causes damage in the territory of a foreign country to a foreign aircraft in foreign airspace. Article III imposes liability based on fault on a country whose space object causes damage to a space object of a foreign country or foreign private entity in space. Pursuant to Article VI of the OST, the liability extends equally to private space activities authorized by a country party to the treaty.

200 Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space (December 13, 1963), UNGA *Res.* 1962 (XVIII).

201 Matte, *supra*, Chapter II, note I, at 148.

seems to recognize the legitimacy of outer space activities carried out by private entities.[202] Accordingly, States are responsible for activities carried out by any of their private citizens or enterprises in outer space even if these States do not exercise any control over such activities.

In States which permit private enterprises to engage in space activities, mainly launches, a system has been established to either set a definite degree of liability on the enterprise, as is the case in the USA,[203] or to grant the State the right to require back payment from the enterprise for all or a share of the damages it has to pay victims. To diminish possible damage, the States have to make sure that the enterprises adjust to the space law principles that they themselves are committed to obey.[204] Furthermore, the private entities may consider it prudent to obtain third-party liability insurance and/or seek an arrangement with the government whereby the latter agrees to indemnify the satellite company for third-party claims. It should be noted, that an injured foreign party has the option of bringing suit directly against the private party outside the framework of the Liability Convention. The Liability Convention does not establish liability of or to individuals but of their respective national States.[205]

The concept of nationality is the main link between an individual or private enterprise and the State. It is usually the only way of assuring that an individual's rights are enforced by international law and to exercise diplomatic protection. Furthermore, it is a continuing legal relationship between the State and its citizen, as well as a two-way

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202 Haanappel P. P. C., "Creating the Appropriate Regulatory Climate for Outer Space Activities Conducted by Private Enterprise"(1988)31 ***Collo. L. Outer Space*** 286 at 287.

203 Nesgos P. D., "Recent Developments in Risk Allocation of Concern to the US Commercial Launch Industry and the Insurance Community" (Address to the "Assicurazioni Generali" Fifth International Conference on Space Insurance, Rome, March 2-3, 1989).

204 ***Infra***, at P. 224*ff*.

205 Foster W. F., "The Convention on International Liability for Damage Caused by Space Objects"[1972] ***The Canadian Yearbook of International Law*** 137 at 152.

relationship with rights and duties on both sides.[206] This leads us to ask how to determine the nationality of a multinational legal entity, and how to determine that the national State be held liable and responsible for its national legal person's outer space activities. It is a normal and important function of nationality to establish the legal interest of a State with respect to nationals and legal persons who have a sufficient connection with the State. There are some authors[207] who believe that international responsibility for national activities in outer space signify that the respective States have the task of using jurisdiction and control over space objects and any personnel thereof, under OST Article VIII. In other words, there must be some genuine link between the State and private entity, and the realistic prospect of an effective control exercised by the State.[208]

In any event, both the body of space law and the nationality of the private entity are important criteria in determining State responsibility. The launching State concept as a criterion on the issue of responsibility will cover nearly all cases of space involvement, excluding those instances in which private organizations launch space objects from locations other than from a State's territory or facility. This writer believes that two principal standards can be employed here to determine the responsible State: firstly the State of citizenship and secondly, the place of incorporation or the principal place of business of a corporation. It seems necessary that States include in their national law relevant provisions regarding the responsibility of private entities for their activities in outer space.

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[206] Williams S. A. & De Mestral A. L. C., ***An Introduction to International Law: Chiefly as Interpreted and Applied in Canada*** (Toronto: Butterworths, 1979) at 177.

[207] Gorove S., "Sovereignty and the Law of Outer Space Re-Examined"(1977)II ***AASL*** 311 at 315; see also, Menter M., "Legal Responsibility for Outer Space Activities"(1983)26 ***Collo. L. Outer Space*** 121 at 122.

[208] Stoffel, ***supra***, Chapter V, note 43, at *40ff.*

(iii) The Liability of International Organizations

The OST, in Article VI, paragraph 3, does acknowledge international organizations' responsibility for their outer space activities. The Liability Convention in Article XXII goes a long way to recognize a separate international legal existence and international legal personality that is liable for its space activity under the following conditions: first, the organization declares its acceptance of the rights and obligations provided for in this Convention, and second, a majority of the States members must be parties to the Liability Convention and the OST. The OST in Article VI, sentence 3 recognizes that the international organization as well as the State party will be held responsible jointly for their non-compliance with the Treaty's provisions. Furthermore, under Article XXII, paragraph 3 of the Liability Convention, the final responsibility in the case where an inter-governmental organization is involved, rests with the States party to the Convention, which will be jointly and severally liable. Also, in the same Article, paragraph 4, it is stated that if the organization sustains damage to any of its space objects, the claim for compensation must be presented on behalf of the organization by a State member, who is party to the Convention as well.

The Moon Treaty, in Article 14, recognizes the responsibility of international organizations which conduct space activities. The Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space,[209] in Article 6 recognizes that an international organization is responsible for its activities provided that such an organization assumes the rights and obligations of the Agreement, and that a majority of its State Members are Parties to the Agreement.

(b) The Impact on the New CNS/ATM Systems

From the brief description of the liability concept in outer space law one can anticipate that liability is applicable to the new CNS/ATM systems mainly with regard

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[209] Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Lunched into Outer Space, UNGA *Res.* 2345 (XXII) 19 December 1967. Opened for signature 22 April 1968; entered into force 3 December 1968 [hereinafter Rescue Agreement].

to damage caused by the space segment to any of its users. There are some significant facts which should be noted here. The definition of a *space object* is heavily challenged.[210] The Liability Convention provided the first legal description of space object, while avoiding any definition of it. Registration Convention[211] Article I(b), followed the Liability Convention by not giving any specific definition of the term *space object*, thereby expanding the scope of the term as used in Article VIII of the OST. To date, *space object* has not been defined; accordingly, at international law, for purposes of liability, registration, return of objects and ownership, space object contains its component parts as well as the launch vehicle and its component parts.[212] The following definition appears to be acceptable,[213] that:

> "*space object is... the term used to cover spacecraft, satellites, and, in fact anything that human beings launched or attempt to launch into space, including their component parts.*"

For the purposes of the CNS/ATM systems we must ask whether the Liability Convention provisions apply to *direct and indirect* damages or not. Article I(a) of the Liability Convention defined the term, *damage*, as:

> "*... loss of life, personal injury or other impairment of health; or loss of or damage to property of States or of persons, natural or juridical, or property of international intergovernmental organizations.*"

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[210] Perek L., "Space Debris" in Bockstiegel K.-H., *ed.*, ***Environmental Aspects of Activities in Outer Space***, *vol.* 9 (Berlin: Carl Heymanns Verlag, 1990), at 7; the OST adopted the terminology of the Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space, ***UNGA Res***. 1962(XVIII)13 December 1963.

[211] Convention on Registration of Objects Launched into Outer Space, ***1023 U.N.T.S. 15.*** Adopted by the General Assembly of the UN, at New York, on November 12, 1974 [hereinafter **Registration Convention**].

[212] See in general, Gorove S., "Toward a Clarification of the Term "Space Object" - An International Legal and Policy Imperative?"(1993)21:1 ***J. Space L.*** at 11.

[213] Cheng B., "Spacecraft, Satellites and Space Objects" in Bernhardt R., *ed.*, ***Encyclopedia of Public International Law, Law of the Sea, Air and Space***, *vol.* II (Amsterdam: North Holland, 1989) 309 at 311.

Although the definition of the term *damage* is quite broad,[214] it is unspecific as to whether it refers both to *direct and indirect* damage. This gives rise to different interpretations. Long ago, S. Gorove concluded that *consequential damages* do not fall under the Convention by having dismissed possible recovery for economic damages.[215] Some commentators stress that most countries felt that indirect damages would create difficulties in practice.[216] The Liability Convention did not provide for pecuniary damage, which is definitely omitted from its scope. This means that the pecuniary loss arising from telecommunication activities due to any transmission failure is not covered under outer space law conventions and is clearly excluded from its scope. Other damages that could arise from satellite activities due to transmission failure, incorrect, unclear, retarded or any transmission deficiency is not covered either.[217]

In some other views[218] in Article 1(a) of the Liability Convention, the "...*loss of or damage to property*..." does not mean or require particular damage to the satellite, and therefore, the term *property* includes all elements of economic value. This view is supported by another commentator[219] who emphasizes that the economic loss incurred by the destruction of property shall also be considered as recoverable under the regime established by the Liability Convention as long as the loss is directly attributable to the accident, *inter alia*, the lost revenue which was created by the object before the incident of destructions. He has gone a step further and claimed that:

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214 Williams S. M., "Environmental Risks and Space Activities"(1987)30 ***Collo. L. Outer Space*** 183 at 183.

215 Gorove S., "Some Comments on the Convention on International Liability for Damage Caused by Space Objects"(1973)16 ***Collo. L. Outer Space*** 254 at 254*ff*.

216 Diederiks-Verschoor I. H. Ph., "The Convention on International Liability for Damage Caused by Space Objects"(1973)16 ***Collo. L. Outer Space*** 100 at 100*ff*.

217 Matte, ***supra***, Chapter II, note 1, at 149; see also, Jakhu, ***supra***, Chapter II, note 221, at 80.

218 Vitt, ***supra***, note 72, at 54.

219 Christol C. Q., "International Liability for Damage Caused by Space Objects"(1980)74 ***AJIL*** 346 at 359.

"it may be anticipated that the Convention will be interpreted as covering both direct and indirect damages resulting from the malfunctioning of a space object and its component parts."[220]

In this writer's opinion, electronic interference with communication or damage caused by transmission failure could be considered as damage by distortion, or preclusion of transmission which carries valuable information that has economic value. Therefore, this writer strongly supports the latter view for its rational justification. Today, for the rationale behind this provision, the term *damage* should be interpreted in a broad sense.

W. Foster[221] emphasizes that the Liability Convention fails to detail effectual regulations and techniques governing liability, and it does not guarantee quick payment of complete and fair compensation. The convention is, however, a step forward from the OST, and marks another meaningful level in the advancement of the legal principle of space activities. Parties to the same space activity may cause damage one to another, and for this, special agreements between the parties are necessary[222] to apportion liability since they cannot invoke the Liability Convention.[223]

Under Article III of the Liability Convention, if two space objects, each owned by a different private entity, collide, and if both entities are under the same jurisdiction,

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220 As cited in, Spradling, ***supra***, Chapter II, note 157, at 98; see for the same opinion, Hurwitz B. A., ***State Liability in Outer Space Activities*** (Dordrecht: Kluwer Academic Publishers, 1992) at 15; see also, Cocca A., "From Full Compensation to Total Responsibility"(1983)26 ***Collo. L. Outer Space*** 157 at 158.

221 Foster, ***supra***, note 205, at 166.

222 An example of such arrangements is found in the *Agreement Among the Government of the USA, Governments of Member States of ESA, the Government of Japan, and the Government of Canada on Cooperation in the Detailed Design, Development, Operation, and Utilization of the Permanently Manned Civil Space Station*; ***Basic Texts of the European Space Agency, vol. II, SL (Space Lab/Colombus), D III f.*** Done on September 26, 1988 [hereinafter Civil Space Station Agreement].

223 For more details of the liability deriving from space activities, see, Bourély M., "Quelques particularités du régime de la responsabilité du fait des activités spatiales"(1990)XV ***AASL***, at 251.

compensation for any damage resulting from that collision is unavailable.[224] It should be remembered that liability is unlimited, a fact which, in view of the history of space flight and the time of the drafting of the two Conventions, seems logical. However, the consequence of the unlimited liability might be that private enterprise engaged in space activities and causing damage will be held responsible to indemnify the liable launching State to the identical unlimited extent when national regulation provides so.[225] This risk would be too heavy for private enterprise to bear. Besides, the entire system of liability based on the Liability Convention is simply recommendatory.[226] In claims filed under current international law, there are a variety of considerations that make this approach undesirable.[227] This writer strongly supports the view that: "*... some form of legislative action--either to limit the governments's exposure or, conversely, to expand it to more comprehensively cover foreign claimants--may become necessary.*"[228]

Therefore, this writer believes that there is a need to modify and expand the Liability Convention in view of the emerging responsibilities in the domains of outer space activities in general, and telecommunication specifically. This is in order to maintain activities by private, public, government (or their agencies) and intergovernmental organizations.

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[224] Kenney S. C., "The Impact of Product Liability Law on Commercial Activities in Space" in ***Space: Legal and Commercial Issues*** (London: Int'l Bar Assoc., 1986) 209 at 233.

[225] Although, in some views the change to a negligence concept for all space activities, will facilitate the insurance difficulties, see, Dunstan E. J., "Space Law and Government: A Generation Later" in Faughnan & Maryniak G., *eds.*, ***Space Manufacturing 6 Nonterrestrial Resources Biosciences, and Space Engineering*** (USA: American Institute of Aeronautics and Astronautics, October 1987) 224 at 231.

[226] *Liability Convention*, ***supra***, Chapter II, note 60, Article XIX(2).

[227] For instance, claims made under the Liability Convention must be filed by the individual's country through diplomatic channels as in Article IX; this in itself may be subject to political considerations having nothing to do with the merits of the claim itseif; also under Article XIX(2) any decision of the Claims Commission only bind the parties if they consent to be bound.

[228] Spradling, ***supra***, Chapter II, note 155, at 100.

C. Selected Outer Space Activities and Related Features

1. Private Activities Participation and Its Legality

Although States and State institutions have dominated space activities until recently, and private industry participated only indirectly in space activities as contractors and subcontractors, or as end-users, a turning point has been reached regarding private industry participation. Direct participation has acquired increasing relevance, while preserving the opportunity for indirect participation as well. In addition to the already existing space activities of private enterprises, their role in space activities in general, and in the CNS/ATM services in particular can be expected to evolve substantially, both in volume and in the relative share of space activities, compared to that of States.[229] Also, with respect to the inter-dependence of the world's nations, there has been increased global economic and industrial activity since the second World-War, with the creation of multinational companies, consortia, institutions and joint ventures. This has led to various difficulties in international law, the question of their legal personality being one of the most crucial. Conventional international law recognizes that States only have an international personality. The ICJ, however, in its advisory opinion in the reparation for injuries suffered in the service of the UN case, (1949) noted that:[230]

> *"... Throughout its history the development of international law has been influenced by the requirements of international life, and the progressive increase in the collective activities of States has already given rise to instances of action upon the international plane by certain entities which are not States."*

Furthermore, in the Court's opinion, although its Charter is silent on this question, the UN: *"...is an international person ...*[and] *it is a subject of international law and capable of possessing international rights and duties."*[231] On the same basis, other public international organizations may be deemed capable of having an international

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[229] Bockstiegel K.-H., "Space Law Past and Future: The Challenges of the XXIst Century" (1992)XVII, Part 1 *AASL* 15 at 22.

[230] *ICJ Reports of Judgments, Advisory Opinions and Orders* (1949) at 174 and 178.

[231] *Ibid.*, at 179.

personality and, therefore, be subject to international law. The question of private commercial use of outer space was addressed during the drafting of the OST. In Article VI the freedom of exploration and exploitation of outer space is not restricted to States but is extended to non-governmental entities including private entities.[232] This is also supported by Article IX, sentence 3. As in Article VI, sentence 1 requires private activities be carried out in conformity with the provisions of the OST, and to comply with all the principles of space law. This writer believes that it is now commonly accepted that private entities can carry out their own space activities. This view is supported by OST in its Articles VI and IX. The provisions of Articles VI and VII of the OST are applicable to physical persons, although the treaty did not refer to the physical person directly; this was justified by the fact that at the time of drafting the OST there was little prospect for a physical person to carry on space activities.[233]

Accepting that private entities can participate in space activities, there are definite legal actions and considerations that must precede the launching and operation of a telecommunication satellite by a private entity. These include acquiring the essential approvals from national authorities and other international organizations, risk management and ensuring harmony of the proposed satellite operation with international space law, such as the ITU regulations. We will focus only upon the above selected elements in order to overview the legality of private entities participating in space activities and offering CNS/ATM services.

(a) ITU Registration

In order to obtain international recognition and protection from interference, national frequency assignments must be registered with the ITU. Acquiring this registration for geostationary or non-geostationary telecommunication satellites involves

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[232] On the legality of non-governmental activities see, Gorove S., "Implications of International Space Law for Private Enterprise"(1982)VII *AASL* 319 at 320.

[233] Kolossov Y. M., "On the Problem of Private Commercial Activities in Outer Space"(1984)27 *Collo. L. Outer Space* 66 at 68.

similar processes,[234] although, obtaining registration of frequency assignments for non-geostationary telecommunication satellites is much simpler.[235] All contact with ITU takes place through national representatives, and the private entity does not deal directly with the ITU.

(b) National Authorization

Private entities require national authorization as the first step in a series of legal actions necessary to place their systems in operation. At the time of drafting the OST it was disputed whether or not private enterprises as well as States could engage in space activities directly. The OST has expressions which set conditions on private activities in space. In Article VI in the second sentence provides:

> *"[t]he activities of non-governmental entities in outer space, ..., shall require authorization and continuing supervision by the appropriate State Party to the Treaty."*

And, Article IX in the third sentence provides:

> *"[i]f a State Party to the Treaty has reason to believe that an activity or experiment planned by it or its nationals in outer space, ..., would cause potentially harmful interference with activities of other States Parties in the peaceful exploration and use of outer space, ..., it shall undertake appropriate international consultations before proceeding with any such activity or experiment."*

While the OST demands the authorization and continuing supervision by a States of space activities of non-governmental organizations, it does not give a clear definition of the term, *national activities*, nor does it give a criterion for the relationship between the entity involved in a space activity and the authorizing State: it uses the neutral term

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[234] Articles 11, 13 ITU Radio Regulations, Final Acts, WARC-79, as annexed to Nairobi Convention, *supra*, Chapter V, note 38.

[235] *Ibid.*, Article II.

appropriate State.[236] In short, it contains no specific provisions concerning the authorization and continuing supervision by a State of the space activities of non-governmental organizations.

It is fundamental to establish which State is the *appropriate State*, since authorization and control are the basic instruments for ensuring that space activities that are carried out by private entities are in accordance with international space law. Due to the fact that the OST does not define the notion of *appropriate State*, various interpretations have been formulated in outer space doctrine.[237] These various interpretations lead one to conclude that it is difficult to extract a single and simple criterion for establishing the *appropriate State*. However, this writer's view that definition of the *appropriate State* should include:

- i. State of incorporation permanent or principal place of business;
- ii. activity taking place from its territory; and
- iii. having exercising jurisdiction such as authorization, licensing over the activity.

Recently, one commentator[238] stated that the *appropriate State* is the State having authority and supervision over non-governmental activities in outer space. Also he asserted that the *appropriate State* may be held responsible only on the grounds that it has supervision and/or control over the activities.

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236 The meaning of "appropriate State", still being argued by writers, for some factors of this deliberations see, Bockstiegel K.-H., "Legal Implications of Commercial Space Activities" (1981)24 ***Collo. L. Outer Space.*** at 1; Ritholz A., "International and Domestic Regulation of Private Launching Ventures"(1984)20 ***Stanford J. Int'l L.*** at 135; Matte N. M., *ed.*, ***Space Activities and Emerging International Law*** (Montreal: CRASL, McGill University, 1984) at 304*ff*.

237 See, Bockstiegel K.-H., "Legal Aspects of Space activities by Private Entities - Introductory Report"(1976)19 ***Collo. L. Outer Space*** at 237; Nesgos P. D., "International and Domestic Law Applicable to Commercial Launch Vehicle Transportation"(1984)27 ***Collo. L. Outer Space*** at 111; Traa-Engelman Van H.L., "Problems of States Responsibility in International Space Law"(1983)26 ***Collo. L. Outer Space*** at 141.

238 Wassenbergh H. A., "Responsibility and Liability for Non-Governmental Activities in Outer Space" (European Centre for Space Law: Martinus Nijhoff, 1994) at 197.

One of the questions that could arise is whether such authorization should be given for a definite period of time or renewed for each launching or activity. Such authorization and continued supervision as required in Article VI is one of the legal actions required for a private entity to operate a telecommunications satellite. This authorization is a license to operate a satellite, which must be acquired from the State in which the satellite is operated and controlled. In some views[239] this authorization and continued supervision does not mean that a government agent must be present during the commercial space activity. Rather, the responsible Government agency or agencies would issue appropriate directives within statutory boundaries. By consultations, reports, examinations and analysis of reported contradictions, compliance should be ensured. To a large extent, supervision would be similar to the regulatory control currently practised over licensed private activities. It seems to be a consensus in the doctrine of international space law, that the way a State fulfills its obligation to provide for authorization and supervision of non-governmental space activities, is left to the discretion of the respective State. In brief, the *appropriate State* must continuously supervise and authorize the operations conducted by its citizens in outer space in order to make sure that these operations conform with rules set forth in the OST.[240]

(c) Risk Management Considerations

Generally speaking, risk is deemed as the possibility of the occurrence of an unpredictable event. Risk management may be defined as the process by which we identify, analyze, and then attempt to eliminate, reduce, or transfer risks which, upon becoming a reality, would result in loss or damage to property of participants in space projects as well as injury and damage to third parties and their property. Risk may be eradicated or decreased by several methods, *inter alia*, quality control, human resources

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[239] Menter M., "Legal Aspects of Commercial Space Activities" (Address to the National Institute on Litigation in Aviation and Space Law at Washington D.C., May 27/29, 1982).

[240] Kayser V., "Commercial Exploitation of Space: Developing Domestic Regulation"(1992) XVII:1 *AASL* 187 at 189.

and financial planning.[241] Managing the risk is very important to the success of commercial space activities. It is now the task of commercial launch companies[242] to allocate risk suitably in their commercial launch contracts. Insurance is usually an essential element of the risk management program for parties involved in a satellite launch, because the total or partial loss of a satellite is too great a responsibility for most private entities to assume.

Typically, a private entity is required to be insured against any financial loss suffered in the event a satellite is lost or damaged during launch. Thus, this risk falls on the satellite owner. Currently, that risk of loss or damage is covered by satellite insurance.[243] Furthermore, there is liability risk for damage caused by the satellite during launching and in orbit. Insurance is often an integral part of the risk management program for parties involved in a satellite project.

Some satellite operators have chosen to self-insure[244] project risks or escape definite risks by purchasing satellites on *turn-key* grounds.[245] A satellite purchased this way requires that satellite delivery and risk loss transfer occur in orbit, after the satellite has been checked out. The *turn-key* system causes the manufacturer, rather than the operators, to assume launch and post-launch risks. This requires the manufacturer to purchase insurance to cover the extra risk and pass the costs on to its customer.[246]

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[241] Margo R. D., "Risk Management and Insurance"(1992)XVII:1 *AASL* 79 at 80*ff*.

[242] Such as *ARIANESPACE, MARTIN MARIETTA, McDONNELL DOUGLAS and CHINA GREAT WALL INDUSTRY CORPORATION.*

[243] Due to the unpredictability of the availability of adequate insurance, several satellite manufacturers now offer to launch the satellite, thereby assuming the risk of satellite loss or damage during launch, for more details see, *infra* at P. 287*ff*.

[244] See *Martin Marietta Corp. vs. International Telecommunications Satellite Organization* (INTELSAT), 763 F. Supp. 1324 (D. Md. 1991); see, Masson-Zwaan T. L., "The Martin Marietta Case"(1993)XVIII:1 *Air & Space Law* at 16; see also, Marcur D. J., "Arianespace Negotiates Launch Liability"[December 14/20, 1992] *Space News* 18 at 18.

[245] Ritorto R. & Mitchell M. S., "Telecommunications Satellite Insurance"(1993)XVIII:3 *Air & Space L.* 136 at 139*ff*.

[246] *Ibid.*, at 140.

Furthermore, it is expected that the manufacturer will raise the cost of their services as their liability or risk increases.[247]

(d) Consistency with International Space Law and Organizations

(i) Space Law

Private entities must be in conformance with the OST, the Liability Convention and the Registration Convention. As previously mentioned, participation by non-governmental, private sector parties, in space activities is permitted by the OST, provided that such a private entity is authorized and supervised by the appropriate State party to the Treaty.[248] This is supported by the UNGA *Resolution* 27/92 concerning the use of satellites for international distribution of television programming.[249]

(ii) International Organizations

If the State authorizing private satellite operation is a party to the INTELSAT, INMARSAT and/or EUTELSAT, technical coordination is required to ensure compatibility with the satellites operated or planned by these organizations. In certain situations, the absence of economic harm must be demonstrated as well. Economic coordination cannot commence until after the private entity has obtained an operating agreement with a foreign country, that is, a right to transmit and receive satellite signals to and form earth stations in a foreign country. As with the ITU, the interface with INTELSAT, INMARSAT and EUTELSAT takes place at the national administrative level.

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[247] Marcus D. J., "Satellite Buyers Negotiating for Less Risk"[September 24/30, 1990] *Space News* 34 at 34.

[248] *OST*, *supra*, note 5, Article VI.

[249] Principles Governing the Use by States of Artificial Earth Satellites for International Direct Television Broadcasting, *UNGA Res. 27/92*, December 10, 1982.

2. Selected Aspects of Space Commercialization

It should be kept in mind that space treaties and international agreements do not differentiate between commercial and non-commercial space activities.[250] Therefore, commercial activities are governed by general international law for space activities. When space treaties were negotiated, the commercial use of outer space was only a futuristic vision. Now that vision is a reality. Commercialization of space activities is a normal result of the continuing advancement of space technology. Consequently, this gives rise to several modern judicial issues. What follows is an attempt to define some selected issues which wili have significant influence on the CNS/ATM systems.

(a) The Space Commercialization Legality

On December 13, 1962, the UNGA *Resolution* 1962/XVIII, expressly recognized that a nation's national activities in space could be carried on by its non-governmental entities as well as by it governmental agencies. The term "space activities" is not interpreted in the OST, but it is commonly accepted that commercial space activities consist of space activities carried on by States and international organizations for profit.[251] Additionally, commercial space activities can be carried on by private venture, even though it is not subject to international space law.[252] Article VI of the OST states: "*...whether such activities are carried on by governmental agencies or by non-governmental entities...* ."

This writer is of the opinion that the activities of non-governmental entities and private persons in outer space are also commercial space activities. It is stated in OST Article I: "*[t]he exploration and use of outer space, ..., shall be carried out for the*

[250] Bittlinger, *supra*, note 196, at 191.

[251] Although, INMARSAT is expressly not for profit but works on the basis of commercial principles - expenses are covered by income.

[252] Noorden Von Wolf D. & Dann Philip J., "Public and Private Enterprise in Satellite Telecommunications: The Example of INMARSAT" (paper presented at the 29*th*. Colloquium on the Law of Outer Space in Insbruck) at 1.

benefit and in the interests of all countries... ." It is a clear indication that the principle of equality of all States applies in the exploration and use of outer space.

Commercial space activities are in accord with the *common benefit* principle and with the treaty provisions as long as such activities contribute in a common sense to the social interest of mankind and benefit from them, such as using INTELSAT for telecommunications or purchasing information from remote sensing satellite operators.

(b) Space Product Liability

Product liability is a term used to describe a type of claim for personal injuries or property damages arising out of the use of a product.[253] For space objects the product liability is not regulated by space law, nor, as yet, by any international law on product liability, and therefore it comes under national law.[254] Liability for defective products may, generally, devolve upon several individuals, *inter alia*, the manufacturer, seller, owner, or the product operator. The manufacturers and sellers are liable toward users, buyers and others for any damages or injuries incurred as a result of the purchased product's defects.[255] In traditional contract law, manufacturers and sellers were liable to buyers only through their contractual relationship and according to the terms of the contract between them. Today, the doctrine of strict liability imposes liability on manufacturers to the contract parties or to the third-party who suffers damage because

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[253] Ghonaim M., "*International Conventions and Arrangements Concerning Product Liability*" (IASL, McGill University, December 1987) at 1; also product liability as in the *Black's Law Dictionary* is: "...the legal liability of manufacturers and sellers to compensate buyers, users and even bystanders, for damages or injuries suffered because of defects in goods purchased.", ***Black's Law Dictionary, 5th. ed.***,(St. Paul, Minn.: West Publishing *Co.*, 1979) at 1089.

[254] Matte N. M., "Product Liability of the Manufacturer of Space Objects"(1977)II *AASL* 375 at 388.

[255] "Convention on the Law Applicable to Products Liability", under the auspices of The Hague Conference on Private International Law, Article 3,(1972)17 ***Int'l Legal Materials*** at 1283.

of the defective product and wants to sue the manufacturer of the space object.[256] The law of product liability originated with a theory of negligence, until recently, when evidence of negligence became unworkable due to the complexity of products and the difficulty of establishing a manufacturer's negligence.[257] The 1960 Henningsen case[258] was a forerunner of a new trend in product liability which developed quickly. The true impact of that case is that the doctrine of strict liability for defective products became widely accepted throughout the USA. The strict liability of the launching State has been largely assimilated in practice to an operator's liability, for the elementary justification that the launching State or the international organization has customarily been the operator.[259] As previously mentioned under the OST and the Liability Convention, the State is liable as a launching State, or as the State from whose territory or facility a space object is launched.[260] This technique of liability varies dramatically from liability for defectively manufactured products. Under the notion of product liability, victims are more likely to file an action against the manufacturer, although they cannot recover under the Liability Convention. Thus, the civil responsibility of spacecraft manufacturers for damage done by their products on Earth or to other spacecraft or aircraft remains an open question. Furthermore, the Liability Convention does not apply to damage caused by a space object of a launching State to:

i. nationals of that launching State;
ii. foreign nationals during such time as they are participating in the operation of that space object from the time of its launching or at any other stage thereafter until its descent, or during such time as they are in the immediate vicinity of a planned launching or

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[256] Qizhi H., "Certain Legal Aspects of Commercialization of Space Activities"(1990)XV ***AASL*** 333 at 339; see also, Haanappel P. P. C., "Product Liability in Space Law"(1979)II ***Houston J. Int'l L.*** 55 at 56.

[257] Ferrell W. E. Jr., "Aircraft Manufacturer's Liability"(1992)XVII:1 *AASL* 97 at 97.

[258] *Henningsen vs. Bloomfield Motors, Inc.* **161 A. 2d 69; 32 N. J. 358 (1969, s.c.).**

[259] ***UNGA Res. Doc.*** A/AC. 105/146/Add. 1, at 11*ff.*

[260] **Liability Convention, *supra*, Chapter II, note 60, Article 1(c).**

recovery area as the result of an invitation by that launching State.[261]

In all these cases State liability and manufacturers' liability will be determined outside the scope of the Liability Convention and in accordance with applicable national laws.

As to the choice of law systems, it is enough to say that the question of product liability of the manufacturer of space objects is not governed by space law conventions. Looking at the rules of international law, the Convention on the Law Applicable to Product Liability was drafted by the Hague Conference on Private International Law to establish common provisions applicable to product liability law in international cases.[262] This is provided it is sufficiently accepted and is generally applicable to product liability. It constitutes a rather complex system consisting of conflict rules of the classical type with certain refinements and correcting devices designed to balance the interests of each party to a products liability case with respect to choice of law. The system of choice contained in Articles 4 to 7 of the Hague Convention can be summarized as follows: subject to an escape clause of unforeseeable distribution of his product, a supplier's liability is determined by the law of the country where certain pairs of connecting factors are located. These pairs are selected from among four connections:

i. place of injury;
ii. victim's habitual residence;
iii. place of business of supplier; and
iv. place of acquisition of the product.

Also, in Article 6, if no relevant pair of factors is found, the law of the defendant's place of business applies, unless the claimant prefers the *lex loci delicti*. Under Article 9, safety standards of the country of marketing may be taken into account

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[261] ***Ibid.***, Article VII.

[262] In the Hague Conference, tenth session in 1964: On October 1973, Convention of the Law Applicable to Products Liability, was formally concluded upon receipt of its first signatures, and in the October 1, 1977 the Convention came into force for the three countries which signed the Convention, see (1972)11 ***International Legal Materials*** at 1283; also see more details, Ghonaim ***supra***, note 253, at 27*ff*.

whatever the applicable law. As evident, the Convention does not ascribe a basis of liability but rather seeks to provide uniformity in the law applicable to injury resulting from defective products. Another instrument to be mentioned is the European Convention on Products Liability[263] which sets out, in Article 3, a regime of strict liability for defective products with respect to personal injury and death. An interesting aspect of the convention is a provision for a limit on the amount of compensation to be paid.[264] Both the OST and the Liability Convention attach liability to the launching State for any damage caused by a space object that was manufactured by a private manufacturer. It may by covered by product liability insurance, or it can be solved by an agreement between States concerned, as well as the private enterprises.

In light of the above instruments which seek to establish a certain degree of uniformity at the national level regarding liability for defective products, the question remains as to the desirability of establishing an international convention governing product liability and its specific content. For the interest of the CNS/ATM service providers and users, a question to be addressed is whether it is advisable to adopt an international convention on product liability related strictly to space activities. In the past, proposals for a discrete international convention applicable to space manufacturers have been posited.[265] Certainly, adoption of a treaty providing uniform conflict of laws rules applicable to product liability is desirable in order to clarify the exposure to liability of the manufacturer. Therefore, this writer is of the opinion that there is need for such treaty. Such treaty should be global, and harmonizing substantive rules of law. It should be based on a strict unlimited liability system without a ceiling on the amount of compensation due by the defendant, manufacturer.

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[263] In 1972 the Council of Europe set up a Committee of intergovernmental experts to examine product liability from the point of view of consumer protection. The result of the deliberations was the Strasbourg Convention on Products Liability in Regard to Personal Injury and Death; Europ. T.S. no. 91; reprinted in 1977, 16 *Int'l Legal Material* 7. Opened for signature January 27, 1977.

[264] *Ibid.*, Appendix, Article 2.

[265] See, for example, Haannappel, *supra*, note 256, at 62*ff*.

(c) Intellectual Property Rights

There are many intellectual protection issues, such as patent, copyright and trade secret protection of the products of human creativities, which will be raised by space commercialization activities. The law of intellectual property seems to be too remote from the law of outer space. The entire area of intellectual property "*know-how*" and rights to property in inventions is one fraught with the utmost difficulty because of the nature of the matter and the value which such invention can hold.

Intellectual property protection in space is not new at either the national or the international level; the protection of new forms of intellectual property has traditionally lagged behind the development of that property, and the emerging area of high technology space-related intellectual property is no exception. It is in the interest of the LDCs as importers, to provide only a minimum level of protection to intellectual property, while at the same time industrialized nations give significant attention to the protection of the intellectual property.[266] The international law of outer space is based essentially on the interpretation and implementation of the UN treaties which do not specifically address intellectual property protection. As M. Milde has stated: "... *the system of legal protection of intellectual property is an unavoidable... for further scientific and technological developments...* ."[267] We now stand on the threshold of a new era, one in which private sector activity in space is increasing dramatically as a consequence of the current movement toward privatization and commercialization. Strong protection for intellectual property, either transmitted through space or resulting from space activities, is significant to the industry's realization of the profitability of such activities. Attention is given to these aspects in various countries, for instance, at the

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[266] Dam K. W., "The Growing Importance of International Protection of Intellectual Property" (1987)21 ***The Int'l Lawyer*** 627 at 630.

[267] Milde M., "Intellectual Property" (Proceedings of an International Colloquium Cologne, May 20/22, 1992) at 94.

highest levels of the USA government.[268] In space, intellectual property protection is subject to greater risks. Furthermore, space communication technology development raises a number of copyright issues.

Present international space law is not sufficient enough to deal with protection of private sector concerns in general, much less their rights on the matter of intellectual property. Considering one of the basic principles of space law which characterize outer space as "*res communis omnium*", one could ask whether it does not indicate that space invention cannot be subject of a patent. Also, some authors interprets Article 1 of the OST in very restrictive means, concluding that whole technical achievements in outer space should be available for the interest of all States. Consequently, such achievements should not be eligible for patent protection. Currently, many States have systems for protecting intellectual property on Earth. Space intellectual property security will undoubtedly be based in part on the existing international space treaties and in part on extension of national law, practice and regulation.[269] Although, protection under one national law does not safeguard protection in other State. In addition, developing case law nationally and possibly globally will set precedents for resolution of intellectual property matters in space.[270] In the following we will examine briefly the protection of intellectual property in space technology and the privacy of individuals and the right to protect their conversations that are transmitted by satellite.

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[268] Luxenber B. A., "Protecting Intellectual Property in Space: Policy Options and Implications for the United States" in Papp D. S. & McIntyre J. R., *eds.*, ***International Space Policy*** (USA: Quorum Books, 1987) 83 at 90.

[269] It has been stated that, the protection of intellectual property rights is basically the province of domestic law. See for more details, Buck A., "Copyright, Harmonization and Revision: International Conventions on Copyright Law"(1981)9 ***Int'l Business L.*** at 475.

[270] Luxenberg, ***supra***, note 268, at 84.

(i) In Space Technology

Space technology is often novel and the body of law protecting it, both nationally and internationally, is still developing. Most space technologies are developed on a national basis, but have global uses and effects.

Generally speaking, there are two kinds of inventions in the field of space technology; firstly, the inventions created on the ground, and secondly, the inventions created in space, and both these can be protected by patent-right.[271] Inventions on the ground are protected by normal patent law of the State. In general, ground inventions are treated like any other inventions.[272] Intellectual property protection in space is subject to greater unknowns. The space-based inventions, since they are commercial space activities which are permitted by the OST as previously mentioned, are also governed by international outer space treaties. These treaties do not address intellectual property protection, which is critical to private sector commercial interest in space. These issues, which have recently been studied very carefully in connection with the agreements on the space station of the western States, have to be seen partly in the context of national law, partly in the context of conflict of law rules, and partly in the context of international treaties. Patents and copyrights are granted under the law of the State in the territory of which they were first recorded or published. In the case of activities in outer space, such as the space station, there is no national territory. The analysis of the still unsolved juridical problems just discussed, regarding the activities of the States in the space sector, leads us to the conclusion that the private entities participating in the space activities must receive stronger support in order to be able to face the challenge of space. Therefore, in this writer's view, they also be protected by a new intellectual property convention that

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271 There are other exceptional inventions, within a certain specialized domain, which cannot be secured effectively by patent-right, such as those relating to national security, the military, energy, *etc.*

272 Oosterlinck R. O., "Intellectual Property and Space Activities"(1983)26 ***Collo. L. Outer Space*** 161 at 161; see also Luxenburg, ***supra***, note 268, at 172.

can recognize and settle such problems.[273] We recommend as a solution, an international agreement on intellectual property in outer space. Introducing such an agreement may be delivered for example by the World Intellectual Property Organization (WIPO). Also, some adjustment to the current Brussels Satellite Convention of 1974,[274] by extending its scope of applicability to cover inventions created in outer space and should envisage the inclusion of the private entities as participants in space activities.

For the choice of applicable law, here as to OST Article VII, and Registration Convention Article II the national law of the State of registry, that is to say the law of the flag should be the applicable one. Nevertheless, the national law which is agreed upon between States involved in a modular space object carrying various nationalities, is the applicable law.[275] It should be kept in mind that INTELSAT's patent policy is directed through the provisions of Article 17 of the Operating Agreement, also INMARSAT's intellectual property rights are determined in the INMARSAT Convention, Article 21. Both Organizations are required to acquire rights in inventions made, and in technical information discovered in connection with any work which they perform by themselves or on their behalf. The EUTELSAT Operating Agreement deals with intellectual property in its Article 18, in which the INTELSAT form is followed in regard to the rights which EUTELSAT seeks to acquire in intellectual property. In short, the above Organizations acquire sufficient rights in inventions and technical information to allow them to carry out their function of establishing and running the telecommunications system efficiently and at the minimum cost.

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[273] This writer's view is supported by Prof. Diederiks-Verschoor's view, who asserts that national laws of copyright must be permitted to be applied to the space objects functioning in outer space; see, Diederiks-Verschoor I. H. Ph., "Responsibility for Space Activities Intellectual Property"(1983)26 ***Collo. L. Outer Space*** at 111; see also, Oosterlinck, ***ibid.***, at 161*ff*.

[274] Convention Relating to the Distribution of Programme-Carrying Signals Transmitted by Satellite, was opened for signature on May 21, 1974, entered into force on August 25, 1979; see Matte, ***supra***, Chapter II, note 220, Appendix XII at 329 for the text of the Convention **[hereinafter Brussels Satellite Convention]**.

[275] Civil Space Station Agreement, ***supra***, note 222.

(ii) The Privacy Protection for Aviation Passengers

The personal data protection and the highly controversial problem of the notion and extent of the right of privacy[276] are also getting attention.[277] It has been stated that:

> "*Until now, privacy rights have been primarily the bailiwick of civil libertarians concerned with protecting the rights of the individual. But ever-sharper eyes in the sky could raise some more ambiguous privacy concerns.*"[278]

Nowadays, using satellite services for civil aviation is even more significant with use of satellite communication by civil aviation passengers. In 1981 the protection of privacy was exhaustively discussed during the drafting of the international convention on the matter adopted by the Council of Europe.[279] In Article 3 the scope of the Convention is defined, whereby the Parties undertake to apply it to automated personal data files and automatic processing of personal data in the private and public sectors.

International communication law, as embodied in the ITU Constitution and Radio Regulations, do not provide sufficient protection for copyrighted material transmitted by satellite. Although Article 26 of the ITU Constitution and Article 17 of the regulations require member States to keep certain telecommunication secret, their relevance to interception of satellite signals is uncertain. The problem is created by the interception of the signal when the radiocommunication is not included for public use.[280]

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276 The protection of personal privacy was dominating the global deliberations in the beginning of 1980s. Also, it should be born in mind, that competition between free flow of information and sovereignty concept primary concerns about information protectionism, reciprocity of advantages and free trade; see, Segal, ***supra***, note 22, at 333.

277 Williams S. M., "Teleinformatics, the Protection of Privacy and the Law"(1982)VII ***AASL*** 447 at 447.

278 Forman B., "Satellite Data: Invasion of Privacy?"[December 7/13, 1992] ***Space News*** 19 at 19.

279 The Convention for the Protection of Individuals with Regard to Automatic Processing of Personal Data; adopted at Strasbourg on January 1982.

280 See for more details, Hosková M., "Convergence of Telecommunication Technologies - Some Legal Aspects"(1990)33 ***Collo. L. Outer Space*** 215 at 217.

Furthermore, ITU sanctions may not be powerful enough to make this an effective mechanism. The Universal Copyright Convention of Paris, 1971,[281] and the Berne Convention for the Protection of Literary and Artistic Works,[282] were not drafted to consider illegal interception of satellite transmissions, or to protect the right of privacy of the civil aviation passengers. The Brussels Satellite Convention,[283] deals only with signals and not the messages those signals carry.[284] In general, national copyright law is not executable extra-territorially.

Hence, where teleinformatic activities are carried out by means of satellites, the legal problem arising out of this will come under the laws governing outer space. Furthermore, one has to mention that **UNESCO** and **WIPO** are studying various aspects of copyright law that relate to satellite transmissions. Also, the Committee on Peaceful Uses of Outer Space (**COPUOS**) has considered satellite broadcasting technologies such as direct broadcast satellite, not in terms of property rights in the transmissions, but rather in terms of free flow of information versus some undefined right to restrict the flow of information.

It is obvious that the aircraft passengers' conversations should be treated as any other current international telephone calls. However it is anticipated problems could arise in the future with the full operation of the CNS/ATM systems globally. In view of the foregoing, there is no protection to aircraft passengers' conversations and any personal data which are carried by satellites or any other means of communication. Consequently, this writer believes that there is substantial need for explicit protection of aircraft passengers' conversations which will be carried and transmitted by the new CNS/ATM

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281 Universal Copyright Convention, originally was drafted in 1952 under the aegis of the *UNESCO*, was revised in 1971 in Paris, 216 *U.N.T.S.* 217 [hereinafter Paris Convention].

282 Berne Convention for the Protection of Literary Works, was completed on September 9, 1886, and was revised in 1908, 1928, 1948, 1967 and in Paris on July 24, 1971, see Guide to the Berne Convention, Geneva, 1978, *P.N.* 615; *WIPO* publication no. 287*E* [hereinafter Berne Convention].

283 Brussels Satellite Convention, *supra*, note 274.

284 Jakhu, *supra*, Chapter II, note 221, at 96.

satellite systems. It is in the interests of all nations to provide for adequate and effective protection for such conversation because the failure to do so can seriously erode valuable property and privacy rights, and ultimately discourage greater use of aircraft passenger conversation.

This kind of protection can be achieved by amending the ITU Convention and the Radio Regulations. In the immediate future, a solution is to adopt particular measures to protect these conversations and any personal data under national legislation. It must be kept in mind that while States can work to improve privacy protection for their citizens through their domestic laws, they have far less control over the treatment of information held in computers or conversations by satellites outside their jurisdictions. Therefore, it is imperative to encourage the completion of regional agreements on this matter. The principle of international cooperation has a decisive role in this field and is reflected in the need to pass laws that should be clear and effective.

(d) The Impact of Space Commercialization on the New CNS/ATM Systems

The above-mentioned is an overview of selected issues arising from space commercialization, created by the participation of private enterprises under the authorization and supervision of the State. Private enterprises which procure the space segment, undertake international telecommunication services and may be under international ownership and control. Some CNS/ATM systems services are already offered by non-governmental entities.[285] We can foresee greater participation of private enterprises in providing aeronautical services, and mobile telecommunication for land and maritime services. The existing rules of international space law are not sufficient to deal with developing commercial space activities. Consequently, there is need to adopt a new set of rules in addition to current space law in order to govern the new services in general. There are views which generally oppose the idea of introducing new international rules on copyright matters. These opinions have been confirmed by the

[285] For instance the *ARINC* and *SITA*.

opposition met to the Brussels Convention.[286] In this writer's view, this opinion does not have any justification at present in view of the massive use of outer space. The need for new rules to govern the new services is enormous and absolute. As been concisely pointed out by M. Milde:

> *"[t]he current law of intellectual property is "Earth-bound", its applicability is determined predominantly by the principle of territoriality and there is a disquietingly broad spectrum of diversified national laws."*[287]

Clearly this writer's view is supported by others who assert that there is a necessity to anticipate a Convention on the space law of intellectual property.[288] Clear legal protection in such areas will help to ensure the expansion of satellite communications.[289]

3. Settlement of Dispute Relating to Space Activities

From the birth of space activities there have been various views, many disputes,[290] and solution has not yet been found. Efforts have been made to develop dispute settlement procedures and institutions to fulfil the need of the space community. Unlike national law, rights and duties of a State in public international law cannot automatically be executed against another State by a court's judgment.[291] Peaceful settlement is the only available means to settle a difference.[292] The UN Charter from which *Resolution* 44/23 acquires its authority obliges States to resolve their conflicts by

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[286] ***Supra***, note 274.

[287] Milde, ***supra***, note 267.

[288] Oosterlinck, ***supra***, note 272, at 164.

[289] Jasentuliyana, ***supra***, note 185, at 7.

[290] Bockstiegel K.-H., "Settlement of Disputes Regarding Space Activities"(1993)21:1 ***J. Space L.*** 1 at 1.

[291] Brownlie, ***supra***, note 192, at 708.

[292] See the **UN Charter**, ***supra***, note 6, Articles 2(3)(4), 33.

peaceful means and to refrain from the use of threat or force against each other.[293] International law and practice has long generated techniques for dispute settlement on the global stage as outlined in Article 33 paragraph 1 of the UN Charter:

> *"[t]he parties to any dispute, the continuance of which is likely to endanger the maintenance of international peace and security, shall, first of all, seek a solution by negotiation, enquiry, mediation, conciliation, arbitration, judicial settlement, resort to regional agencies or arrangements, or other peaceful means of their own choice."*

Some principles are stated in the UNGA *Resolution* 2625(XXV): *"[p]rinciples of International Law Concerning Friendly relation and Cooperations Amongst States in Accordance with the Charter."* However, there is the prevailing view that disputes could be settled in space as well as on earth, by arbitration, mediation and judicial settlement.[294]

Nowadays there is a marked increase in the use of outer space for commercial activities by a growing number of States, private entities, and international organizations. Therefore a solution has to be established for anticipated disputes in order to guarantee that there is orderly and effective exploration and use of outer space and that this will remain so for the future interest of mankind.[295]

Looking to the Permanent Court of Arbitration (PCA) is an international organization offering a broad range of services for resolving disputes between States and between States and private parties. Its procedures include arbitration, good offices, mediation and conciliation.[296] Recently the PCA adopted two new sets of arbitration

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[293] *Ibid.*, Article 1; see also, Kelsen H., ***Recent Trends in the Law of the United Nations*** (London: Institute of World Affairs, Stevens, 1951) at 953.

[294] Almond, ***supra***, note 2, at 20.

[295] Bockstiegel, ***supra***, note 290, at 1.

[296] Established by intergovernmental agreement in 1899, revised in 1907 at The Hague in the Netherlands.

rules.[297] Both sets of rules are patterned after the widely-accepted United Nations Commission on International Trade Law (UNCITRAL) arbitration rules. These rules are in force since July 6, 1993. As in Diederiks-Verschoor's[298] view that it could be suitable to extend the PCA's rules to include disputed between private entities. The International Law Association drafted Convention on the settlement of space disputes[299] in its Article 10 gives private enterprises the right to arbitration as a method of dispute settlement independent of their national States. Recently private entities in France created what is known as the International Space and Aviation Arbitration Court.[300] The jurisdiction of this court will not be limited to space activities disputes but will also encompass those arising from the practice of aviation activities. It is aimed to settle private disputes. As been stated that: *"It will be up to the parties in any space transaction to include provisions in the contract which charge this court with disputes arising out of the contract."*[301] Below we will discuss the specific features of such disputes, their mechanisms under UN, selected space law conventions, intergovernmental organizations, and the impact these have on the new CNS/ATM systems.

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[297] The first rule issued in October 1992, is for optional use on resolving disputed between States; the second rule adopted in July 1993, is for disputes between States and private parties.

[298] Diederiks-Verschoor I. H. Ph., "Legal Aspects Affecting Telecommunications Activities in Space"(1994)I *Telecommunication & Space J.* 81 at 90.

[299] Bockstiegel K.-H., "Proposed Draft Convention on the Settlement of Space Law Disputed" (1984)12 *J. Space L.* 136 at 136*ff*; see also, International Law Association, Report on the 61*st* Conference, Paris 1984, 325 at 334.

[300] Bourely M. G., "Creating an International Space and Aviation Arbitration Court"(1993)36 *Collo. L. Outer Space* at 144.

[301] Bockstiegel K.-H. & Stoffel W., "Private Outer Space Activities and Dispute Settlement" (1994)I *Telecommunications & Space J.* 327 at 335.

(a) The Dispute Feature

The aspects of substantive and procedural law, in relation to dispute classification differ for example, in: disputes between States; disputes between a State and its nationals and disputes between individual/private enterprise and foreign States or international organizations. Each of these classifications has to be approached separately. However, there are definite factors which are common to the all categories, firstly, the parties in a dispute should be subjected to a formal obligation to use peaceful procedures for dispute settlement; this commitment is in force for States under Article 33 of the UN Charter. Secondly, there should be a general requirement for individuals, private entities and States, to exhaust every national remedy available under the national law of specific States for claims *vis-à-vis* such State. Thirdly, there should be an option given to any party of a dispute to begin a conciliation process in order to achieve a friendly settlement between the parties. Naturally, there will be a time limit within which a conciliation must be achieved. Fourthly, parties to a dispute should have the choice of determining the procedure most suitable to them. Fifthly, the parties should be given the choice as to whether they accept an obligation to arbitrate the dispute by special agreement, or by some other method. The other methods being the dispute settlement requirement in the INTELSAT Agreement,[302] and in INMARSAT.[303] Finally, regarding enforcement, there should be duties and an obligation on the part of each of the parties to act in good faith and without delay on any ruling achieved.

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[302] INTELSAT Agreement, *supra*, Chapter II, note 192, Article XVIII; Operating Agreement, *supra*, Chapter II, note 193, Article 20 and ***Annex C to the Agreement***.

[303] INMARSAT Convention, *supra*, Chapter II, note 32, Article 31, INMARSAT Operating Agreement, *supra*, Chapter II, note 33, Article XVI; and the ***Annex*** to the Agreement on (Procedures for the Settlement of Disputes Referred to in Article 31 of the Convention and Article XVI of the Operating Agreement).

(i) Disputes Between States

States are governed by public international law in their mutual relations. The regime in question here is either a convention or a contract regarding space activities. The contract may be enacted in cooperation by the two States, or it is carried out by one party for the other. In the latter instance one party will be in the place of a client to the other for a service supplied, or for delivery of a space object at a specific cost. The relation between two nations would be governed by public international law if they have regulated it by a treaty. In commercial and economic links between States it is possible to regulate the relation by a contract subject to the contractual conditions which may be stipulated regardless of any specific national law or possibly a combination of national and public international law, or either one of them if they so decide. If their relation is fully governed by a particular national law, it might be appropriate and sufficient to have a particular dispute settled by the respective national courts. It would also be appropriate to give States the choice of settling their conflicts before the ICJ or an arbitration tribunal. In the latter instance, the States might adopt *ad hoc* arbitration or an institutionalized court of arbitration for space law disputes which would have to be established.

(ii) Disputes Between State and Its Nationals

The relations between a State and its nationals[304] are outside the reach of public international law and are governed by national jurisdictions of that State, except with regard to primary protection in the human rights domain. There is no logical reason to deviate from that precept when it concerns space activities. Therefore, it is suggested that disputes between the State and its nationals should by governed by the appropriate national law.

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[304] The term of "*national*" means that the *individuals* having the nationality of that State, or *private entities* belonging to that State due to its seat, registration or any other aspects.

(iii) Disputes Between Individual/Private Enterprise and Foreign States or International Organizations

Some conflicts may arise without any contractual relationship in circumstances where the private entities or individuals claim to have suffered damages from space activities of a foreign State or international organization; or these conflicts may come about as States form contractual relations. Such contractual relations might be characterized by one party being a customer to the other party for services or deliveries relating to space activities. In the CNS/ATN service implementation it might be either that a State provides space services to a private customer, or that a State is the customer of a private entity.

Usually in such relation a national law will be selected by the rules of private international law, and the settlement of disputes might fall under either the jurisdiction of a national court or of an arbitration tribunal, as is usually provided for in commercial contracts. As a consequence of the participation of States in international trade and commerce, it is widely accepted that relations between States and private entities are subject to institutional procedures of commercial arbitration such as the arbitration of the International Chamber of Commerce (ICC),[305] or *ad hoc* arbitration in popular arbitration sites, such as Switzerland.[306] In the case of trade disputes, the GATT system preserves the rights and obligation of the contracting parties.[307]

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[305] ***ICC arbitration*** is the most widely used in international business relations has been available for more than sixty years.

[306] In some commentators' view States seem to prefer *ad hoc* arbitration with foreign enterprises; see for details, Vagts D. F., "Dispute-Resolution Mechanisms in International Business" (1987)3 ***Recueil des cours de l' Académie de Droit Int'l.*** P. 83; Dubisson M., "La négociation d'une clause de reglements des litiges"(1981)7 ***Droit et Pratique du Commerce Int'l.*** P. 77.

[307] For farther details see, Jackson J. H., ***Restructuring the GATT System*** (USA: The Royal Institute of International Affairs, 1990).

Furthermore, the rules for the arbitration of international commercial disputes which have been developed by the UNCITRAL[308] may be an additional choice for the settlement of commercial disputes between States and foreign private entities.

Also disputes may occur without any contractual relation in instances where an individual or private entities claim to have suffered damages from the space activities of a foreign State or international organization. The Liability Convention provides for a certain settlement procedure in such incidents of damage, as mentioned earlier, but does not guarantee a conclusive and binding decision for those incidents in which State parties do not agree. If local remedies are exhausted, it might be useful to grant them direct access to some universal procedure in which they can proceed with their claims.

In any case, due to the complexity of the controversies arising from aviation and space activities that create difficulties in the settlement of disputes that are usually brought before national courts and existing arbitration courts.

(b) The Dispute Mechanism

The present analysis deals with the question of settlement of disputes in the context of the UN mechanism, selected existing international space law conventions, and relevant intergovernmental organizations.

(i) Under the UN Mechanism

For the settlement of disputes the UN Charter in Article 2(3) states: "*[a]ll Members shall settle their international disputes by peaceful means in such a manner that international peace and security, and justice, are not endangered.*" The ICJ, as chief judicial agency of the UN, has jurisdiction in disputes between States only[309] on the basis of the consent of the parties. The decisions of the court have no binding force other

[308] Upon unanimous adoption by ***UNCITRAL*** on April 28, 1976, the rules were sent to the UN General Assembly which in turn adopted the rules without further debate on December 15, 1976. The rules are reprinted in 1977, ***2 Yrbk of Commercial Arbitration*** **(International Council for Commercial Arbitration)** at 161.

[309] Statute of the ICJ, ***supra***, note 6, Article 34(1).

than between the parties, and with regard to that specific case.[310] Furthermore, the importance of dispute settlement was also acknowledged by UNGA which adopted the principle that global conflicts should be resolved peacefully and on the basis of the sovereign equality of States.[311] UNGA *Resolutions* do not create binding international law, but have the nature of recommendation and may embody a step in the mechanism of the ongoing development of the customary international law.[312]

(ii) Under Selected Space Law Conventions

Present space law, generally speaking, does not provide a mechanism for binding dispute settlement. Surprisingly, the OST does not contain any provision for the settlement of disputes, and hence any such dispute between parties over application or interpretation of the provisions of the Treaty are left to an individual State's discretion or bilateral agreements. Article IX of the Treaty which concerns the avoidance of harmful interference of the earth/space milieu, includes elements of a consultation methodology which do not suffice as a procedure. Article IX decrees that a State, preparing to carry out an activity in space which it believes might produce harmful interference with the activities of other States parties, must consult with other States before proceeding. While this is the extent of the dispute settlement provision contained within the OST, Article III of the Treaty also obliges States to carry on activities in space:

> *"...in accordance with international law, including the Charter of the United Nations, in the interest of maintaining international peace and security and promoting international co-operation and understanding."*

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[310] *Ibid.*, Article 59.

[311] *UNGA Res.* 2625 (XXV), October 24, 1970.

[312] UN Charter, *supra*, note 6, Article 17.

The majority of COPUOS in negotiating the Liability Convention wanted the arbitral decision to be final and binding upon the parties to the conflict.[313] Article IX of the Liability Convention provides that a claim for compensation shall be presented to a launching State through diplomatic channels within one year of the occurrence of the damage. Presentation of a claim in this form does not require previous exhaustion of any local remedies which may be obtainable to a claimant State or to natural or juridical persons it represents.[314] If diplomatic channels prove unfruitful within one year of starting the claim, the parties concerned shall establish a Claims Commission at the request of either party.[315] Decisions are by majority,[316] and on the merits of the claim the Commission could determine the amount of compensation payable.[317] Article XIX(2) is deemed to be the weakest component of the procedure where it states: "*[t]he decision of the Commission shall be final and binding if the parties have so agreed; otherwise the Commission shall render a final and recommendatory award, which the parties shall consider in good faith. ...*"

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[313] Cheng B., "International Liability for Damage Caused by Space Objects" in Jasentuliyana N. & Lee R., *eds*., ***Manual on Space Law***, vol.I (Oceana Publications, 1979) 83 at 136.

[314] Liability Convention, ***supra***, Chapter II, note 60, Article XI(1).

[315] ***Ibid.***, Article XIV.

[316] ***Ibid.***, Article XVI(5).

[317] ***Ibid.***, Article XVIII.

Therefore, conciliation only is assured in the Liability Convention, not a binding decision.[318] Also, the Civil Space Station Agreement of 1988[319] fails to assure a binding decision in case of a dispute in view of its Articles 16, 23.

(iii) Under Selected Intergovernmental Organizations

The means of dispute settlement provided by the intergovernmental organizations agreements differ from negotiation to compulsory arbitration, depending on the organization's structure and the parties of the dispute. The following is an illustration of the INTELSAT and INMARSAT organizations' ways of settling a dispute.

As pointed out earlier the INTELSAT definitive arrangements[320] instituted defined dispute settlement procedures and Annex C to the Agreement contained certain provisions on procedures regarding the disputes settlement. An arbitral tribunal is given the ability to settle conflicts referred to in the INTELSAT arrangements.[321] The tribunal has jurisdiction to make its judgment on the basis of the INTELSAT Agreement and the Operating Agreement, as well as by the accepted principles of law.[322] The tribunal's judgments are binding and shall be carried out in good faith.[323] As

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[318] That is supported by the dispute' decision in the Soviet satellite *COSMOS* 954 accident on January 4, 1978 over the Canadian territory; on January 23 1979 Canada filed a claim against the Soviet Union for more that $6 million Canadian for the damage caused by COSMOS; the clean-up operation ended on October 15, 1978, cost the Canadian Government some $14 million; a settlement was reached on April 2, 1981, with Soviet Union to compensate Canada $3 million with only half of the compensation which was originally claimed; see, Reiskind J., "Towards A Responsible Use of Nuclear Power on Outer Space - The Canadian Initiative in the United Nations"(1981)VI ***AASL*** 461 at 463; see also, "Canada-Union of Soviet Socialist Republics: Protocol on Settlement of Canada's Claim for Damage Caused by 'Cosmos 954'"(1981)20 ***Int'l Legal Materials*** 689 at 689.

[319] Civil Space Station Agreement, ***supra***, note 222.

[320] ***Supra***, Chapter II, at P. 70*ff.*

[321] Annex C to the INTELSAT Agreement, ***supra***, Chapter II, note 190, Article 2.

[322] Annex C, ***ibid.***, Article 13.

[323] ***Ibid.***, Article 13(b).

established by the INTELSAT arrangements, arbitration is restricted to legal disputes.[324] This clearly eliminates political disputes which are usually much more difficult to settle on the basis of law only.

The method of dispute settlement for INMARSAT has been adopted from INTELSAT. Thus, Article 31 of the Convention provides that disputes relating to rights and obligations under the Convention occurring between parties or with the Organization should be settled by negotiation. Parties may also agree to submit the dispute to the ICJ or any other settlement procedure. They may also consent to arbitration in harmony with the procedures for the settlement of disputes defined in the Annex. With regard to disputes arising from agreements concluded between the Organization and any parties, recourse to arbitration is obligatory unless otherwise jointly agreed.[325] Decisions of the INMARSAT arbitration tribunal are to be in agreement with international law based on the INMARSAT arrangements, and customarily accepted principles of law.[326] Disputants are bound by the judgments and must act in good faith.[327] It is worthy noting that the settlement of conflicts envisaged by the INMARSAT Convention and Operating Agreement, unlike INTELSAT Arrangements, extends to legal and non-legal disputes as well.[328] Therefore one can say that INMARSAT did not follow the INTELSAT 's concept of compulsory arbitration.

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[324] INTELSAT Agreement, ***supra***, Chapter II, note 190, Article XVIII(c).

[325] INMARSAT Convention, ***supra***, Chapter II, note 32, Article 31 (2).

[326] INMARSAT Annex to the Convention, ***ibid.***, Article 11 (1).

[327] ***Ibid.***, Article 11(2).

[328] INMARSAT Convention, ***ibid.***, Chapter II, note 32, Article 31; INMARSAT Operating Agreement, ***supra***, Chapter II, note 33, Article XVI.

(c) The Impact on the New CNS/ATM Systems

The fundamental charter of space law, the OST, does not contain any compulsory or elective provision on dispute settlement.[329] The Liability Convention contains in its Articles XV and XVII a *conciliation* solution similar to that offered by the Vienna Convention on the Law of Treaties.[330]

As indicated above, current space law is insufficiently equipped for the peaceful settlement of disputes; also, such disputes are likely to arise in the near future, especially with the implementation of the new CNS/ATM systems and other space commercial activities. Consequently, it must be realized that States are unwilling to agree to binding settlement decisions by tribunals. With the growing use of space and increasing number of States' interest in space activities, more disputes can be expected to develop where disputes on various aspects of space law can no longer be left unresolved, allowing every State to act unilaterally.[331] Furthermore, taking into account the growing importance of international commercial arbitration with respect to the international transaction, it is to be expected that international arbitration will continue to play an important role between States and State enterprises on the one hand and foreign private parties on the other hand. However, in K.-H. Bockstiegel's view:

> "*[it is] less necessary for commercial space activities, especially as far as the participation of private enterprises is concerned, because the international business community has developed and used for many years international commercial arbitration as the preferred method of dispute settlement. ...*"[332]

It is widely agreed to be a wide agreement that effective machineries for disputes settlement have to be available now and in the future. Adjudication and arbitration are

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[329] OST, ***supra***, note 5, in its Article IX, only provides, regarding substantive law, for the relatively vague principles of cooperation, corresponding interest of all other States, and finally regarding to procedural law, for consultation in cases where harmful interference might be expected.

[330] Vienna Convention, ***supra,*** Chapter V, note 42.

[331] Bockstiegel, ***supra***, note 229, at 24.

[332] Bockstiegel, ***supra***, note 290, at 10.

the obvious two choices to assure a binding settlement. Arbitration has become the preferred method of dispute settlement both between States and between private entities, especially in international commercial and economic relations. Present space law instruments sometimes provide for arbitration, but very often still lack an effective and binding method of dispute settlement. It can be expected that for commercial space activities arbitration will be the main method of dispute settlement.

However, a binding technique in a general forum as well as a set of legal procedures for dispute settlement of space commercial activities, including space communication on the global stage, will be in the interest of all States concerned. It is in this writer's view that binding method of dispute settlement for the new CNS/ATM systems seems justified and effective, although conflict prevention and avoidance is more important than conflict resolution.

4. Satellite Insurance

(a) Overview

On October 4, 1956, there was no question of insurance when the Russians launched Sputnik 1. In the early 1960s, the USA nominated its National Aeronautics and Space Administration (NASA) as the responsible government agency for satellite launch services,[333] when the USA government had taken up the space challenge.[334] Shortly after this, private enterprises began to enter the space business arena. Consequently, primary satellite insurance concepts were developed and exercised in the USA.[335] In the last two decades, commercial space telecommunication has developed and currently

[333] Today, besides the USA and USSR there are Arianespace, China, and soon Japan; see, Kuskuvelis I. I., "Space Insurance" in Tatsuzawa, *supra*, Chapter II, note 221, 60 at 61.

[334] Only since 1975 that insurers have accepted to cover risks occurring from space activities, *inter alia*, loss of the satellite, and loss of the opportunity to make use of the satellite. Formerly, as space activities were controlled fundamentally by States they were their own insurers.

[335] Thoma W. & Shimrock H., "Insurance of Satellites"(November 1978)16 *ESA Bulletin* 65 at 65.

include about 94 operational satellites.[336] This number will increase substantially as a consequence of the increase in commercial space activities, including, *inter alia*, the *Iridium* communication system.[337] Space law provisions influence space insurance. The OST introduced in Article VI international responsibility of States for the governmental or non-governmental space activities of its nationals. The concept of third-party liability was also introduced by Article VII of the OST, and again in the Liability Convention in its Article II. Nevertheless, an insurance market developed to finally cover most space activities. The need to manage risks will always be there, and whether insurance as we now know it will always be available to enable manufacturers or operators to transfer their risks remains to be seen. In the following, the insurance categories and the insurance impact on the CNS/ATM systems will be discussed briefly.

(b) The Insurance Categories

(i) Pre-Launch Insurance

Pre-launch insurance may cover launch delay fees, lost profits and other accidental damages attributable to a physical damage incident occurring at any time or place prior to launch, including while in storage, transit, pre-ignition or mating to the launcher.[338] This coverage ends during the launch cycle at the time of intentional ignition of the launch vehicle's main engines, but may reattach in the event of an on-the-pad abort in which no loss or just a partial loss has occurred.

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336 *Airanespace News Letter* [February 1993] at 2.

337 Also the launch service for telecommunications satellites is expected to double during the next decade; see more details, De Selding P. B., "Larger Satellites to Boost Launch Prices" [December 8-15, 1991] *Space News* 6 at 6.

338 Bunker, *supra*, Chapter IV, note 17, at 251.

(ii) Launch Insurance

It begins concurrently with cessation of pre-launch insurance at the launch effort and is traditionally maintained by owner/operators, and on a contingency basis by transponder buyers or lessees. The protection is against failure of the satellite to complete a successful launch into space and becoming operational. This is the highest risk phase of all space activities.[339] Generally satellites are insured for an agreed upon value which provides timely settlement of known losses during coverage time, though the physical consequence of such losses might remain for the residue of the satellite's lifetime.[340] Lower premiums are encouraged by the commercial launchers' increasing reliability.[341]

(iii) Satellite Life Insurance

The coverage begins concurrently with the ending of launch insurance. It is the period of operational life of a satellite commencing at the time it has achieved a successful launch, and frequently begins when the launch policy expires. There are several criteria that should be taken into account in the definition of satellite life failure, *inter alia*, failure of the satellite to maintain its required orbit and position, unbudgeted use or loss of station-keeping fuel, the inability of the satellite to generate and store power necessary to attain its design life, and failure of the transponders to function as intended.[342] This kind of insurance is relatively recent, the first policy not being issued until 1976 in the USA. Service interruption insurance is also available, under this category, to indemnify an owner/operator or transponder lessor for consequential and

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339 Due to the great figures of various hazards a satellite may face between engine ignition and successful beginning of services; see, Bunker, *id.*

340 Margo R. D., *Aviation Insurance* (London: Butterworths, 1980) at 206.

341 Chenard S., "Space Insurers Now Fret About Satellites"(May/June 1989)4:2 *Interavia Space Markets* 94 at 95.

342 Margo, *supra*, note 340, at 204.

direct financial damages arising out of a partial[343] or total failure of a transponder. This insurance is tailored to the exact needs of the insured and takes into consideration contractual exposure as well as alternative options, such as spare or reserve transponders. This writer believes that satellite life insurance is of a special interest, and one of the most important for CNS/ATM service providers since it protects the satellite operators from failure of service and the resulting liability toward users. Although, in some views while the aim of the satellite operator in acquiring life insurance is to gain protection in the event of a malfunction of one or more of the satellite's transponders, the life insurance should be adequate to cover losses caused by other failures.[344]

(iv) Third-Party Liability Insurance

Due to the risky character of satellite launches, and apart from the main property coverage on the satellite itself, there are the third-party insurance schemes. These cover the liability for damage to third-parties. The need for this kind of insurance is essential for the reason that tragedy during launch may endanger persons or property on the earth.

Compensation for damage caused to third-parties during the satellite launching, by the launch vehicle, the satellite itself, or the component parts of these is governed by the Liability Convention.[345] Hence, the Liability Convention provision seems to encourage States and persons/enterprises, participating in or involved in launching operations, to have insurance. However, as has been expressed,[346] without adequate third-party insurance to cover property damage liability tolerated by the USA

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[343] In the case of communications satellites, partial failure can be defined on the basis of the proportion of malfunctioning transponders.

[344] Ritorto R. & Mitchell M. S., "Telecommunication Satellite Insurance"(1993)XVIII:3 *Air & Space Law* 136 at 138.

[345] If the claimant State is not party to this Convention, then compensation is determined according to public or private international law; see, Dahbi M., "Consideration of Satellite Liability Insurance" in *Space Commerce*, Proceedings of the 2*nd*. International Conference and Exhibition on the Commercial and Industrial Uses of Outer Space, Montreux, February 21-25, 1988 (N. Y.: Gordon & Breach Science Publishers, 1989) at 426.

[346] "Congress Advises Shifting Space Contract Liability"[Spring 1992] *Space Law News* 6 at 7.

Government, no manufacturer could participate in the space manufacturing domain due to possible risk. Furthermore, liability in space activities is unlimited, and with respect to third-parties on the surface or aircraft in flight, this is absolute and the launching State is liable. It should be kept in mind, and as pointed out by one commentator,[347] that the unlimited absolute liability of the launching State will become a obstacle not only for States to authorize private enterprises/nationals to participate in the outer space commercial activities from their territory, but also to discourage private ventures to join the activities of outer space. This writer strongly supports the view that States or private entities willing to join space activities and are capable of providing service must carry the risk of their operation. Therefore, this writer's opinion is that the launching State's liability toward third-parties should continued to be unlimited and absolute. This means the victim does not have to prove fault or negligence on the part of the State or the private entity operating the space object which caused damage. However, it is enough to establish a causal connection between the space object and the damage to bring that liability about.

(c) The Impact on the CNS/ATM Systems

Existing space law rules are not sufficient to support current commercial activity. The space insurance industry is essential to space activity financing, and without its participation private enterprises would have to withdraw. Also, banks and other sources of space financing are by their character adverse to risk, will only participate in projects where they are totally secure. Insurance coverage is a central element of space financial contracts of commercial satellites for communication and other aeronautical purposes. This will encourage satellite owners and/or service providers which could facilitate the implementation and continuation of the development of the new CNS/ATM systems. Hence, the stability of the insurance industry is important. Therefore, it is predicted, or already in demand by insurers, that manufacturers of space hardware take more responsibility for the efficiency of their machinery in order to diminish risks. That is, to

[347] Wassenbergh H. A., "Liability in Air and Space Law"(1989)XIV:6 *Air Law* 261 at 265.

limit financial exposure through allocation of risk among a number of organizations. It would also be necessary that manufacturers build risk management costs into their contracts.

Accordingly, the insurance and overall risk management program must be carefully reviewed to ensure that the terms and conditions of the satellite purchase agreement and launch services agreement are compatible with the various insurance coverage. Furthermore, the determination of the proper law of an insurance contract may have significant consequences for insurers and the insured. The present practice of leaving the selection of the applicable law to chance is undesirable and unsatisfactory.

In general the participation of private entities requires liability insurance against third-party injury and damage.[348] Consequently, compulsory liability insurance should be applicable. The rights and obligations of the insurance buyer and the insurer must be declared in order to avoid disputes when malfunctions occur.[349] In this writer's view there is no question that satellite insurance will perform an increasingly important role in the upcoming years as far as commercialization of space activities is concerned; particularly in view of the introduction of satellite services into civil aviation industry, and its forthcoming operational schemes to include private entities. A failed space insurance market will inhibit subsequent industrialization of space in general.[350] Although insurance is not a magic solution, it is just a means of pooling or sharing the risk; this writer supports the view that space insurance market will play the major role in the space industry and commercial space activities of the future.[351]

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[348] Cassidy D. E., "Allegation of Liability Between Government and Private Sector and Implication on Insurance for Space Commercialization"(1990)33 *Collo. L. Outer Space* 23 at 23.

[349] Robson M. R., *The Space Insurance Market* (Bachelor of Arts, Middlesex Polytechnic, 1990) at 50.

[350] Hauck F., "Facing the Consequences: Launch Failures Challenge the Insurance Industry" [April 12/18, 1993] *Space News* 16 at 16.

[351] Kuskuvelis, *supra*, note 333, at 72.

Law-Making Perspectives and Challenges

It is this writer's intention to stress the importance of the current applicable rules in telecommunication, air and space law for the CNS/ATM systems' limiting the scope of discussion only to international law, keeping national laws out of the discussion. Due to the crowding of airspace, international norms governing air navigation have to become more binding than they are now. As a result of an examination of the basic fundamental principles governing space use, it is evident that the conduct of space activities is based on the laws of general application. While these general rules of international space law apply to the CNS/ATM systems they are clearly insufficient to govern the new system. Nevertheless, these principles serve to form a basis upon which any regulation is established. Yet, it seems that space law will exhibit two separate styles, first, there will be broad challenges to space law in the political and technological developments framework; and second, some space law areas can be expected to become increasingly profound as commercial space activities develop. In the world of the future, law must be an instrument of management, and intervene to enable technology to serve mankind through appropriate regulatory mechanisms.

The question to be addressed here is whether the existing legal regimes are adequate to meet the present demand and the expected developments in the aviation community? One can say that in spite of the above deliberations, at present more clarification and precision is required for addressing an extremely sophisticated and diverse space industry. The present conventions on space law have been created with a view to research in space, balancing the conflicting super-power interests during the cold-war, emphasis on security and peaceful use of outer space which has been the dominating space activities in the early years. Their application to present and future commercial space activities brings up gaps and difficulties of interpretation. This will be ever more so in the future, especially with the direct participation of private enterprises. The further development of the legal framework for commercial space activities will have to follow what factually develops in practice. In this writer's opinion, CNS/ATM implementation will require changes and a development of appropriate space, telecommunication, and public air law in a number of areas. In one commentator's[352] view: "...*emergence of international private space law is not likely.*" This writer strongly disagrees with that view because at the time which it was given it may have been accurate but the current state of law, the massive movement toward privatization and commercialization of outer space activities, and the momentous participation by the private entities provides the necessity for developing international private space law.

This will demand the least amount of regulation, the simplest procedures, and the least restrictive interactions with existing legal regimes. Despite the difficulty of reaching this, it is needed to secure and motivate agreeable and willing institutions to take part in the aviation services offered by satellite. In brief, resolving the unanswered legal questions and issues will certainly demand global commitment, specifically in view of the expected unlimited use of satellites for the interests of the aviation industry. Also, the legal and the commercial environments in which CNS/ATM systems will operate are subject to continuous change. Solutions and contractual issues can be expected to follow a corresponding pattern of change.

[352] Kolossov, ***supra***, note 233, at 67.

Chapter VII: The Institutional Aspects of CNS/ATM Systems

Introduction

The new CNS/ATM systems are in need for "institutional arrangements" which may be defined as necessary arrangements for the implementation of the new systems. The main purpose in considering institutional matters, is to develop a clear picture of the most acceptable CNS/ATM institutional arrangement in view of the current ICAO discussions and to identify the opportunities for a CNS/ATM system to grow and to evolve in a new direction in the field of satellite applications for next century.

As the aviation industry and ICAO move towards the use of satellites, a new set of pressures will call for changes within present institutions.[1] If these prevailing institutions cannot change, other institutions will replace them. The prime importance is the development of an effective organizational solution for the use of the CNS/ATM systems that meets all criteria.[2]

Critical issues must be examined, such as: financial arrangements; operation and maintenance responsibilities; opportunities for retrofit; subsystem switching and interconnection; ownership; leasing arrangements; liability and insurance; shared versus exclusive use; decision-making mechanisms; and a variety of technical, economic, political and legal trade-offs.[3] It should be borne in mind that there is an urgent need to define standards and to create institutions in order to initiate satellite surveillance, communication functions and navigation functions. In the following we will examine, some difficulties of the new systems, some aspects that influence a State's decisions on the institutional planning, and the institutional options available to States.

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[1] *Supra*, Chapter II, at P. 35*ff*.

[2] Pelton J. N., "Is There a Space Platform in INTELSAT's Future? Facing the Institutional Challenges of the 1980's and 1990's" in the , ***AIAA 8th Communications Satellite Systems Conference: A Collection of Technical Papers*** (USA: American Institute of Aeronautics and Astronautics, Florida, April 20-24, 1980) 408 at 409.

[3] ***Ibid.***, at 410.

Section I: Selected General Difficulties of the Systems

A. Fiber Optics Challenge

Fiber optic technology was developed in the 1970s, and began to be used operationally in the early 1980s.[4] This new technology transmits information, via light, through very fine and flexible glass cables. It has several advantages,[5] *inter alia*, revolutionizing point-to-point communication (particularly for contiguous land masses with high-density population and high-density communication needs), a wide transmission band, and freedom from electromagnetic interferences.[6] It is becoming the medium of choice for some long-haul transmission. It has the capability to carry literally tens of thousands, even hundreds of thousands, of parallel voice telephone conversations.

ARINC and the aviation industry have the capability and might use *fiber optic* facilities for specialized objectives and operations; also ARINC might use a *fiber optic* system in airport facility information distribution systems.[7]

The planned Pacific *fiber optic* cables will not offer the level of connectivity or cost-effectiveness on the Pacific's various thin paths that can be achieved by a satellite system.[8] This technology is desirable in order to adjust global and trans-oceanic traffic and reduce the strain on the frequency spectrum and the geostationary orbit.[9] It will also take up some of the increase in communication traffic. Some telecommunication specialists believe that there will be a naturally occurring significant change from

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4 Tosco F., "Optical Transmission"(1991)58:XII ***ITU Telecommunication J.*** 890 at 890.

5 See Podmore C. & Faguy D., "The Challenge of Optical Fibres"[December 1986] ***Telecommunications Policy*** 341 at 343*ff.*

6 Tosco, ***supra***, note 4, at 890*ff*; furthermore it can be fabricated at less expense than the conventional copper cables; also it can support a much higher bandwidth, see more details, Martin J., ***Data Communication Technology*** (New Jersey: Arben Group, *Inc.*, 1988) at 193*ff.*

7 The ARINC Story, ***supra***, Chapter II, note 17, at 131*ff.*

8 Betty Alewine, Comsat Vice President, see, "Comsat Presents First Satellite-Delivered ISDN Demo in Pacific"[January 29, 1989] ***Satellite News*** 8 at 8.

9 Report of the Second UN Conference on the Exploration and Peaceful Use of Outer Space, at Vienna, ***A/CONF.101/10*** (August 9/21, 1982), at 18.

satellites to *fiber optic* cables for particular services. This will free some of the orbit/spectrum frequencies,[10] which in this writer's view will be one way of solving the spectrum crisis for mobile communication generally, and for aeronautical communication in particular.

There is a complex link between *fiber optic* and satellites. *Fiber optic* technology is indeed generating a revolution in communication, but its challenge to satellites should note be overstated.[11] This writer believes that the coexistence of satellites and *fiber optics* is advantageous to the CNS/ATM systems. There are views which assume that by the end of the century the satellite will be all but extinct because of the *fiber optic* competition; others oppose this belief and say that *fiber optic* technology and satellites are complementary and competitive to each other, and that they will coexist and achieve their own market objectives.[12] This writer supports the latter view, and believes that although on one hand *fiber optic* cables have advantages over satellite communication (such as immunity from electronic interference, greater bandwidth, greater speed and lower cost), they cannot provide mobile communication services. Therefore, one could say that each system, operating as it does in an individual environment, has advantages, disadvantages, capacities and limitations, as determined by the ownership by different entities.

B. Technology Transferring Limitations

The central issue of technology transfer is balancing national security goals with other national goals, such as the tradition of open academic exchange, and encouraging invention, commercializations, and exports. It is generally acknowledged that advances in space science and technology have benefitted mankind. However, there are imbalances created by the inability of most LDCs to acquire such costly technology. The UN

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[10] Schaefer K., "Technology & The Future of Satellite Communications"(1985)28 ***Collo. L. Outer Space*** 298 at 299.

[11] Podmore & Faguy, ***supra***, note 5, at 345.

[12] ***Id.***

Conference on Trade and Development (UNCTAD) has provided non-binding Rules on Technology Transfer, which fall short of meeting the LDCs needs.[13] The INTELSAT[14] and INMARSAT[15] agreements promote the transfer of space technology. These rules do not apply to inventions and technical information created by organizations under contract.[16] To overcome the problem, there is a need to develop a cooperative mechanism worldwide, either between developed countries and LDCs, or among LDCs themselves. There is a need for the transfer of technology from developed countries to LDCs in order to assist the LDCs in increasing their technical competence. However, technology transfer has become a moral necessity for various LDCs who tie human rights to what they see as the developed countries' duty to transfer technology.[17] One of the fundamental principles underlying the ICAO philosophy, which has been developed by the FANS Committee, is the concept of non-discrimination. In practice, developed countries do provide technological assistance to LDCs such as, *inter alia*, providing satellites launch services, engineering aid and specific restricted hardware, but not an actual transfer of *know-how*.[18] For example, the US has dominated the creation of law for the transfer of space technology because of its preeminence in the manufacture and use of space instrumentalities. The policy of the USA has been to avoid technology transfers in cooperative efforts, providing only the minimum amount of technical

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[13] Matte, *supra*, Chapter II, note 220, at 199*ff*.

[14] INTELSAT Operating Agreement, *supra*, Chapter II, note 191, Article 17(b).

[15] INMARSAT Convention, *supra*, Chapter II, note 32, Article 21(2).

[16] INTELSAT Operating Agreement, *supra*, Chapter II, note 191, Article 17(c), and INMARSAT Convention, *ibid.*, Article 21(3).

[17] See for *e.g.*, Potter M. A., "Human Rights and Outer Space: An Overview of the International Legal and Political Context"(1989)31 *Collo. L. Outer Space* 382 at 387.

[18] Leister V., "Space Technology: From National Development to International Cooperation" (1983)26 *Collo. L. Outer Space* 217 at 218.

information necessary to ensure an effective interface between project elements.[19] One can assume from this that constraints on the use or transfer of technology are based on political reasons or for its military capabilities.

There is need for more cooperation which will provide mutual benefits for both sides. It is also important to prevent such technology from being abused as this may well endanger international peace and security. Therefore, it is reasonable to impose some restrictions and conditions which, however, should not impede the general policy of transferring technology to LDCs.

This writer believes that technology transfer should be taken into consideration, without any discrimination in the process of implementing the new CNS/ATM systems between regions or States. One can assume that technology is not only an economic asset, but also of strategic and political significance, and its transfer is inhibited for these reasons. However, there is an optimism that commercialization of space activities will bring greater opportunity and benefits for LDCs. Space technology transfer in the future, with the exception of that which is required for national security, will be seen in a similar light and be regulated by the same or similar rules as those relating to the transfer of other industrial technologies.[20]

C. Space Debris as a Threat to Space Commercial Activities

Space debris is caused by the natural and artificial space debris. Thus the hazard from the natural debris environment has been assessed as acceptable; the main concern are the hazards posed by the artificial space debris.

The term space debris immediately creates a mental picture of meteoroid swarms, asteroid belts, and ejecta from Comets as they pass close to the sun. Space debris is a self generating stream of natural debris in space by the breakup of a giant *COMET* some

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[19] Pedersen K. S., "International Cooperation and competition in Space: A Current Perspective" (1983)11 ***J. Space L.*** 21 at 23.

[20] Matte N. M., ***Space Policy and Programmes Today and Tomorrow*** (Montreal: ICASL McGill University, 1980) at 119.

5,000 years ago, and has had a constant, documentable impact on human history.[21] Artificial space debris is the product of natural satellite operations, the deterioration and the fragmentation or breakup of satellites. As has been stated:

> *"[a]ll man-made debris orbiting in outer space... is generated by manned and unmanned space programmes of the world's space-capable nations and international organizations. While meteoroids are a source of naturally-occurring orbital debris, they are not considered to be a serious hazard."*[22]

The exact amount of debris is unknown because the smallest particle cannot be detected or tracked, there are thousands of pieces of space junk over four inches in diameter.[23] Space debris has a serious effect on both outer space and earth environment. It presents a danger of both collision with operative satellites and interrupted radio-astronomy.[24]

Space debris poses risks of, *inter alia*, collision which may result in loss of property or life, damage to persons or property, and interference with scientific, commercial and military space activities.[25] Since 1957, one hundred and eleven satellites have exploded or broken into pieces while in orbit, including Snapshot,[26] the only US satellite to have been powered by a nuclear reactor. Scientists believe that the explosion of the Soviet navigation satellite COSMOS 1275 in July 1981, was caused by impact with

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[21] See, Foley T., "Scientists Link Cometary Debris, Historical Milestones"[November 29/December 5, 1993] ***Space News*** 18 at 18.

[22] Baker H. A., ***Space Debris: Legal and Policy Implication*** (The Netherlands: Martinus Nijhoff Publishers, 1989) at 3.

[23] See, Johnson N. L. & Mcknight D. S., ***Artificial Space Debris*** (USA: Florida, Orbit Book Company, 1987).

[24] Vlasic I. A., "The Nineties: Problems and Prospects"(1992)XVII:1 *AASL* 35 at 45.

[25] Debris can collide with both active and inactive satellites, damaging active ones and possibly making them inactive and producing more debris from both types; ***supra***, Chapter VI, note 87, at 4.

[26] "Space Debris/Pollution:Increasing International and Legal Concern"[Spring 1994] ***Space L. News*** 5 at 5.

debris.[27] Therefore, mobile satellite service flights and other space activities may become too risky by the year 2000 if nations do not make an attempt to cut down space debris.[28] The increase in GSO objects has led to a greater possibilities of a collision. As stated by Johnson and McKnight:

> *"[i]t is estimated that by the year 2000 the chance of a collision will increase by over three orders of magnitude for the present hazard to a 5% chance of collision per year. An increase in the debris population at geosynchronous altitudes could be cataclysmic."*[29]

It is apparent that there should be serious concern for space debris in LEO.[30] The collision hazard in LEO is much greater than in GSO,[31] not only because LEO is increasingly occupied with functioning satellites, but also for reasons of debris.[32]

The progressively greater number of objects in outer space augments the possibility of collision,[33] and threatens space operations. The launching State retains the burden of liability for space debris.[34] While the physical mass in space is known,[35]

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[27] "Government Catalog Understates Extent of Space Trash"[Spring, 1993] ***Space L. News*** at 8.

[28] See for techniques and States effort to reduce space debris, Jakhu, ***supra***, Chapter VI, note 74, at 316*ff*; Baker, ***supra***, note 22, at 86*ff*; Gorove S., ***Developments in Space Law: Issues and Policies*** (The Netherlands: Martinus Nijhoff Publishers, 1991) at 157*ff*; Jasentuliyana N., "Priorities for International Protection of the Space Environment" in Bockstiegel, ***supra***, Chapter VI, note 210, at 231; Perek L., "Telecommunications and the Geostationary Orbit: The Missing Regulation"(1983)26 ***Collo. L. Outer Space*** 33 at 33.

[29] As cited in, Vitt, ***supra***, Chapter VI, note 72, at 49.

[30] Reynolds R. C., Fischer N. H. & Edgecombe D. S., "A Model for the Evolution of the On-Orbit Man-Made Debris Environment"(1983)10 ***Acta Astronautica*** 479 at 749.

[31] Jakhu, ***supra***, Chapter VI, note 74, at 315.

[32] ***Supra***, note 26, at 5.

[33] Flury W., "The Situation in the Geostationary Orbit" in Bockstiegel, ***supra***, Chapter VI, note 210, at 17.

[34] Diederiks-Verschoor I. H. Ph., "Harm Producing Events Caused by Fragments of Space Objects (Debris)"[1982] ***IISL-Proceedings*** 1 at 3.

[35] Johnson N. L., "The Crowded Sky"(December 1982)24 ***Spaceflight*** at 446.

there is no universal arrangement for debris management.[36] As has been stated: "...[an] *early action to prevent such* [a disaster]... *would be very cost-effective if appropriate collective action can be agreed* [upon] *by space users.*"[37] In any case, this writer's view is that space debris is a serious threat to space operations, to satellite communication, navigation and surveillance which could hinder the CNS/ATM systems in specific. Also, it is evident that (not only from the cost-effective but also from the environmental and satellites operation safety point of view) the method of one global satellite system will satisfy all the civil aviation requirements and will prevent the escalation of man-made debris as an effect of multiplicity of the satellite numbers in the outer space.

Section II: Selected Aspects which have Direct Impact on the Institutional Framework and Influence a State's Decisions

There are many features which have an effect on the decision to adopt a suitable institutional framework for the CNS/ATM. In the following, we will illustrates some of these features.

A. National Security

Modern outer space technology should be used to enhance international cooperation or else individual countries may perceive that their security is threatened.[38]

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[36] The ESA in its first space debris conference which held in Germany on April 5 to 7, 1993, was for presenting a research results on space debris; to assist in defining future direction for research, to identify methods of debris control, reduction and protection, and to discuss international implication and policy issues; see also more details, Reibel D. E., "Prevention of Orbital Debris"(1987)30 ***Collo. L. Outer Space*** 147 at 147*ff;* and Qizhi H., "Towards International Control of Environmental Hazards of Space Activities"(1987)30 ***Collo. L. Outer Space*** 138 at 138*ff.*

[37] Collins, ***supra***, Chapter VI, note 88, at 142.

[38] Konstantinov E., "International Regulation of the New Activities and International Security" (1987)30 ***Collo. L. Outer Space*** 48 at 48.

Since the 1960s, the conventional security concepts as well as economic growth have been stressed. This has paved the way to expanding the national security concept to include economic strength.[39]

National security has customarily played a large role in developing aviation policy.[40] Due to economic, technological, or political motivations, large number of States have established nationally owned and operated domestic satellite telecommunication systems. National security demands secrecy, however secrecy may be impossible to preserve in our modern, technologically advanced world.[41]

Self-control will become widespread when State governments choose to rely not on military power and increasing defence spending, but on political and legal means to increase mutual trust between nations.[42] Politics play a significant role, along with fear over lost national sovereignty, in slowing down the introduction of the CNS/ATM systems.

However, with air transport representing a major sector of the economy and the travelling public clamouring for improvements to the system, reforms to the present structure will become a necessity rather than merely desirable. Technology can only be effective if the political obstacles are removed.[43] The role of the military is of major concern because it is feared that national security may be used as an excuse to obstruct any attempt to bolster commercial aviation. This is especially of concern as long as border disputes continue between countries.

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39 Ploman E., "Communications Research and Communication Issues: Some Reflections" (Address to the IIC Annual Conference, Berlin, September 21, 1984).

40 "Free Trade in the Air Report of the Think Tank on Multilateral Aviation Liberalisation" (Address to the Global Aviation Associates, Washington D. C., January 1991).

41 Kramer G. M., "The First Amendment Viewed From Space: National Security Versus Freedom of the Press"(1989)XIV *AASL* 339 at 367.

42 Vereshchetin V. S., "International Control and the Concept of Open Skies" in McWhinney, *eds.*, *supra*, Chapter III, note 99, at 35*ff*.

43 *Supra*, Chapter I, note 4, at 20.

The sovereign control of States over telecommunication and wireless transmission from the territory of a State is customarily governed partly by regarding security as well as an interest in holding on to the economic benefits that are created by telecommunication.[44]

We exist in an era in which confidence and trust between States are essential elements in implementing the new CNS/ATM system. This writer believes that the successful implementation of the new systems will depend on a new global security structure. This structure must be built on a firm foundation of openness. For example, it is hard to accept the fact that in the common European market where some countries have restricted or prohibited zones, since this gives rise to suspicions, and does not create confidence. As a result of the recent movement towards a stable and balanced international order, there will be a need for greater level of trust between States in order to achieve stability.

The end of East-West confrontation made it possible to envisage synergies which only a few years before were unthinkable.[45] The early 1990s saw international cooperation take on a new dimension. The achievement of open skies in the future would show trust in an inter-State link, and this is a practical step towards disarmament. Consequently, this would reduce national security needs. It should be kept in mind that the unity ideal is supported by shared values, embodied in worldwide cooperation like that seen in global commerce and security.[46]

It is important for the civil aviation future to support the use of satellites and the need to retain the frequencies now available.[47] Advancement of international aviation, always has been carried out by the powerful States in structuring a global network of routes and systems efficiencies. However, the greatest benefit of any new concept will

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[44] Milde, *supra*, Chapter V, note 41, at 218.

[45] "International Cooperation"[1992] ***European Space Agency: Annual Report*** 64 at 64.

[46] Matte, *supra*, Chapter VI, note 135, at 170.

[47] Eser, *supra*, Chapter I, note 55, at 9.

only be achieved if governments are ready to enter into a global gathering.[48] It is incumbent upon members of ICAO to show the same will and desire to resolve even more difficult problems in order to achieve the CNS/ATM systems, so that the airlines which have long served the interests of States, can become the chosen means of their common business.[49]

The ICAO Legal Committee at it's 27*th* Session indicated that the introduction of FANS would rely not only on the advancement and availability of new technology, but, to a large extent, on the level of cooperation of States, and their agreement to place the modern systems into every day use governed by designated legal conditions.[50] As E. Sochor asserts:

> "*[t]he development of international aviation has actively contributed to the trend toward 'interdependence' highlighted in various studies of the changing international system.* [in addition]...*international civil aviation differs from other industries in that it is also closely linked to national security and military interests as well as to the sovereignty and prestige of almost all countries of the world.*"[51]

This writer has no doubt that national security concept will affect the way in which either the American GPS system or the Russian GLONASS system will be controlled and operated if they will be chosen to provide the GNSS service for civil aviation in the *short-term* period.

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48 Rochat, ***supra***, Chapter III, note 85, at 7.

49 Sochor, ***supra***, General Introduction, note 13, at 224.

50 ICAO Doc., ***supra***, General Introduction, note 23, at 3-1; see also, Van Dam D. R., "Regulating International Civil Aviation: An ICAO Perspective" in Masson-Zwaan & Mendes de Leon, ***supra***, General Introduction, note 28, at 20.

51 Sochor, ***supra***, General Introduction, note 13, at XVI.

B. Financial Constraints

Most of the ICAO members States face a number of difficulties with regard to space technology and its efficient utilization. In particular, most countries do not have or cannot afford space technology. The investment needed for CNS/ATM systems' ground or/and space segment would depend on the type of system, the type of application and whether the space segment would be bought or leased in full or on a cost-sharing basis and whether access to it or its data is granted free without discrimination, or at nominal cost. However, CNS/ATM applications on a global basis are likely to make significant economic contributions to the airline industry, and expenditures in this domain should be looked upon as assets investments on which there will be a recovery of investment.

C. Geographic Application

Many countries of the world with a large land mass, such as the USA, Russia, Canada, India and Indonesia, found satellite telecommunication systems' significantly more economical than terrestrial options. The trend towards nations owning and operating their own satellite telecommunication systems began in the 1970s and carried on into the 1980s.[52] In general, long distance communication, linking rural communities with other areas of a country, are very important to growth and development. This has caused LDCs to also move in the same direction. In order to do this they need large financial and technical resources, as well as access to the geostationary orbit, none of which they can afford. Consequently, some countries have found the answer in regional satellite systems.

It should be kept in mind that for economic reasons the global and regional CNS/ATM systems application is better than a domestic one. However there is the exception of the earlier mentioned countries with large territory. According to the Chicago Convention in Article 28(a) domestic applications of radio services,

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[52] Smith M. L., ***International Regulation of Satellite Communication*** (The Netherlands: Martinus Nijhoff Publishers, 1990) at 34.

meteorological services and other air navigation facilities are acceptable and specified. For the majority of States the geographical range of CNS/ATM systems is too broad for domestic use only. The creation of a global or regional system would be a cost-effective means for the geographically small States, such as those in Europe, and for large geographical States with underdeveloped air navigation infrastructure, as in Africa, to develop satellite based CNS/ATM systems. The regional CNS/ATM systems could be the most problematic in the continental regions. Cooperation between States in regions with common cultural and economic backgrounds will be essential for the creation of regional systems.

For oceanic and polar areas, global application would be the most suitable way to provide CNS/ATM services since they are not part of any one State's airspace, and State sovereignty, as stated by Article 1 of the Chicago Convention, does not extend to airspace above the poles or the high seas. As will be addressed later, in this writer's view, CNS/ATM systems will eventually appear as a global system.

D. The Sharing Concept

1. Overview

In setting worldwide standards, ICAO from the DC-3 to the supersonic aircraft has kept pace with rapidly-growing technology. It has focused not only on aircraft, but also on the flight environment. Over the years, ICAO has made momentous choices in selecting new communication and navigation systems for global use. New equipment inevitably creates new problems because it takes years for a new system to be fully implemented, and the space-based new system must coexist harmoniously with the old during this period of transition.[53]

A proposal to form a new ICAO policy body to help carry out the work of the FANS Committee, which is to speed up the implementation of the new systems and to help ICAO coordinate work on system issues, is essential if ICAO is to retain its

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[53] Sochor, *supra*, General Introduction, note 13, at 24.

leadership role the future[54] of the CNS/ATM systems as this writer illustrated following in Chapter VIII. It was observed recently by another commentator[55] that the greatest obstacles to FANS implementation are no longer technical, but financial, legal, political and institutional.

In 1969, when ICAO formed for the first time a Panel of Experts to consider and to make recommendations concerning the Application of Space Technology Relating to Aviation (**ASTRA**) the following question was asked: should international civil aviation have an exclusively dedicated satellite system, or should it share the system with other users? Although the other factors affecting the system sharing concept are, *inter alia*, financial limitations, it is crucial that one distinguishes between the concepts of space segment sharing and radio frequency band sharing in answering this question.

2. Space Segment Sharing

Many countries satisfy their national telecommunication needs through the lease or purchase of capacity from international telecommunication organizations, *e.g.*, INTELSAT or INMARSAT, and/or other regional organizations. INTELSAT is working with the Pan American Health Organization and the World Health Organization, as part of its *Project Share* activities, to demonstrate how smaller earth stations can significantly improve the delivery of emergency services and health supplies.[56] This is done through the provision of free satellite communication for rural health and long-distance educational programs for selected projects.[57] As of 1987 about forty countries have participated in these and other *Share* projects. The program's success and usefulness has

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[54] Poritzky, *supra*, Chapter I, note 73, at 14.

[55] Jeanniot P., "Countdown to Global Navcom"[2/1993] *IATA Review*, 4 at 4.

[56] Project *Share* has linked a Canadian hospital in Nova Scotia to provide tele-medicine services to medical schools in East Africa and the Caribbean.

[57] Project *Share* has brought higher education video classes to students throughout the vast expanse of the People's Republic of China.

been underscored by its extension beyond the initial allotted time period.[58] Also, time-sharing computer systems have been in existence for a few decades already, allowing several users to share the computing capacity of a single machine.[59]

In 1964 INTELSAT came into being, and by 1965 universal service was introduced.[60] One could ask whether this success story can be repeated for satellite applications in the aviation industry. This writer has no doubt that it can happen, but only with an enormous amount of global cooperation and the good will of ICAO's member States.

The implementation of satellite systems requires financial resources and a highly developed technological base, and this usually exceeds the capabilities of a single country. Technically, satellite systems are extremely complex and sophisticated and States will have no alternative but to join efforts at the regional and global level. There is also the need to harmonize systems and airspace into a global ATM system and to use limited and expensive resources in the most efficient manner. Thus, it seems obligatory to adopt a global view; clearly, this calls for the cooperation and goodwill of all nations.

As mentioned earlier, in 1969 ICAO felt that aviation safety was of paramount concern and it formed the Panel of Experts for ASTRA. Ideas of shared usage of satellites or of a system that did not exclusively serve the aviation community were dismissed as being inconceivable.[61] However, these views came at a time when airlines were experiencing a slow-down in business. The costs for establishing a dedicated satellite system were considered unacceptable, and the ASTRA Panel was disbanded.

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[58] Araya A., "Recent Activities of INTELSAT Benefiting the Developing Countries"(1987)15:1 *J. Space L.* 64 at 65*ff.*

[59] Elbert B. R., ***Private Telecommunication Networks*** (USA: Norwood, Artech House *Inc.*, 1989) at 141; see also, *"Global Access Tele-Health and Education System"* (The Final Report of the International Space University, summer session, 1994, held at Barcelona: Spain) at XXXVI.

[60] Pelton, ***supra***, note 2, at 410.

[61] Freer D. W., "Applications of Satellite Communication Technologies to International Civil Aviation"(XII/1986)53 ***Telecommunication J.*** 710 at 712.

Nevertheless, the dedicated civil aviation satellite system was maintained in the context of the AEROSAT programme. In the early 1970's the idea of sharing satellite capability with maritime mobile satellite services became more agreeable, and the ITU, IMCO, and ICAO focused on shared radio frequencies for aeronautical and maritime services. In the beginning of the 1980's, according to the Committee of the AEROSAT Council, the idea of sharing satellite systems for the benefit of civil aviation was raised. The AEROSAT Council suggested that the INMARSAT system might be suitable for such a sharing arrangement.[62]

The USA also believed that substantial advantages might well accrue for joint maritime and aeronautical capabilities.[63] As a result of the Final Act of the International Conference on the Establishment of a Maritime Satellite System, it was recommended that plans should be made by INMARSAT for the institutional, financial, technical and operating consequences of multipurpose satellites providing both a maritime and aeronautical mobile capability.[64]

The cost of some vehicle electronics will become less expensive through mass production that results from a wide variety of users of aeronautics, maritime and land satellite applications.[65] One can also expect that installation of the new systems avionics on board aircraft will become more generalized. Aeronautical communication could be shared with other services through the assignment of exclusive channels for aeronautical mobile safety communication.[66]

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62 *Id.* at 711*ff.*

63 That was the USA view on the sharing concept, as introduced by its representatives at the International Conference on the Establishment of an International Maritime Satellite System, ***MARSAT/CONF/WP-14*** (February 19, 1976), at 1.

64 Final Act of the International Conference on the Establishment of an International Maritime Satellite System, ***IMCO* 69**, London 1976.

65 Eydaleine G., "Navigation by Satellite the Next Step for Civil Aviation"[March 1988] ***ICAO Bulletin*** 16 at 16.

66 "Air Mobile Communications could Go Global with Satcoms: Mitre Exec"(December 22, 1989)3:11 ***Mobile Satellite Reports*** 4 at 4.

Aeronautical satellite service by sharing or leasing the space segment from or with another satellite service[67] seems to be a promising option. This is because civil aviation has acquired experience in the use of satellite communication by its association with international, public and private organizations, *inter alia*, INMARSAT, SITA and ARINC, which are competing to provide the service to civil aviation.[68]

The conclusion is that when it comes to economical and efficient use of limited resources, there are many reasons to consider a possible integration of existing and planned systems. Furthermore, sharing the aeronautical system with other users offers economies of scale to the benefit of users, and gives aviation the possibility of a low cost, low risk and immediate entry into the satellite age.[69] Obtaining right of use and access to shared services seems, in terms of contemporary international legal science, more sophisticated than the direct ownership of particular dedicated hardware in outer space.

This writer is of the opinion that a starting point in the achievement of satellite service to the aviation industry is the outcome of ICAO's new systems standardization measures. This will limit the transition costs since the same avionics would remain on board aircraft, and the cost of the major parts of the ground and/or space segments would be shared. This would minimize cost during the transition period. As the aviation industry's financial situation improves so too will the ICAO member States', as well as the worldwide community's confidence in satellite service implementation and its benefits to civil aviation. Ultimately, this could be prospect for ICAO member States to join a regional, global suitable systems or even considering the concept of a dedicated civil aviation system if it proves operationally desirable and economically feasible.

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67 Kabuga W. K., "Satellite-Based Technologies will Greatly Improve Air Navigation in African Region"[January/February 1994] *ICAO J.* 20 at 20.

68 *ICAO FANS I-WP/7*, at 2.

69 Ryan, *supra*, Chapter III, note 101, at 16.

3. Radio Frequency Band Sharing

Recently, there has been a move towards sharing individual transponders by users of different services in order to maximize the operational use of a satellite.[70] Many systems, other than aeronautical mobile systems, have suggested that they operate in the same bands as aeronautical services.[71] This has resulted in proposals to change the allocation from AMS"R"S to mobile satellite service.[72]

Consider also the fact that a shared transponder has its own technical problems, *inter alia*, it will cause a diversion of transmitted power from the satellite; the transponder has a limited power supply which, when shared by different users, reduces the power available to all users.[73] Advancement in technical efficiency in orbit and spectrum utilization may furnish adequate capacity at a fair cost for all future requirements, such as *time sharing concept, space sharing concept, and the concept of merging different service in one.*[74] This would permit the ITU to avoid what is likely to be the greatest challenge it has ever had to face, namely how to share limited

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[70] Frequency bands sharing have been preferred for many reasons, *e.g.*, "*transponder bandwidth too large for specified service, desire of main channel operator or transponder owner to maximize revenue and maximization of available satellite capacity.*" See, Rose J. L., "Multiple User of Satellite Transponders" (Address to the Section on Business Law Committee, *IBA*, on the *9th* Conference, London, September 1987).

[71] As land mobile, search and rescue services.

[72] The idea being that a mobile satellite allocation will make more efficient use of the spectrum since it is accommodating a broader range of services.

[73] Rose, *supra*, note 70.

[74] In brief one technique to multiply the transmissions is to regulate their operation by scheduling a certain time for every transmitter on a designated frequency, that is known as *time sharing* which is prominent solution, although it is not practical for use between adjacent States; another solution is known as *space sharing* which is more adaptable than time sharing concept and is only restricted by the state of technology; see more, Fleming D. J. & Ducharme E. D., "Technical and Legal Compromise in International Radiocommunication Regulation" in Bacelli, *supra*, Chapter V, note 41, 74 at 78*ff*; second approach is to revise the Table of Frequency Allocations to *merge different services*, *e.g.*, merging all mobile satellite services into a single mobile satellite service, and making the allocations to the more generic mobile satellite service. This would reduce the number of different services to be allocated, and should provide greater flexibility to the spectrum users.

resources for satellite communication between users from various States in a manner which appears to be fair.

In the report of the ITU Voluntary Group of Experts concerning the revision of the ITU Radio Regulations there is a recommendation to merge land mobile, maritime mobile and aeronautical mobile into one mobile service as a basis for designation of frequencies in services. This writer supports and shares the ICAO position that merging of all mobile satellite services certainly will have serious negative repercussion of the AMS(R)S.[75] This situation will be worst if the *first-come first-served* concept will be applicable, where aeronautical services implementation would be seriously disadvantaged. Aeronautical services must be treated separately by the ITU with respect to frequency allocation. If aeronautical services are treated as just another user of the electromagnetic spectrum, it could reduce the margin of safety. And this margin is fundamental for the effective management of aeronautical mobile services which support aviation operations.[76]

On December 11, 1970, the ICAO Council recognized that a possible use of shared frequencies was a shared emergency, search and rescue system. The International Maritime Consultative Organization Panel of Experts on the establishment of a maritime satellite system, also regarded this as appropriate.[77] In addition, the demand for shared use of radio frequencies was acknowledged in 1971 by the ITU Conference, which said that specific frequency bands should be allocated for both maritime and aeronautical mobile satellite communication services. Nonetheless, both INMARSAT and ICAO have been very cautious with respect to the idea of sharing. ICAO has been concerned about the potential unfavourable effects of extensive sharing of frequency bands between

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[75] *ICAO, AN-WP/6923*, 20/6/1994, at A-6.

[76] ICAO Doc., *supra*, Chapter I, note 8, at 2-1.

[77] Von Noorden, *supra*, Chapter II, note 38, at 30.

maritime and aeronautical users. It has declared that such sharing is inappropriate, and that any proposition to this effect should be opposed.[78]

In the early 1980's the ITU, IMCO and ICAO were considering the idea of shared radio frequencies for aeronautical and maritime services. Spectrum sharing is not as desirable as having an exclusive band but it is possible. This particularly in MSS down-link where interference occurs between spacecraft and receiving terrestrial stations and receiving terminals.[79]

At the first ITU Space Radio Conference in Geneva in 1963, the band 1540-1660 *MHz* was allocated to the AMS"R"S for the use and development of communication systems using space techniques. At the second ITU Conference of 1971, this 120 *MHz* of aeronautical mobile spectrum space was reduced to two small sub-bands of 15 *MHz*. The rest was divided between the maritime and other services. A further reduction was made to aeronautical allocations at the 1979-WARC.[80] At the 1987-WARC for mobile services, the frequencies allocated to the AMS"R"S were reduced again. However, the impact on aeronautical interests of the decision taken at that Conference was not as severe as it might have been. In 1987 there was adequate spectrum allocated to accommodate all known requirements. Unfortunately, this is no longer true.[81] Also, the 1987 WARC introduced rule 729A to the ITU Radio Regulations. Under this rule, non-safety services and public correspondence must cease immediately if they block flight safety messages. These flight safety messages are enumerated in the priority order of

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[78] *IMCO Doc*. MARSA II/6 (January 25, 1973) at 2.

[79] "MSS Industry Pressured to Increase Spectrum Efficiency as WARC Nears"(June 22, 1990) 4:3 *Mobile Satellite Reports* 6 at 6.

[80] *ICAO FANS/I-WP/II* (1984), at 1.

[81] Shilling F. L., "WARC' 87 Cuts Aero-Mobile Frequency Allocation"[December 1987] *ICAO Bulletin* 13 at 15.

Article 51 of the ITU Radio Regulations.[82] In view of the ITU Radio Regulation no. 3633 which states that:

> *"[a]dminsitrations shall not permit public correspondence in the frequency bands allocated exclusively to the aeronautical mobile service, unless permitted by special aeronautical mobile regulations adopted by a conference of the Union to which all interested Members are invited. Such regulations shall recognize the absolute priority of safety and control messages."*

It is a clear indication and recognition that the safety messages must be in priority to the non-safety. It remains to be seen, as has been stated by M. Milde:[83] *"how such a priority could be practically implemented in a fully automated system and in a multi-provider and multi-user environment."* As a way of solving this problem, this writer shares the opinion that one option is to remove all non-safety communication from the AMS"R"S frequencies and move them to non-safety aeronautical frequencies, in other words to utilize the normal MSS frequencies.[84] At the 1992-WARC, additional radio frequency spectrum was allocated to mobile satellite services.[85] The decisions taken at the conference clears the way for the future of the MSS. The Conference recognized that many of the new allocations will require new mobile satellite services to coordinate closely with other spectrum users to avoid interference.[86]

In the final analysis, the following factors must be taken into account in determining aviation's spectrum requirement:

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[82] The flight safety messages are: (a) distress calls, messages and traffic; (b) communications preceded by the urgency signal;(c) communication relating to radio direction-finding;(d) flight safety messages; (e) meteorological messages; and (f) flight regularity messages.

[83] Milde, *supra*, Chapter V, note 41, at 225.

[84] Kaiser, *supra*, Chapter V, note 30, at 18.

[85] Rothblatt M. A., "Report on ITU's 1992 World Administrative Radio Conference in Torremolinos, Spain"(1992)20:2 *J. Space L.* 39 at 39*ff.*

[86] "WARC Maps Satcom Future"[April 1992] *Ocean Voice* 8 at 8.

"i. prospective changes in technology; ii. the future need for either new services or changes in current services; iii. the expected number of participants in the system; and iv. the anticipated distribution of aircraft in representative areas ranging from high-density traffic environments, to oceanic, and to low-density operation in developing parts of the world."[87]

Furthermore, for reasons of safety and priority, access to the service, the portion of the spectrum allocated for satellite air navigation/communication must be for the sole use of international civil aviation.[88] The integrity and availability of communication services must be of the highest order and must be guaranteed at all times. Also, aviation services should not, at the current state of unclarity, accept the redesignation of the present AMS(R)S bands to the generic allocation of MSS or any form of dynamic simultaneous operation with other mobile satellite services. It should be kept in mind that a division of power problems exist between the ITU regulatory authority in the Radio Regulation Articles 47 to 53, which give the ITU the competence to regulate matters related to air navigation safety, and ICAO on the other hand in the Chicago Convention Article 37, has the same right in relation to AMS"R"S through frequency allocation, particularly in connection with the safety of air navigation.[89] In this writer's opinion all aeronautical mobile service regulations in the Radio Regulation Chapter X should be at least under the auspices of joint ITU/ICAO delegation if not delegated totally to ICAO in order to achieve consistency and regulatory compatibility for the safety of air navigation.

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[87] ***ICAO FANS WG/2 WP/19*** (Paris), at 2A-2.

[88] ***FANS/1-WP/11, Appendix***, at 2.

[89] Masson-Zwaan T., "International Telecommunications and ITU Developments" (Address to a Conference on the Law, Police and Commerce of International air transport and Space Activities, Taipei, May 26/31, 1991).

E. CNS/ATM Systems Control, Ownership and Operation

It is evident that the majority of the ICAO contracting States and user(s), or service provider(s), lack certain guidelines in any CNS/ATM global controlled system. From the point of view of the system user(s), they need something that is global, reliable, and sufficiently accurate in order to fulfill their needs. They also favour an inexpensive service, one that is automated, simple to use with a guarantee of continuity, and a system that is stable, one which cannot just be turned *ON or OFF* at the will of a single State. Furthermore, governments would favour a universal, non-discriminatory system, accessible to all. They would certainly choose a system which they can control, even if they have to pay for this, and the service providers need users to reimburse them for services which are furnished. However, the main institutional aspects in the global introduction of sole means GNSS are related to establishing the continuous availability of relevant services to sovereign States. International acceptability depends to a large extend on the distribution of the elements "control", "ownership" and "operation" among the user States and service providers. In the following, CNS/ATM systems control, ownership and operations are briefly presented in order to highlight their impact on a State's decision.

1. CNS/ATM Systems Control

The FANS Committee defined the Control as:

> *"...the competence to exert control over policy and to define the framework for operations. Exerting control means, e.g. to influence standard setting, and to define procedures and financing arrangements. It also means influencing continuity, availability and quality. Control will therefore provide the State ATS authority with the influence and/or jurisdiction to derive at the level of safety, liability arrangements, funding and cost-recovery mechanisms, management structure and procurement policy as required by the State ATS authority."*[90]

[90] ICAO, *supra*, Chapter II, note 80, at 6-7.

This means that system control is the most significant institutional factor and requirement for adequate assurance that the system could fulfill the service user's needs. System control is a basic factor in the ability of a system to achieve its purpose and reduce interruptions in service,[91] and to reach assurances on the required level of safety. When the service is furnished by an international institution or agency, no specific State should have control over the system in periods of national emergency. This is in the interest of the entire civil aviation industry. Consequently, in order for any intercontinental system to be generally accepted it must be understood that primary activities will not be subject to political influences.

In the FANS Committee's view, control will influence continuity, availability and quality of service; accordingly, it is considered to be the most important factor in the system, as opposed to ownership and operation, and by means of institutional agreements that give an adequate degree of control, a State can influence the system in operation.[92] If the system is exclusively controlled by one country, the users become subject to denial of access by the governing agency.[93] On the individual State level, as long as air traffic service authorities have control over aspects related to their basic responsibilities, every stage of the evolutionary path can be made institutionally feasible. For example, European administration and industry is worried about the dominance in the near future of GPS/GLONASS over global navigation and ATC. They call for ICAO to harden its stand on formulating a global scheme on GPS/GLONASS control and management.[94]

Nevertheless, it should be clear that the level of system control may vary depending on the providers if they are State or intergovernmental organization or private

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91 Weber F. W., "Multiple Satellite Operations and Management"(1980)23 ***Collo. L. Outer Space*** 592 at 593.

92 ICAO, ***supra***, Chapter III, note 49, at 6.

93 Rosetti C., "Mobile Communications, Navigation and surveillance" (1987)16 ***ACTA Astronautica*** 265 at 278.

94 Butterworth-Hayes Ph., "Satellite Divisions Persist"[March 1994] ***Jane's Airport Review*** 23 at 23.

entities, and has to be arranged through agreements and/or international regulation. This writer of the opinion that new systems must operate according to the ICAO's SARPs, and its policy should also maintain the general institutional guidelines, institutional guidelines for AMSS, institutional arrangement for ATN and institutional arrangements for GNSS.[95] It is felt also that ICAO must promote a common approach to the certification in the technical and operational aspects of the systems.

2. CNS/ATM Systems Ownership

The FANS (II) Committee, in its 4*th* meeting, defined the meaning of ownership as:

> "... *the quality* ... [of having or holding] *GNSS space segment as property, which provides the owner with a number of rights and obligation, within the boundaries of laws, regulations and agreements (e.g. the right to dispose of the property, the right to manage it, the right* ... [to] *the fruits of the property, etc.).*"[96]

Ownership, in international law, is normally seen either in terms of private rights under national law, which may become the subject of diplomatic protection and State responsibility, or in terms of territorial sovereignty.[97] Commercial property carried into outer space, or constructed in outer space or on a celestial body is unaffected by its presence in outer space. However, commercial property is subject to the jurisdiction and control of the country of registry which carried it into space as stated in OST Article VIII. This was elaborated upon by the Registration Convention.[98] Still, the OST does not discourage nations from owning national satellites. Ownership can be shared or distributed, however, through various means of control, the State ATS authority can

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[95] ICAO Doc., *supra*, General Introduction, note 26, Appendix A to the Report on Agenda Item 8, at 8A-24*ff.*

[96] ICAO, *supra*, Chapter II, note 80, at 6-7.

[97] Brownlie, *supra*, Chapter VI, note 192, at 428.

[98] *Registration Convention*, *supra*, Chapter VI, note 211; see also, Young A. J., "A Decennial Review of the Registration Convention"(1986)XI *AASL* 287 at 287*ff.*

influence operations, management, quality level, continuity, cost and procurement. As illustrated later in the next Chapter, this writer is of the opinion that the framework of new systems should be based on an international agreement for service provider(s) provisions that to be formulated and adopted under ICAO auspices.[99] As the Rapporteur to the 29*th* ICAO Legal Committee pointed out in his report, in this case the establishment of a regulatory institution would be responsible for the supervision and oversight of GNSS providers but it would not have ownership of the system.

3. CNS/ATM Systems Operation

The management of the systems must take into consideration the participant States as well as the non-participants; or it should assure the non-participating States, in particular LDCs, that their needs will be fulfilled in the operation and management of the system. INTELSAT, for example, allows the participating States to be involved in system operation. According to FANS Committee:

> "[operation] *is the provision of a GNSS system and the GNSS services in compliance with the Standards and Procedures as defined by the civil aviation community. The operator of the space segment is tasked with the day-to-day management of the space segment. The operational functions may include technical management, financial management and commercial management.*"[100]

This means that operational functions may include, technical, financial and commercial managements. It must be kept in mind that the GNSS system must be maintained at a high standard in order to insure the continuity of service which is essential for flight safety; therefore, the new systems must operate according to the ICAO's SARPs and its policy (as stated earlier) with respect to the system control. Regardless of the system ownership this writer considers operation a key element which reflects directly on the quality and availability of service.

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[99] See this writer's view on such agreement, *infra*, Chapter VIII, at P. 340.

[100] ICAO Doc., *supra*, Chapter II, note 80, at 6-7.

F. The Space Privatization, Commercialization, Liberalization/ Deregulation, and GATT Impact on the CNS/ATM Systems

Not too long ago it was believed that only the State itself could execute ATM and aeronautical CNS. The move towards commercialization, liberalization and privatization has changed these attitudes. Privatization of ATS may lower the general resistance of States to the introduction of international ATS.

As indicated in some views, in the current political and economic atmosphere in which the aviation industry operates, the most significant and far reaching changes are transpiring as a result of deregulation and liberalization.[101] Both in North America and in the European Union, liberalization, deregulation and privatization, and the move to single, open markets are well under way. In the following, we will briefly address issues of privatization, commercialization, liberalization/deregulation, and GATT with respect to their general effect on the civil aviation industry, and specifically, their impact on the implementation of CNS/ATM systems.

1. Privatization

Privatization means the transition from government to the private sector of some or all of the control, operations, management and/or ownership of State-owned industries.[102] In general, there are many reasons for privatization, *e.g.*, some countries consider privatization as a matter of political philosophy, in other countries privatization is to escape the responsibility for massive new injection of capital in competitive markets. The tremendous interest created by space activities provides motivation for private enterprise to invest, and to take part in new services such as communication.[103]

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[101] Soeparno M., "Responding to Global Challenges"(March/April, 1990)60 *ITA Magazine* 19 at 19.

[102] Steptoe E. J., "Regulation of Private Commercial Space Transportation by the United States Department of Transportation"(1985)28 *Collo. L. Outer Space* 240 at 243; see also, Katz J. E., "New Directions Needed in U.S. Space Policy" in Papp & McIntyre, *supra*, Chapter VI, note 264, 46 at 52.

[103] Qizhi, *supra*, Chapter VI, note 256, at 334.

Privatization can generate improvements in the telecommunication domain which will contribute to the overall economic and social growth; it will also improve and enhance primary services.[104]

Many INMARSAT signatories have evolved from government-owned monopolies to private companies that compete openly for mobile communication services. For instance, on July 1, 1993, *Deutsche Bundespost Telekom* of Bonn privatized operation of its mobile communication business.[105] New INMARSAT plans will carry the organization and its members into crowded consumer markets, potentially competing with successful companies like Motorola *Inc*, and others. It was very astutely stated by an INMARSAT official that:

> *"[w]e recognize that the management of the early 1970s, when INMARSAT was a purely inter-governmental organization, now has to move to a more business-oriented approach."*[106]

The privatization of INMARSAT cannot be eliminated as a probability. And the fact that this issue is being addressed at all is indeed a frightening prospect for many of INMARSAT's members. Others see INMARSAT privatization as an unrealistic alternative.[107] INMARSAT may be pushed to shed its status as a multinational consortium if it wants to participate in the global trend to secure absolute access to

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[104] Lerner N. C., "Telecommunications Privatization and Liberalization in Developing Countries" (May 1991)V:58 ***Telecommunication J.*** 279 at 286.

[105] Vollmer A., "Deutsche Telekom Privatizes Mobile Communications"[June 28, 1993] ***Electronics*** 11 at 11.

[106] Koulaouzos D., the Australia's INMARSAT Council member from OTC Maritime of Sydney; see, Marcus D. J., "Inmarsat: Ready for Business?"[November 30-December 6, 1992] ***Space News*** 3 at 29.

[107] ***Ibid.***, as an alternative option to making INMARSAT more business oriented, is to elect independent council members who would serve the financial interests of shareholders only. As a result, the organization signatories and earth station operators still could be shareholders but they could not sit on the council.

telecommunication markets.[108] Other satellite organizations, such as INTELSAT, are also feeling the pressure to become more commercial. At the moment, INTELSAT faces competition from private international satellite operators who are launching new satellites and offering creative new services.[109]

There are other views which believe that, as a consequence of privatization and deregulation policies, the new satellite systems threaten not only the already operating agencies' economic well being, but limited natural resources, *inter alia*, GEO positions and radio frequency spectrum.[110] Even so, there is no doubt that competition will improve the efficiency and innovation of these services.

In one commentator's view, privatization is the major culprit in the landing fees increase in Europe, and he also predicts that it will be a serious problem in the future.[111] The director of EUTELSAT also criticized the shifts toward privatization by the INMARSAT and INTELSAT organizations. In his view, any move by INMARSAT, INTELSAT or EUTELSAT toward privatization may create numerous risks for smaller organizations whose concerns would be shunted aside by the more forceful nations. He also questions whether INMARSAT's move to modify its status would mean anything; as he stated the issue is not how to be more commercially free, but to retain the trust of smaller nations.[112] Another view sees that complete privatization will guarantee that INMARSAT and INTELSAT satisfy their users' requirements in a competitive

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108 INMARSAT has agreed to decrease the price of its mobile communications services as an element of its planned change into a private enterprise in a competitive marketplace. The price cuts will include the whole range of its services in the aeronautical, maritime and land-mobile communication. That indicates, in some views, that the organization is moving much more to the business climate; see, Selding P. B., "INMARSAT's Lower Rates to Signatories Could Benefit Users"[November 29/December 5, 1993] ***Space News*** 16 at 16.

109 See in general, ***supra***, Chapter II, at P. 70*ff*.

110 Jakhu, ***supra***, Chapter II, note 221, at 98.

111 Butterworth-Hayes Ph., "Airlines Present Flawed Case for Overcharging"[September 1993] ***Jane's Airport Review*** 29 at 31.

112 De Selding P. B., "EUTELSAT DG Blasts INMARSAT"[November 15-28, 1993] ***Space News*** 1 at 1, 28.

atmosphere.[113] INMARSAT has taken steps to transform the corporation into something similar to a private company.[114] In this writer's opinion since the signatories are agencies, represent INMARSAT's parties and are its investors, they will continue to safeguard their governments' policies in such way that we will not see much of a change.

A commentator has stated that privatization is a business-oriented concept and not a true privatization of outer space.[115] The commentator justified his view on the basis that there will not be any participation by private entities in space activities without government support. Others say that it is a given that private entities will require their governments' protection, for instance against unfair foreign competition.[116] In another commentator's view it seems likely that States will remain wholly liable for national space activities, and will have to supervise them in the future.[117] This writer favours the USA Vice President Al Gore's view that privatization will:

> "[inspire a] *telecommunications policy that encourages private investment, promotes and encourages competition, and ensures a flexible regulatory framework that keeps pace with rapidly changing markets and technologies.*"[118]

This is a clear indication that whatever the reasons for privatization, one of the primary motivations of economic nationalism is removed. It is not to state that privatization will abolish nationalism, but definitely will diminish it and give more chance for private entities to join space operations and provide CNS/ATM systems services.

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[113] Crockett B. L., "Privatize Inmarsat and Intelsat"[March 7/13, 1994] ***Space News*** 19 at 19.

[114] De Selding P. B., "Key Player Discussing Independent Satellite Phone Plan Based on Consortium Technology"[March 14/20, 1994] ***Space News*** 1 at 20.

[115] Hurwitz B. A., "Liability for Private Commercial Activities in Outer Space"(1990)33 ***Collo. L. Outer Space*** 37 at 39.

[116] Fuqua D., "Space Industrialization: Some Legal and Policy Consideration for Private Industry"(1980)8 ***J. Space L.*** 1 at 3.

[117] For more details see, Kolossov, ***supra***, Chapter VI, note 233, at 66.

[118] As cited in Crockett, ***supra***, note 113, at 24.

2. Commercialization

The commercialization of space activities is no longer an academic question, it is the result of new space technology. Space commercialization involves the selling of services, such as satellite communications, the launching of space objects, remote sensing, *etc.* Space activities are developing rapidly and space commercialization has been on the rise in both States and private enterprises.[119]

Commercialization does not necessarily mean that each space activity must return a profit. Private enterprise in technically advanced areas is used to the fact that it has to invest in development in order to generate a revenue.[120] Economic purposes themselves are now the mainspring of space attempts. Therefore, one of the main differences between privatization and commercialization is not the actors, but rather, their goal.[121] Because of both the qualitative and quantitative shifts in space activities and the difficulty of raising funds, nearly all States, at least in western market economy, have begun more direct involvement in private enterprise.[122] The LDCs voice concern over domination by industrialized countries. They fear for their communications and information activities, as well as for the data gathered on their natural resources as a consequence of the commercialization of outer space activities, *inter alia*, communication and remote sensing.[123]

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[119] Qizhi, ***supra***, Chapter VI, note 256, at 333*ff.*

[120] Niederau G., "Economic Benefits of ESA Contracts"(1979)18 ***ESA Bulletin*** at 48.

[121] While the *States* involved in the space activities are interested in furthering the international prestige of their countries and international cooperation, the *private entities* are interested in making profits.

[122] Bockstiegel, ***supra***, Chapter VI, note 173, at 177.

[123] Levine A. L., "Commercialization of Space: Implications for U.S. Relations with Developing Countries" in Papp & McIntyre, ***supra***, Chapter VI, note 268, 119 at 122.

Some observers feel that the commercialization of space activities can be considered a threat to global peace and security.[124] While several countries seek to foster space launch vehicles, even more are concerned about ballistic missiles. Thus, without reliable arrangements, the commercialization of space technology may be adding to the already massed genus of unexpected results.

In any developments of law regulating commercial utilization of outer space, attention should be focused on the attempts to insure that commercialization will carry more opportunities and advantages and less negative effects. This applies both to developed countries and the LDCs. The principal requirement of reaching such a goal is the worldwide cooperation on a global, regional or bilateral basis.

Many parts of the law dealing with commercial activities on the surface of the earth will now become relevant for space activities. This may require new interpretations and sometimes adaptations of these parts of commercial and economic law. It has been stated that:

> "*...with the current proliferating scale of space commercialization, the manufacture, ownership and launching of a space object may be attributed to different countries, and thus the issues become more complicated.*"[125]

It must be clear that there would be many participants in the space activities in which each or some of them will be attributed to different country. This will create conflict of laws between the States concerned. On the other hand it will lead to mor competition between CNS/ATM service provider(s) which will be for the interest of the service user(s).

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[124] Karp A., "The Commercialization of Space Technology and the Spread of Ballistic Missiles" in Papp & McIntyre, *ibid.*, 179 at 179*ff.*

[125] Qizhi, *supra*, Chapter VI, note 256, at 337.

3. Liberalization/Deregulation

Liberalization is allied with privatization in that it is the development of the political and regulatory factors which assure that privately-owned systems will perform efficiently and for the public benefit. There is a shift in the satellite telecommunication system to commercial orientation, which in turn will lead to an increased, enhanced telecommunication infrastructure, and then most probably contribute to the country's economic growth.[126]

Probably the most significant liberalization developments outside the USA have taken place within Europe, particulary surrounding the air transport liberalization initiated by the European Union. In preparation for the institution of the Single Market on January 1, 1993, the European Community has already passed, in three phases, a number of liberalizing measures concerning market entry, capacity sharing, traffic approval, and the application of anti-trust provisions. It is expected that for peripheral States, with liberalization of air transport in Europe, air traffic movements and the number of passengers travelling will increase congestion problems on the ground and in the air.[127] On the other hand, it is the President of ECAC, D. Moss'[128] view that:

> *"[a]ll concerned should benefit from liberalization. Travellers should benefit from the wider choice of services and airlines should benefit from being able to design services to match what they judge the market to want."*

This a clear indication that in a deregulation and liberalization environment air transport participants will achieve more freedom to market and self-adjust in order to meet the market demand. Deregulation was enacted by the USA Congress in 1978. Since then there seems to have been a ripple effect of liberalization across the aviation world, albeit a slow one. As has been emphasized,[129] aside from the USA, not many countries

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[126] Lerner, *supra*, note 104, at 280*ff.*

[127] *ICAO Doc.* A27-WP/82, EX/22.

[128] Moss D., "The ECAC Outlook"[5/92] *IATA Review* 5 at 6.

[129] Koo, *supra*, Chapter VI, note 129, at 83.

are ready to liberalize their air service agreements.[130] However, major change occurred in the 1980s, and the deregulation effects on communication and the air transportation industry was tremendous.[131] The nature of service patterns began to change very rapidly. This resulted in an enormous strain on airport facilities because all aircraft were attempting to take off and land at the same time, and there were many passengers in the airport terminals at the same time. That resulted in lengthy delays and a large number of passenger complaints. Furthermore, deregulation did not work for the benefit of airline employees and is not working for the consumers either.[132] Additionally, since air transport is essential in today's economic climate, the philosophy of *Laissez-faire* toward this service will, in the long run, weaken a country economically.[133] The European industry fears that without government aid in research, it will be thrown out of business by USA enterprises as Europe shifts to deregulate its telecommunication sector. The reason being that deregulation will make USA products more attractive and possibly less expensive.[134] Some critics have asserted that the intense competition unleashed by deregulation has a deleterious impact on servicing and safety standards.[135] J. Shane brushed aside these allegation by stating:

> "*[h]ave the economic gains* [of deregulation] *come at the expense of safety? Absolutely not. The record shows that since 1978, air safety in the U.S. has improved markedly... . Since 1978, the rate of accidents per hundred thousand aircraft hours flown has fallen some 26 percent. For the big scheduled carriers, the accident rate per number of departures has*

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[130] Notable exceptions are the countries with limited domestic market bases, normally with fruitful airlines, such as Singapore and the Netherlands.

[131] The ARINC Story, *supra*, Chapter II, note 17, at 122.

[132] Hall R., "Deregulation in the United States"(December 1987)8 *IFALPA Quarterly Review* 28 at 28*ff*.

[133] *Ibid.*, at 32.

[134] De Selding P. B., "Europe Struggles to Keep Up with Competitors"[January 24/30, 1994] *Space News* 10 at 10.

[135] Soeparno, *supra*, note 101, at 20.

been halved... . There is no evidence that airlines have cut corners on maintenance. A 1968 study commissioned by CAB and repeated in 1986 by the DOT found no correlation between airlines profitability, liquidity, or debt level and the amount spent on maintenance."[136]

This is a clear expression that safety has not been compromised as a result of deregulation. Also, this writer supports J. Shane's view that the deregulation economic gain does not occur at the expense of the flight safety measures. In a deregulated environment the USA domestic airlines are able to lower fares, airlines inspire discretionary travellers to fill seats which might have flown empty. With higher profits, there was satisfaction among consumers and airlines. The current USA Administration policy favours a liberal multinational aviation framework which is committed to a global *open skies* policy, as stated in the report issued in January, 1994 by the Department of Transportation. The report says that any USA carrier seeking approval from the government for an international route will have to "*provide any plans it has developed for protecting potentially displaced workers.*"[137]

On the other hand there is also the view that operating standards will improve as a result of the greater competition which results from the process of deregulation.[138] For example, ARINC has always provided communication for aviation's special needs that cannot be served by common carriers. In a deregulated industry, there will be less incentive to rely on ARINC to develop systems on a common basis. Individual airlines will concentrate their efforts on creating services that will benefit only themselves.[139] In another view, deregulation will mean that more services will be offered, which it is

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[136] Shane J., "The U.S. Perspective on the International Air Transport Regulatory Environment" (Address to the Air Canada/AMDA Conference, Montreal, Canada, May 25, 1987).

[137] As cited in the "USA Pledges to Tear Up the Chicago Convention"[January/February 1994] *ITF News* 16 at 16.

[138] *Ibid.*, at 20.

[139] The ARINC Story, *supra*, Chapter II, note 17, at 123.

in the interest of user(s) in general,[140] and the CNS/ATM systems service user(s) in particular.

This writer believes that in the forthcoming decades the multiplicity of mobile services will expand into various countries as the current move towards deregulation and liberalization of telecommunication continues to gather momentum. On the other hand there can be other perspective which is that deregulation was to open the market, but the actual result is that the market has narrowed in the sense that many airlines went out of business and the survivors are the oligopolistic *mega-carriers* hence one can say deregulation is not a panacea. Accordingly this writer sees that there is a need for a common-sense and enlightened course must be steered between excessive regulation and destructive *Laissez-faire* philosophy, possibly even allowing for the coexistence of different regulatory systems. Indeed, the Agreements reached in the Uruguay round of GATT 1993[141] show that all participating States recognize the contribution of liberal trading policies on the growth and development of their own economies and the entire world.

4. Satellite Communication and GATT

GATT's aim, as a multilateral treaty signed in 1948,[142] has been to initiate general principles and rules for the liberalization of global trade. GATT's focus is not only on trade liberalization, as traditionally observed, but also on furnishing a secure universal order for global trade that allows for orderly change, dispute settlement and legal security.

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[140] Lowenfeld A. F., "Competition in International Aviation: The Next Round" (Address to the International Conference on Air Transport and Space Application in a New World, Tokyo, Japan, June 2/5, 1993) at 6.

[141] Note by the GATT Secretariat on "Trade in Telecommunication Service" at ***MTN/FA III-2***.

[142] GATT was part of the attempt after World-War II to reshape the international economic system and institutions to avoid perceived mistakes of the pre-war era, see Jaenicke G., "General Agreement on Tariffs and Trade" in Bernhardt R., *ed.*, ***Encyclopedia of Public International Law*** (Instalment 5, 1983) at 20; see also, Hudec R. E., ***The GATT Legal System and World Trade Diplomacy***, 2*ed*. (USA: Butterwort Legal Publishers, 1990).

Today there are considerable efforts to restructure the telecommunication rules by introducing competition and gaining some authority over telecommunications and trade institutions that assist current political constituencies. Telecommunication networks and services play a fundamental part in the globalization of economic ventures, and they certainly contribute to the current tension in the global economy.

At present, the universal trade of satellite communication has become a matter of concern because of the approach of competition, and the displacing of monopolies which has occurred not only in Europe, Japan and North America, but also in the LDCs.[143] As previously discussed, there has been increasing pressure, certainly from USA private satellite communication entities, to join the worldwide markets in competition with European and other international intergovernmental organizations.

The forgoing developments have raised many questions, including what future role international satellite organizations such as INTELSAT and INMARSAT should play under more competitive conditions. As private transoceanic cables or private satellite systems are concerned in the negotiations on telecommunication there are many controversial issues, such as competition between States for third-party transit services; telecommunication network-based services are furnished universally through public or private networks, such as traded services specially as in various countries, these services are obtainable on a competitive basis.[144] In the Uruguay round of GATT 1993, in its Ministerial Decision on negotiations of basic telecommunication, the following was decided:

> "*1. Negotiations shall be entered into on a voluntary basis with a view to the progressive liberalization of trade in telecommunications transport networks and services... within the framework of the General Agreement on Trade in Services.*"[145]

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[143] Wright D. & Gibson R., "Institutional Models: Examining Now Modes for Space Communications Organizations"(1991)VII ***Space Communications*** 303 at 305.

[144] ***Supra***, note 141, at MTN.TNC/W/52-7.

[145] ***Ibid.***, at MTN/FA III-7(d).

On October 1, 1993 the Group of Negotiations on Services (GNS) issued a revised text of the General Agreement of Trade in Services (GATS) which amended some of the text of the Annex on Air Transport Services but did not alter the basic substance from that tabled in December, 1991. The December 1993 round of Uruguay tasks concluded with a comprehensive package of agreements including the GATS, which retains the Annex on Air Transport Services with no substantial changes. The GATS provides a potential vehicle for an alternative regulatory regime for international air transport to that which has been applied for the past five decades in this sector. The liberalization of trade in telecommunication services is regulated by the framework GATS,[146] the Annex on Telecommunications,[147] the Schedules of Specific Commitments of participating States,[148] and the Annex on future Negotiations on Basic Telecommunications.[149] Without entering into the details of the agreement, it should be noted that it aims at liberalizing among Member States the access to and use of public telecommunications networks and services on non-discriminatory and reasonable terms and conditions, excluding the cable or broadcast distribution of radio or television broadcasting. However, the ICAO Council, at its 133*rd* Session in 1991, emphasized the need for a broader conference and, in April, 1992, to exchange views on a number of fundamental regulatory issues, including the possible applicability of trade concepts and principles to international air transport. Consequently, the Council adopted agenda for a global air transport conference held from 23 November to 6 December, 1994. This was oriented to an exploration of future air transport regulatory arrangements.[150] The Conference principal focus was on the development for the future of a full range of

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146 The documents are reproduced in International Legal Materials (1994)XXXIII:I at 44.

147 *Ibid*, at 73.

148 *Ibid.*, at 78.

149 *Ibid.*, at 78.

150 *ICAO' State Letter SC 4/1-93/97* of December 21, 1993; see also, *ICAO CONF/4 WP/13*, 26/9/94.

arrangements for the economic regulation of international air transport along with changes in the external environment in the form of new world trading arrangements developed through Uruguay round of GATT 1993.[151] However, not all participant States wished to make that transition immediately or even in the near future and some considered the current regulatory tools and their existing bilateral agreements to be satisfactory and capable of meeting their foreseeable national requirements and objectives. In this writer's view the discussion of air transport matters in GATT is an indication that air transport industry cannot be any more treated differently from other industries, and the current bilateral regime should be re-examined so as to adapt to new commercial climate. Also, close cooperation between ICAO and the World Trade Organization (WTO)[152] will be essential in view of the complexity of the air transport industry and the difficulties implicit in the different regulatory regimes and not to overlap or doubling efforts on identical issues. Yet major problems will continue to reside in the field of national implementation of supranational telecommunications policy and rules for years to come.

Section III: Institutional Planning Considerations and the Available Options for States

In the following we will briefly illustrate institutional planning and ICAO FANS Committee' views. Thereafter, an overall appraisal will be made of all these institutions.

A. The Planning and Transition Considerations

1. System Implementation Planning

It is apparent that there is a fundamental need for effective coordination planning on a global and regional basis, as well as a need for intra-regional and trunk route

[151] *ICAO AT CONF-/4-WP/81.*

[152] ***The International Legal Material*** (1994)XXXIII:13.

designs to be coordinated with State planning to implement the CNS/ATM concept. Careful planning will be necessary to ensure that aircraft of the future do not carry an excess of existing and new CNS equipment. Also, for reasons of economy and efficiency, there is a need to guarantee that differences in global rate of development do not lead to incompatibility between CNS/ATM systems.

(a) Implementation on State Basis

According to the Chicago Convention, States have a task where it is practicable to provide air navigation systems that is not absolute and is limited in its scope and nature, as been pointed out in Article 28 (a). However, the obligation of States is limited only to its territory, and no State has the obligation to provide air navigation facilities beyond its own territory. Furthermore, the Chicago Convention does not impose any specific determined level of facilities and services that are to be provided even in the sovereign territory of the State concerned. From this and because of State sovereignty principle in Article 1 of Chicago Convention we can draw a conclusion that the introduction of the new CNS/ATM systems within a territory of one State, on a regional and/or global basis, will require express consent of the States concerned. Therefore, it is important that every State should develop its own implementation plan.[153] Recommendation *no.* 8/2 of the 10*th* Air Navigation Conference of 1991 requested that:

> "... *States, in co-operation with other States as necessary, formulate plans, with a view to achieving timely implementation of the future CNS/ATM systems in conformity with planning at the regional level.*"

It should be borne in mind that any State's plans cannot be finalized without considering specifications by neighbouring States, and this requires better harmony of State plans within FIRs and adjacent FIRs.

CNS/ATM services could be provided by one State beyond its area of jurisdiction. However, there are some conditions which must be fulfilled, especially with respect to the sovereign rights of other States such as the rights to regulate their national

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[153] ***ICAO Doc.*** ASIA/PAC/3-WP/41, at 9.

telecommunication. The same principle applies to global systems which are provided by a single State. The American GPS and Russian GLONASS systems belong to this category. The unilateral services they offer have significant deficiencies, *inter alia*, the service can be revoked unilaterally for a political, economic or security reason, or for national emergency reasons. Even though the contractual agreements may decrease the above mentioned risks, they will continue to exist.

(b) Implementation on Global Basis

The new CNS/ATM systems will be global by nature because of the satellites' vast coverage areas. It was essential to develop a global system by coordinated implementation plan; the FANS Phase(II) completed developing that plan in September 1993. As P. Rochat, the ICAO Secretary General, stated:

> "*the global coordinated transition plan will not be a substitute for the regional plans, but rather a plan that provides general guidelines to serve as a basis for CNS/ATM - related regional planning activities and production of the detailed implementation plan.*"[154]

It is a clear indication that a global plan for the transition is needed as a general guideline for the regional or States' planning in order to get the benefits of the new CNS/ATM systems. Therefore, the 10*th* Air Navigation Conference in its Recommendation *no.* 7/1, requested to:

> " *a) complete and maintain a global co-ordinated transition plan with a view to facilitating the harmonious and timely development of global future communications, navigation, and surveillance... and air traffic management ...systems; and b) include the subject of global transition planning in its programme of regional seminars and workshops.* "

The FANS Committee realized that transition planning would be a complex matter between the demands of different airspaces, contrasts in technical and operational

[154] Rochat, *supra*, Chapter III, note 85, at 7.

maturity between several of the system components, and variations in investment schemes in various regions of the globe.[155]

The new systems' plans include various elements, *inter alia*, terrestrial systems, earth stations and air traffic services. The global arrangements should permit these elements to be furnished by different suppliers, and permit competition between service providers, while meeting ICAO SARPs.[156] The global plan should be a dynamic document, with updates anticipated from time to time.

(c) Implementation on Regional Basis

Regional cooperation should not be a protective and separated attempt, but a means to improve the merging to global air services network of the future. In the 10*th* Air Navigation Conference Recommendation *no*. 8/1 stated that the purpose of regional cooperation is to:

> *"a) accomplish the planning for implementation of the future CNS/ATM systems through the ICAO regional planning and implementation groups; b) ....;c) ensure that the terms of reference and working arrangements for regional planning and implementation groups adequately take into account their duties and responsibilities for the planning and implementation of future CNS/ATM systems in the respective region with adequate priority; d)..... ...."*

This is articulate that regional planning is a milestone in implementing the new CNS/ATM systems. As traditionally, ICAO's air navigation planning has been conducted through a regional planning process. Also in the past detailed new systems implementation planning shall remain a regional responsibility. Every ICAO region will be responsible for the development of the concept and the implementation strategy of its own future ATM. Some regions have been developing such plans for many years while others are just starting the process. A global plan should fulfil the following functions:

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[155] Turner J. E., "Global Coordinated Plan Under Way for FANS"[September 1989] ***ICAO Bulletin*** 26 at 26*ff*.

[156] ICAO CONF., ***supra***, note 150, at 27.

"[i] *provide guidelines for use by regional planning bodies, States, and users, for transition from the current air navigation system to the future system; and* [ii] *serve as a benchmark for the evaluation of implementation progress.*"[157]

For reason of economic and technological development differences, the new systems implementation calls for practical coordination of global, regional and inter-regional planning. It is clear that growth and implementation of new systems on a global basis should be accomplished through the continuing work of regional planning groups.

2. ICAO Policy on the CNS/ATM Systems and Its Impact

ICAO Council at its 141*st* Session on 7/8 February and March 9, 1994, considered a "*Statement of ICAO Policy on CNS/ATM Systems Implementation and Operation*" which is to be included in the legal framework for the provision of a *long-term* GNSS system. The Council approved the statement and requested the Legal Committee to incorporate, as appropriate, the elements of the policy statement in its proposals regarding a legal framework.[158] In the following we will examine the statement's principles and its impact on the new CNS/ATM systems.

(a) Universal Accessibility Concept

According to Article 15 of Chicago Convention the uniform conditions have to applied to the use of airports and air navigation facilities available for public use by national and foreign aircraft engaged in similar operation on equal basis. This issue underlies the philosophy of ICAO as the civil aviation specialized agency of the UN. Also Article 15 of the Chicago Convention provides a basis for this principle.

OST, in its Article 1, stipulate that the use of outer space shall be carried out for the benefit and the interest of all counties. As to satellite communication, international

[157] Ostiguy G. J. N., "Global Transition Plan is Key Reference Document for Planning Implementation of New Systems"[December 1993] *ICAO J.* 10 at 11.

[158] *ICAO LC/29-WP/3-2.*

organizations have been established for promoting and facilitating satellite communication services to all States such as INTELSAT and INMARSAT which function on the basis of non-discriminatory rights of access granted to their all member States. This gives effect to the OST Article 1, paragraph 1. The universal accessibility concept was specified as one of the acceptable general institutional guidelines presented by the FANS Committee (Phase II).[159]

From the above legal basis, as well as the States' practices in space, guaranteeing a universal accessibility is one of the fundamental elements to be taken into consideration in any institutional arrangements. Hence the new CNS/ATM systems must be accessible ɹ all States without discrimination. This principle is one of the fundamental principles underlying the philosophy of ICAO.

(b) Sovereignty, Authority and Responsibility of Contracting States

The principle of State sovereignty over the airspace above its land including its territorial waters is confirmed in Article 1 of the Chicago Convention which states: "*[t]he contracting States recognize that every State has complete and exclusive sovereignty over the airspace above its territory.*"

In addition, States have absolute jurisdiction to provide in its territories and airports, radio services and other air navigation facilities. They are also free to regulate technical matters as expressed in Article 28 of the Chicago Convention. Although CNS/ATM systems require one global standards, States will always reserve jurisdiction above their airspace.[160] As M. Milde stated:

> *"States do not have any pre-existing legal obligation to provide air navigation facilities or services beyond their sovereign territory. Express consent of states, possibly in the form of international agreements, will be*

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[159] ***Ibid.***, at 8A-24.

[160] As been stated: "*... automated handoff between centres and common message formats and protocols, should make those boundaries transparent to flight crews.*"; see, Sweetman B., "FANS: The Road to Realisation"[April/May 1993] ***Aeronautical Satellite News*** 15 at 16.

required for their participation and assumption of duties with respect to the operation of the new air navigation system."[161]

On the other hand, ICAO Assembly *Resolutions* continue to request that States ignore the national boundaries' limitations in ATC services planning. The requests are becoming edicts as the inexorable laws of aeronautical technology blur national boundaries in the interests of flight safety.[162] In view of the current events, this writer perhaps could support such requests; also, it is no exaggeration to say that they are needed to carry out ICAO's new CNS/ATM concept. However, States' authority shall be preserved in the coordination and control of communication and in the augmentation of satellite navigation services.

(c) Responsibility and Role of ICAO

ICAO cannot rest on the laurels it has earned in the past, but must adapt itself to this new reality if it is not to risk being overtaken either by technology or by the emerging roles of other global or regional bodies. According to Article 37 of the Chicago Convention the Organization shall continue to discharge the responsibility for the adoption and amendment of SARPs governing the CNS/ATM systems.[163] ICAO should coordinate and monitor the implementation of the new systems on a global basis. The Organization shall also provide the assistance needed to States in the technical, financial, managerial, cooperative and legal aspects of the systems implementations. Finally, ICAO's role in regard to communication and navigation in support of international civil aviation shall continue to be recognized.

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[161] Milde, ***supra***, Chapter I, note 2, at 98.

[162] Fitzgerald F. G., "Air Law 1972-2022"[May 1973] ***The Canadian Bar Review*** 264 at 269.

[163] See for more details, ***supra***, Chapter III, at P. 123*ff*.

(d) The Institutional Arrangements and Implementation

As explained earlier in Chapter II the new systems should as far as practicable use the existing organizational structure or modified, and shall be operated in accordance with existing institutional arrangements and legal regulations. The global coordination with full participation of States, service users and service providers through, *e.g.*, the ICAO regional air navigation planning and implementation groups, is the key to the realization of full benefits of the new CNS/ATM systems. The role of regional planning groups is of paramount importance to give impetus to ensure regional coordination of the implementation of the global plan through the various ICAO' regions. A free competition between all service providers should be maintained as long as they are complying with the relevant ICAO' SARPs. New institutional arrangements and legal regulations should not be established if the existing ones are satisfactory.

(e) The Global Navigation Satellite System

ICAO's Contracting States wish to exercise an appropriate level of influence over the management and control of the GNSS system. As starting point the GNSS should be implemented as an evolutionary progression from existing global navigation satellite systems, for example the American GPS and the Russian GLONASS systems. ICAO has a major role in the effort which is currently taking place internationally in order to achieve a civil, globally controlled GNSS at least for the *long-term* period.

(f) The Airspace Organization and Utilization

The airspace shall be organized so as to provide for efficiency of service. While no changes to the current FIR organization are required for implementation of the CNS/ATM systems, States may achieve further efficiency and economy through consolidation of facilities of services. The ultimate planning ideal must be a single continuum of airspace within which each aircraft can fly its optimum profile and be separated from all other air traffic. In the design of the future airspace structure, airspace boundaries and divisions should not prevent the efficient use of automated conflict detection and resolution techniques nor the exploitation of the advanced avionics of modern aircraft. The permanent segregation of airspace should be avoided in favour of flexible use of airspace; however, where it is necessary to cater for specific flight operations, *e.g.*, military, reservation of airspace for such events should be limited in time and space to the minimum required.

(g) Continuity and Quality of Service

Availability and continuity of service from the CNS/ATM systems, including effective arrangements to minimize the operational impact of unavoidable system malfunctions or failure and achieve expeditious service recovery, shall be assured. Also, service quality shall comply with ICAO's SARPs of system integrity and be accorded the required priority, security and protection from frequencies interference.

(h) The Technical Cooperation

ICAO should play its central role in coordination technical cooperation arrangements for the new CNS/ATM systems implementation. Also the Organization invites States in a position to do so to provide assistance with respect to technical, managerial, financial, legal and cooperative aspects of implementation.[164] ICAO recognizes the need for technical cooperation in the implementation and efficient operation of CNS/ATM systems.

(i) The Cost Recovery

Use of satellite services must not be discouraged or inhibited by the charging policies. Therefore, arrangements must not prevent States from being able to allocate costs among themselves, in accordance with the benefits provided to all sectors using the services. As Recommendation 7/2 ICAO conduct a preliminary cost-benefit analysis and business case analysis to determine the economic viability of a civil GNSS. Any recovery of costs incurred in the provision of CNS/ATM services shall be in accordance with

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[164] See for more details, *infra*, Chapter VIII, at P. 342.

Article 15 of the Chicago Convention and shall be based on the principles set forth in the Statements by the Council to Contracting States on Charges for Airports and Air Navigation Services,[165] including the principle that it shall neither inhibit nor discourage the use of the satellite-based safety services.

3. Needs in the Transition From 1996 to 2010

It is recognized that the transition period should be as short as possible to decrease dual system operations, and yet long enough to allow for an agreeable and safe transition without imposing undue strain on neighbouring regions. This would result in the necessity to plan at both global and regional stages.[166] The FANS Committee recognized three elements which would facilitate the transition period. They are related to the systems' *Certification*, *Specifications* and *User Involvement*.[167]

The FANS Committee distinguished four implementation periods for transition which will vary between regions of the world, and between system elements. Because of differences in the level of ATM in many regions of the globe and the variety of other elements influencing the transition, specific time frames for the transition cannot be defined. However, significant transition events are expected to occur as follows:[168]

"*Previous term*	*1991 - 1992*
Near term	*1993 - 1995*
Middle term	*1996 - 2000*
Long term	*2001 - 2010.*"

ICAO air navigation planning has traditionally been conducted through the regional planning process which directly involves member States. Introduction of the

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[165] *ICAO Doc.* 9082.

[166] *Ibid.*, at 10; the lengthy transition periods set a massive weight on the implementation of new systems, because the old and new systems will be in use during this period, see US Federal Aviation Administration, *supra*, Chapter III, note 42, at 23.

[167] ICAO, *supra*, Chapter II, note 80, at 4-24.

[168] *Ibid.*, at 8A-24.

ICAO CNS/ATM systems does not modify this process; the global coordinated transition plan will not be a substitute for the regional plans. Rather, it will be a plan that provides general guidelines to serve as a basis for CNS/ATM related regional planning activities as well as the production of detailed implementation plans. This additional step is necessary to ensure that future regional ATM systems and their supporting CNS services are inter-operable with adjacent ICAO regions, and that they meet the overall objectives of the global implementation plan.

Through ongoing participation in regional planning activities, States are responsible for the development of regional strategy for implementation of the CNS/ATM systems.[169] While implementation details will vary around the world, the different elements of the CNS/ATM systems must provide the level of sophistication needed to service the airspace concerned without leading to undue diversification or proliferation of avionics and ground segments.[170] Transition and implementation planning remain a regional duty. It is fundamental to preserve and enhance coordination between global and regional planning activities through which the global plan for the new system is to be implemented.[171]

To guarantee that States and regions affirm the institutional ability of achieving the new CNS/ATM systems, the FANS Committee formulated institutional guidelines which have been endorsed by the ICAO Legal Committee. They are expected to help States and regional planning groups to judge the adequacy of suggestions for the delivery of AMSS, ATM and GNSS services. The transition must be accomplished to guarantee consistent air traffic services globally, permitting graceful transitions between FIRs.[172] The transition to the new CNS/ATM systems demand cognizance of the following events for planning purposes:

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[169] *Chicago Convention*, *supra*, General Introduction, note 5, Article 28.

[170] Rochat, ***supra***, Chapter III, note 85, at 7.

[171] ICAO, ***supra***, Chapter II, note 80, at 8B-40.

[172] ICAO, ***supra***, Chapter III, note 55, at 7.

"[t]he availability of standards and procedures; ...completion of necessary trials and demonstrations; ...availability of adequate satellite capacity (when applicable); [o]perational use; [t]raining."[173]

In this writer's view, the *immediate or near and middle periods* should go beyond the time specified by the FANS(II) Committee, and end by the year 2010 instead of the year 2000, as specified. These two periods should end with the termination of the offer by the American GPS system and the Russian GLONASS system to provide a service free of charge. Then the *long-term* in which the new system will be the sole means is left to be determined. That, in this writer's opinion, will give LDCs and other ICAO contracting States a chance to appreciate the benefits of the new service, and give the provider States, intergovernmental organizations and other providers time to adjust their institutions in accordance with ICAO requirements and guidelines. This includes the up-coming SARPs related to the new systems which in any case are not ready yet. Also, this will be a good judging period, from the legal point of view, to be able to draft an international instrument which could adequately govern the relations between service providers and users. As well, this would clarify the service providers' liability based on actual practice and the systems' use, and to retain the support of the ICAO contracting States.

B. Views of the ICAO FANS Committee

The ICAO Council asked the FANS(II) Committee to recommend adequate institutional preparations for funding, ownership and management for a global CNS/ATM system. This assignment was pursued by the FANS(II) in its first meeting where it was recognized that various scenarios[174] might be deemed suitable for different regions of the world. These scenarios ranged from a State-owned system to a privately owned one. The FANS Committee found that the needs of a global CNS/ATM system could be mated by using any of these scenarios. These could be implemented in various parts of

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[173] ***Ibid.***, at 31.

[174] ***ICAO FANS(II)/2-WP/74.***

the world and operated jointly. For specific operational need in a particular region the technical/operational approach might vary between regions with regard to the implementation schedule as well as the required augmentation to the space segment. The FANS Committee, in its fourth meeting, developed five GNSS options for States choose from:

> "[i] *GPS or GLONASS*; [ii] *GPS and GLONASS*; [iii] *GPS/GLONASS plus overlay*; [iv] *GPS/GLONASS plus several civil GNSS satellites*; *and* [v] *civil GNSS satellites.*"[175]

The German's representative to the ICAO *Task Force Committee* argued that sufficient global coverage will need at least thirty two satellites.[176] Neither GPS nor GLONASS will be adequate enough to achieve the accuracy, availability and service flow necessary for all phases of flight.[177] Therefore, neither of these two systems can be the sole navigation system for civil aviation. Hence, for this and other reasons (such as international politics)[178] this writer sees that options *no.* [i] (*GPS or GLONASS*) and [ii] (*GPS and GLONASS*) are not justified, at least not for the *long-term* period. The European Union will not adopt the notion of using a system operated and controlled by a single State which is not itself European.[179] As stated by the FANS Committee GPS or GLONASS are just subsystems and when either of them is joined with other subsystem(s) then the compound systems could fulfil the essential GNSS requirements.[180] On November 30, 1993 the ANC agreed to establish a Global

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175 ICAO, ***supra***, Chapter II, note 80, at 5.

176 ***ICAO CASITAF/1, Background Paper no. 10***, May 24/26, 1994, at 1*ff*; see also, ***ibid.***, Paper *no.* 5, at 5.

177 ***ICAO CASITAF/1, Background Paper no. 5***, May 24/26, 1994, at 5.

178 Simpson T. R., at 17; "Managing the World's Air Traffic"[March 1993] ***Aerospace America*** 15 at 17; see also ***supra***, Chapter II, at P. 61*ff*; see also ***supra***, at P. 304*ff*.

179 ***ICAO C-WP/9482, Appendix B, at B-4.***; see also, Carel, ***supra***, Chapter III, note 52, at 27.

180 ICAO, ***supra***, Chapter II, note 80, at 4-13.

Navigation Satellite Panel (GNSSP) to develop technical and performance requirements for *short-term* and *long-term* periods GNSS and associated subsystems.[181]

C. Appraisals of the Possible Arrangements

1. Overview

This writer' view is that approaching CNS/ATM implementation should occur in two different periods (the *short-term period* and the *long-term period*), which is important because the arrangements' requirements and their impact in each period are likely to be different.

The *short-term* period goal is to give civil aviation industry experience in using the satellite service, to catch-up with the new technology and to solve the industry's present shortcomings. All implementation steps should be taken as quickly as possible in order to facilitate the following permanent and *long-term* period's need. The *long-term* period can be considered an evolutionary period of planning so that the new systems can meet all its requirements without any institutional, financial, legal or political difficulties.

ICAO has affirmed the need for the transition to GNSS to begin in the immediate and middle periods, utilizing existing systems expanded as required, to guarantee service integrity and availability of the needed navigational aids. There are many ways to make the transition, and the chosen course will be the result of, *inter alia*, a cost-benefit analysis. The alternatives vary from the existing systems such as GPS/GLONASS developed for integrity and availability, to a regional choice in which supplementary systems proposed by other States or organizations are connected to a *long-term* GNSS, and/or using current systems controlled by a global body, as yet unspecified.[182]

However as a result of the likely many options available to States, this writer's opinion is that States will select the most appropriate and agreeable system to suit their

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[181] ***ICAO AN-WP/6903, on May 9, 1994.***

[182] ICAO, ***supra***, Chapter II, note 80, at 8B-44.

needs, priorities and financial resources capabilities. Political influences will also play a critical role. Global unity cannot be established unless there is a global consensus.

The planning for creating or implementing any of these systems on a regional, global or State by State basis, requires that States should carry out a cost-benefit analysis before making a decision. Such an analysis must take into account not only the economic features, but also technical, environmental and social effects that might result from using this new technology. The majority of the LDCs will not be able to do this by themselves, and in such cases it would be advantageous to consult with ICAO or any other State which has the ability to do it.

For the GNSS this writer's opinion is that the most suitable solution for the *long-term* period will be one global system. This would ensure compatibility and require lower investment because the space segment costs could be widely shared by different entities having jurisdiction or control over different regions and altitudes. Also, possibility to combine navigation and communication together in one system will make it possible to create a highly efficient system of Automatic Dependent Surveillance (ADS). This will provide the possibility, in all regions of flight operations along optimal space-time flight paths. Also, will increase the cost-benefit ratio of air transport with a guaranteed high level of reliability. Lastly, it will lead to increase in air navigation safety in the international arena.[183] In the following we will examine the possible institutional arrangements on the *short-term* period and the *long-term* period.

2. The Short-Term Period

This period, as illustrated above, will be composed of the immediate and middle periods which could indeed be the most substantial periods in the entire ICAO forecasted transition period. As this writer proposes, these two periods should end by the year 2010, or at least with the expiry of the free-of-charge service offered by the USA and the Russian. The ICAO's role of overseeing coordination and facilitation must continue.

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[183] Anodina T. G., "Prospects Are Very Good for Using Satellites for Aeronautical Navigation" [September 1989] *ICAO Bulletin* 29 at 31.

Also, the continuation of the existing ground systems is essential because the CNS/ATM systems implementation is not going to occur on a global basis in this period but could be on regional or on a State basis, subject to the free will of States. There is a need to have transitional provisions which would recognize the existence of GPS/GLONASS systems as a component part of the evolutionary approach to the definitive global navigation satellite system. As illustrated earlier in Chapter II[184] this would emit in the GNSS frequency band both differential corrections that provide enhanced precision of the GPS/GLONASS satellites, and also a spread spectrum signal providing additional pseudo-range measurements. This kind of a solution is generally referred to as an overlay, since by itself it does not provide global navigation, but does improve the navigation of the other systems in the future. From the various views expressed in the 29*th* Session of the ICAO Legal Committee in 1994, one can have the feeling that there is uncertainty and lack of understanding of the substance of the problems. Therefore, from a practical point of view, this writer strongly supports the idea that in the *short-term* period we should not create any legal obstacles (*e.g.*, requiring international agreements on the functions and duties of the service provider(s) and user(s), on issues of liability, *etc.*). The relationship between the two navigation service provider States could be adequately based on the simple *Memorandum of Understanding* between themselves as GNSS service providers and the States which are interested, willing and have the capability to use such systems as they are would be sufficient.

In the following ICAO as a coordinator and facilitator, institutional arrangements for navigation, communication and surveillance purposes and the need for continuity of the existing ground systems are examined.

(a) ICAO as Coordinator and Facilitator

To successfully implement the CNS/ATM system there is a fundamental need for ICAO leadership in the planning, coordination and monitoring. ICAO's role was the focus of ICAO's 10*th* Air Navigation Conference in September 1991. Recommendation

[184] *Supra*, Chapter II. at P. 61*ff*.

no. 4/5[185] was adopted by the Council, calling for the establishment of an ICAO mechanism in order to provide, *inter alia*, assistance to States with regard to such technical, managerial, financial, legal and institutional aspects to implement the new CNS/ATM systems on a global basis.[186] Furthermore, recommendation *no.* 6/2 was also adopted which said that guidance material on cost-effectiveness and cost/benefit techniques should be developed to assist all States in undertaking these studies.[187] As stated by the President of the ICAO Council:

> "*ICAO is receiving increasingly frequent requests from national authorities for assistance on the many technical, financial, organizational and managerial aspects of CNS/ATM implementation.*"[188]

However, ICAO must take fast and proper action in order to avoid unilateral implementation of some elements of the CNS/ATM system. A commentator[189] stated his belief that a proposal to form a new ICAO policy body to help carry out the work of FANS and to help ICAO coordinate work on system issues is essential if ICAO is to retain its vital leadership role into the future. As the Council's President asserts:

> "*[t]he implementation of CNS/ATM by users and providers will not be an instantaneous change-over but a progressive, harmonized and timely phase-in of systems and technologies.*"[190]

Therefore it is essential that the appropriate ICAO body maintains an impetus to achieve the global plan, and promotes such coordination as required. In 1956 the idea of the special short-term, high-level task force was developed to help ICAO contracting

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185 AN-CONF/10, *supra*, General Introduction, note 17, at 4-10.

186 "CNS/ATM Report" (A report was presented to the ICAO Council by the President of the Council and the Secretary General, on March 17, 1993) at 8.

187 *Ibid*, at 6.

188 Kotaite A., (Address the Fourth Meeting of the FANS, Phase II Committee, Montreal, September 15, 1993), see, *ICAO D:\DATA\WP51\SPEECH\FANSII-4*.

189 Poritzky, *supra*, Chapter III, note 1, at 14.

190 Kotaite A., "Mechanism to Provide Implementation Coordination and Assistance Under Active Consideration"[December 1993] *ICAO J.* 5 at 6.

States in facilitating the introduction of the commercial *Jet* aircraft. In 1993 the ICAO Council established the *High-Level Task Force* to recommend a method to implement the CNS/ATM systems concept, including priorities, cost-recovery and funding aspects, and techniques to integrate between governments and monetary institutions. The FANS Committee in its recommendation 9/1 specified the duties of the *Task Force*:

> "[i] *identifying implementation priorities, including the timing for needed investments and advising on funding and other resources needed;* [ii] *providing advice on the type, role and composition of the ultimate mechanism; and* [iii] *providing advice on the methods to best achieve awareness by civil authorities of the need for the rapid implementation of the new technologies.*"[191]

The *Task Force Committee* is not a replacement for an ICAO implementation mechanism but rather an advisor for the arrangement, and a *short-term* guide.[192] The *Task Force* team is assisting in the implementation process by achieving a global consensus on priorities and means. The nomination of members to the *Task Force* took into consideration equitable geographic representation.[193] This writer has a few observations, *inter alia*, that it is not important to select high-ranking individuals (which reflects the usual weakness of the Organization in this matter), but to chose the real experts with variety of backgrounds, such as economists, technical and legal professionals representing all regions. Members must be familiar with the CNS/ATM system concepts and problems in order to provide practical, correct and satisfying responses to all the matters that require resolution to meet the LDCs needs or even those of developed countries. Secondly, in the above mentioned duties, the Committee was called to define specific tasks which are not well clarified, and this makes it impossible for Committee members to achieve satisfying resolutions. Also, the Committee was just given a task which the Council itself should have done as a policy-making body. Therefore, we do

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191 *ICAO FANS(II)/4-DP/9*, at 9-6.

192 *ICAO C-WP/9823*, at 3.

193 *ICAO News Release PIO 5/94*.

not expect that much of outcome from the Committee meetings mainly because most of its members are "high-ranking" nominees without profound professional expertise. It would appear that the ICAO Council made a grave mistake by referring these critical issues to the *Task Force* and by avoiding its own decision-making responsibility.

Considering the complexity and scope of the work associated with the CNS/ATM systems implementation, if ICAO cannot meet the States' needs, it will have no alternative but to turn elsewhere and the leadership role of ICAO in international civil aviation will be hopelessly compromised.

(b) Institutional Arrangements for Navigation Purposes

In the following, we will briefly examine GPS/GLONASS, GPS/GLONASS and INMARSAT, and the GPS/GLONASS and regional system as feasible possible models to provide GNSS service in the *short-term* period.

(i) GPS/GLONASS Systems

In order for civil aviation to benefit from the new satellite systems, use of the GPS/GLONASS systems is needed as a starting point; however, some adjustments for the civil use of the systems will be required, and this should be determined by the service provider States and ICAO. Since the American GPS and the Russian GLONASS are the only systems available currently to provide the GNSS service, this writer is of the opinion that their use in the transition period is indispensable.

It would seem that an agreement is required between the service provider(s) and the user State's air traffic services authority.[194] It was the view of K. Rattray, ICAO' Legal Committee Rapporteur, that the establishment of a legal framework should be considered.[195] Also, he concluded in his report that a *Memorandum of Understanding* is needed between ICAO on one side, the USA and the Russian Federation on the other

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[194] *Ibid.*, at 13.

[195] *ICAO C-WP/9901*, on 10/02/94 (Attachment 1), at 12*ff*.

side as a service providers. Therefore, this writer suggests that one of the most suitable models for cooperation should be the flexible COSPAS/SARSAT scheme. The multilateral agreement of July, 1988,[196] which is used for the COSPAS/SARSAT system is capable of functioning adequately without an international organization with a legal personality.[197] Presumably, for GPS/GLONASS systems an agreement similar to the COSPAS/SARSAT agreement of 1988 would be adequate at present between the service provider States. The lack of clarity as to the service providers liability will be a distinct disadvantage but perhaps no other alternative is currently available for the *short-term* period.

Nevertheless a third system should be developed and operated either by a regional or global civil institution. In this case, the need for coordination between the GPS/GLONASS and third-party service providers would be necessary.[198] A third-party could participate as an intermediary between service providers and States or users in order to safeguard the existence of consistent services governed by appropriate procedures.

(ii) GPS/GLONASS and INMARSAT

One of the most acceptable solutions is to have a system that is governed by a globally approved agency such as INMARSAT.[199] The navigation broadcast from INMARSAT satellites would support a real time integrity monitoring information and warning information service to civil users.[200] In some views,[201] if INMARSAT were

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[196] **COSPAS/SARSAT Agreement, *supra*,** Chapter II, note 122.

[197] ***Supra*,** Chapter II, at P. 56*ff*.

[198] North R. F., "Implementation of Satellite-Based Systems Involves Major Institutional Issues" [December 1993] ***ICAO J.*** 13 at 14.

[199] Rosetti, ***supra***, note 93, at 278.

[200] ***ICAO Doc. 9630-LC/189***, at 3-3*ff*.

[201] Viewpoint by Klass Ph. J., "GPS, GLONASS and Glasnost"[October 5, 1987] ***AW&ST*** 11 at 11.

to supplement the service of the two systems, it would overcome the reluctance of other nations, especially European States and LDCs, to use GPS/GLONASS systems. Therefore, the most logical compromise would be to use GPS/GLONASS satellite signals, and having INMARSAT[202] to run the system as subcontractor, as the coordinating institution which would tie the two systems together and observe ICAO' SARPs.[203] It has been stated by R. Ryan[204] in his statement to the FANS Committee that if the space segment may be used free of charge for periods to be agreed, upon application by INMARSAT signatories, this would assist in the development of new services and to test and demonstrate new capabilities of the new system.

More importantly, for service users to count on the accuracy and availability of these systems with a model of global civil control, the INMARSAT system would be invaluable.[205] Therefore, this scheme should be adequate for the civil users in the LDCs or in the European Union.[206] We envisions this form of cooperation taking the following scheme:

This scheme is to be created by way of cooperation between GPS/GLONASS and INMARSAT. This cooperation could be similar to the COSPAS/SARSAT system as in the GPS/GLONASS as pointed out above. It could take the form of an *Agreement and/or Memorandum of Understanding*. In the accepted form, INMARSAT system could be designated and act as an *Interim Manager*. This would be done through a *Service Agreement* to be formulated by, or at least with the assistance or participation of ICAO and the concerned parties as in the first scheme above. This would be to ensure and preserve the Guiding Principles for the GNSS institutions, the applicable SARPs, service providers to be licensed, and also to maintain the general accessibility, continuity and

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[202] "ICAO Underlines GPS as Candidate System"[September 1993] ***Jane's Airport Review*** 11 at 11.

[203] Verchere, ***supra***, Chapter I, note 75, at 41.

[204] ***ICAO FANS/3-WP/29***, at 5.

[205] Blanchard, ***supra***, Chapter I, note 92, at 146.

[206] ***ICAO FANS/3-WP/28***.

integrity principles. The *Interim Manager* could then begin offering the service or leasing capacity to interested States.

This writer believes strongly that the participation of a third-party, to provide the services of GPS/GLONASS to civil aviation and act as mediator between the users and the services providers, would be the most suitable and acceptable solution for the LDCs and the European Union.[207] Furthermore, this scheme will ease the fear of the international aviation community about dealing directly with the military authorities of the USA and Russia. Accordingly, to ease the concerns of European Union and LDC's, the INMARSAT as an supplementary system to provide any signals to the GPS/GLONASS systems is one of the most economical solutions available.[208] The problem of control over a system[209] could also be settled by the installation of GPS-type hardware on INMARSAT-III satellites.[210] INMARSAT's third and fourth generation satellites are capable of providing their service on the same frequency band as the GPS/GLONASS systems.

With one navigation channel on each of INMARSAT's-III generation satellites which offer an enhanced global navigation capability for civil aviation users of GPS/GLONASS systems. INMARSAT-III will be the first satellite system capable of providing both navigation signals, and relaying independently-monitored integrity information, on a timely basis, on navigation signals generated by GPS/GLONASS systems.[211]

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[207] Domogala Ph., "Europe Reschedules Integration"[March 1994] ***Jane's Airport Review*** 8 at 8.

[208] In fact INMARSAT-C and GPS are functioning at parallel frequencies, which means that one antenna could be utilized for both systems, and combined receiver units have been confirmed, see Sutton, ***supra***, Chapter II, note 185, at 51.

[209] ***Supra***, at P. 283*ff*.

[210] Sutton, ***supra***, Chapter II, note 185, at 51.

[211] "INMARSAT Opens the Door to Civil Use of the Global Positioning System" ***INMARSAT News nr9418 cfa***, August 17, 1994.

The INMARSAT services will be governed by its Convention and Operating Agreement and the ITU Constitution and Convention. This writer's view is that there will be a need for cooperation agreement to be concluded between ICAO and INMARSAT to prevent any possible overlapping of jurisdiction and regulate their cooperation on this issues. Such agreement would be even more vital for the *long-term* period if INMARSAT presumed to provide the GNSS service for civil aviation. These instruments will assure that the Organization services will be available on a universal, non-discriminatory basis, and observe ICAO' SARPs. INMARSAT, in this writer's view, with its experience, international presence and global ownership, provides a powerful background in taking part of the new CNS/ATM systems implementation. It is the appropriate agent to serve as an umbrella organization providing a universally acceptable interface between the user and various service providers, such as GPS/GLONASS systems. This would increase the accuracy of the information provided, and reduce the involvement of the military authorities. Also, it is crucial if the civil aviation industry is to turn to satellite service in accordance with the FANS Committee timetable.

(iii) GPS/GLONASS and Any Regional System

The European Union's intention in developing the NAVSAT system, for example, was to supplement services provided by the GPS/GLONASS systems for the civil aviation industry under civilian control.[212] The ESA did not intend to operate the system, but to grant its operation to an international organization such as INMARSAT.[213] While European countries agreed to use the GPS/GLONASS systems, they did not explicitly endorse its use as a permanent system. Accordingly, at the ATC Conference of February, 1993 held in Maastricht, the European ATC authority delegates stressed that it would be better to re-equip the ailing Russian GLONASS network with

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[212] Park, ***supra***, Chapter I, note 109, at 24.

[213] ***Ibid***, at 25.

European technology as a way to help the Russian space industry.[214] The other option was to develop a totally independent system, possibly based on the INMARSAT system, offering the European industry the possibility of developing a system of its own and to provide a rival system to GPS,[215] rather than allowing the Americans to dominate the market.[216] The NAVSAT system is an attempt in Europe to create a civil satellite navigation system that is distinct from the American and the Russian military systems.[217] It was stated by G. Schanzer in his paper to the ICAO's Task Force in may 1994 that:

> "..., *the German government is willing to convince its European partners to launch a civil satellite navigation system. This system shall be GPS compatible and shall consist of minimum 12 satellites. Other nations are welcome to participate in such a programme.*"[218]

Notably, the Japanese MTSAT system will also provide GNSS overlay functions, including the GPS integrity channel function for oceanic and land areas throughout the Asia/Pacific region.[219]

From a practical point of view, and in view of the shortcomings of using the GPS/GLONASS systems as the sole systems for the GNSS global system for the civil

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214 As indicated some of GLONASS satellites have had a service life of only one to two years, contrary to life of seven to eight years for GPS satellites, also until currently about fifty GLONASS satellites have been launched, but only 13 are presumed to be presently operational. However, Russian are dedicated to complete the system, see Sutton, ***supra***, Chapter II, note 185, at 52.

215 Butterworth-Hayes Ph., "Europe's ATC Plan: Panacea or Placebo?"[May 1993] ***Aerospace America*** 10 at 12.

216 Butterworth-Hayes Ph., "Improving Satellite Approach Precision"[May 1993] ***Jane's Airport Review*** 24 at 26

217 ***ICAO FANS(II)/2-WP/48***, at 3.

218 ICAO, ***supra***, note 192, at 2.

219 ***Supra***, Chapter II, at P. 49*ff*.

aviation industry,[220] the participation of other nations with their systems should overcome problems stemming from the sole use of the GPS/GLONASS systems.

(c) Institutional Arrangements for Communication and Surveillance

In general, communication and surveillance satellite systems can be built together. ARINC/SITA Joint Venture is a major private service provider for aviation communication on a global basis. The venture will provide communication service for ATC objectives.[221] The MOTOROLA Iridium system can also be one of the aviation communication service providers. As pointed out earlier, INMARSAT is one of the most efficient agencies equipped to provide aviation communication. Also, using the INMARSAT system is important because it is able to make available the facility of redundancy in the event of system failure. It also safeguards safety communication against harmful interference, and provides message priority in accordance with ITU and ICAO requirements. More recently it is announced by INMARSAT that in 1999 its new system INMARSAT-P will be in operation; such system will provide a unique, low-cost global satellite phone service as well as data fax and paging, using handheld pocket-sized terminals. This will extend the benefits of mobile communication to business travellers.[222]

The above shows that existing organizations are capable of providing aeronautical mobile communication. This writer sees that ICAO's continued assistance and its rules for establishing the technical standards for the aeronautical CNS services, as well as for its coordination of the use of frequencies allocated to AMSS, is essential in order to coordinate between the various services providers. Systems which provide AMSS are already in existence and additional satellite systems to meet the increasing demand are expected in the near future. The communication services are provided at present, and are

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[220] *Supra*, Chapter II, at P. 61*ff*.

[221] Gribbin W. J., "Commercial Satellite Communications Undergo Pacific Trials"[March 1991] *ICAO J.* 13 at 14.

[222] *INMARSAT News* nr95/2/invcom, January 23, 1995.

expected to continue to be provided through entities which are known as service providers. It is provided by the FANS Committee[223] that States have the following options:

> "[i] *contact certified service providers;* [ii] *contact existing multilateral State organizations such as European Organization for the Safety of Air Navigation (EUROCONTROL) or the Agency for the Security of the Security of Aerial Navigation in Africa and Madagascar (ASECNA) to act on their behalf, dealing with service providers;* [iii] *from an ad hoc group of States or a new international organization with responsibilities for air traffic management which would negotiate for service; and [iv] use a mechanism within ICAO (such as the DEN-ICE Agreement for Joint Financing) to act on behalf of States concerned in dealing with service providers.*"[224]

Yet, the following principles must be observed as guidelines for discussion and agreement:

> "*1. arrangements must ensure the ability to protect safety communications from harmful interference; 2. arrangements must ensure guaranteed priority of aeronautical mobile-satellite safety communications over aeronautical non-safety and non-aeronautical mobile-satellite communications in accordance with ICAO Standards and Recommended Practices; 3. arrangements must facilitate the certification by States of those service providers whose services comply with ICAO Standards, Recommended Practices and Procedures of the aeronautical mobile-satellite (route) service (AMS(R)S); 4. arrangements should make all four identified aeronautical satellite communications services (ATS, AOC, AAC and APC) available through any given satellite in any region of the world; and 5. arrangements should enable all AMSS functions (ATS, AOC, AAC and APC) to be provided through common avionics equipment in the aircraft.*"[225]

This writer strongly suggests that for the sake of the implementation of these services in the *short-term* period, contact between service provider(s) and user(s) should be left free, and subject to the market competition principle. This writer's observation

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[223] ICAO, ***supra***, Chapter II, note 80, at 8B-44.

[224] ***Ibid.***, at 6-15.

[225] ICAO, ***supra***, note 75, at A-15.

is that a principle that must be preserved is that all service provider(s) obtain the approval of ICAO. As illustrated later in Chapter VIII, this is the only institution that can issue such *Certification* in order to comply with its SARPs and preserve the principles of *Universality, Non-discrimination, service Continuity and Integrity.*

(d) The Need for Continuity of the Existing Ground Systems

Although the use of satellite technology is a viable solution to meet civil aviation industry's future demand, VHF augmented with data link and SSR Mode"S" data link will continue to be used in terminal areas where communication is not a problem.[226] That is, ground-based systems will not be eliminated, some of them will be used as back-up systems. Many ICAO' contracting States, such as Canada, support the continuation of the current terrestrial systems until the year 2010.[227]

As stated by the FANS Committee in its fourth meeting,[228] the planning and implementation arrangements of the systems will occur at the regional level, and various countries will issue their consent based on their own policies and rules. The global application of a CNS/ATM system is seen as necessary. However, for a variety of reasons, it is not feasible in the immediate and intermediate periods. The achievement of a new system would not occur at the same time and at the same rate in all regions. Therefore, in this writer's view, the implementation of CNS/ATM systems on air-routes should occur where there is greater need for it, where it will be beneficial and feasible to implement; thus the continuation of the existing ground system is essential during the transition period and until the full implementation of the new systems is globally achieved.

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[226] O'Keeffe H. B., "System Development Enters New Phase with Detailed Regional Planning Under Way"[December 1993] *ICAO J.* 7 at 7.

[227] *ICAO C-WP/9482*, at B-2.

[228] ICAO, *supra*, Chapter II, note 80, at 5.

3. The Long-Term Period

The *long-term* period, in this writer's view, should start only after the year 2010, with the ending of the last transition period as specified by the FANS(II) Committee. In the FANS(II)/3 Committee meeting held in March/April 1992 the following options for the *long-term* period were considered:

> "[i] *Provision of a GNSS system by an international organization e.g. International Maritime Satellite Organization (INMARSAT), or a new United Nations body*; [ii] *Provision of a GNSS system by a single State or group of States (a binding contract or agreement with other States would be necessary)*; [iii] *Provision of a GNSS system by a private company.*"[229]

It should be clear, that any *long-term* settlements must consider the principles which are stated in the ICAO Guiding Principles on Institutional and Legal Aspect of the CNS/ATM systems.[230] Such principles as non-discrimination in respect to system accessability, restraint of monopoly, preserving the sovereign rights of the user States and non-interruption and service integrity are all articulated. Beyond its immediate communication needs, the civil aviation community looks forward to a highly accurate, multi-purpose satellite system. There seems little doubt that any such system will use GPS/GLONASS systems as its starting point, and have a degree of compatibility which will enable the users to benefit from investment in receivers designed for the GPS/GLONASS systems. However, the system users have expressed a preference for a GNSS which in the *long-term* period overcomes all the known weaknesses of the current systems. In the following the possible institutional arrangements for navigation, the aviation's dedicated system and the institutional arrangements for communication and surveillance services are examine.

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[229] *ICAO C-WP/9725.*

[230] ICAO Doc., *supra*, General Introduction, note 17, Report on Agenda Item 4, Appendix D, at 4D-1.

(a) Institutional Arrangements for Navigation Purposes

(i) Possible Continuity of GPS/GLONASS or their Alternate

In the *long-term* period, these two systems could provide the services to civil aviation only if they are able to convince the international civil aviation industry to adopt the needed modifications and characteristics which will place both systems on the same rank as other civil systems offering their services. This also depends on their accuracy and capability in the immediate and middle term. However, before these services are adopted, there are many questions that need to be answered, and a number of legal, economic and institutional issues to be dealt with. Only then could a *long-term* commitment from the international civil aviation community be obtained.[231] As the French position indicates, the only way to use the GPS/GLONASS systems will be through global harmony.[232] This writer sees that the only case in which these two systems (GPS/GLONASS) could continue offering their services is one in which there is a great response to the needs of international civil aviation community. It would be essential also if their control and operation is entirely in the hands of the civil authority. Perhaps a workable situation would be one in which NASA (USA) and the Russian Federation decided to sell their systems to an agency which could be created under ICAO' authority or to a new international entity with its own legal personalty and strong ties to ICAO as explained later.[233]

(ii) The EUROCONTROL Scheme on a Global Basis

The majority of States designate their civil aviation departments within existing ministries to administer civil aviation activities, and this includes ATC. Some regional organizations have been formed, *inter alia*, ASECNA in Africa, COCESNA and CENAMER in Central America and EUROCONTROL in Europe. In 1958

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[231] *ICAO C-WP/9271*, at 4.

[232] ICAO, *supra*, note 227, at B-4.

[233] *See, infra*, at P. 336*ff*.

EUROCONTROL was indicative of the difficulty in implementing a global ATC system,[234] as demonstrated[235] in the early 1980s, when the European States refused to transfer the control of their airspace to EUROCONTROL, and it became an optional advisory agency which does not impinge upon the sovereignty of individual countries. Member States are no longer required to transfer the ATC of their upper airspace to EUROCONTROL, and each contracting State retains its sovereignty over its airspace. In other words, member States are now free to delegate their ATC operation to EUROCONTROL, or to retain it in the hands of national or foreign agencies. Currently, EUROCONTROL is working on new proposals in which the European infrastructure can support the needs of all modes of transport. Other nations in other regions will ensure a global infrastructure that can meet the demands of all users.[236]

It should be kept in mind that there are two ideas to solve the European air traffic problem, one is to encourage the idea of a single, unified ATC system in Europe, the second that EUROCONTROL believes in setting up and harmonizing common specifications and standards while leaving individual States to manage their own projects. The ICAO Council President has stated:[237] "*[t]here is a definite need for supranational bodies in aviation who can issue constraining directives to States.*"

However, the increase in density of air traffic in Europe, and particularly the corresponding increased demand on ATC services, has lead to many technical difficulties. The solution to these problems may be found in the attribution of a larger scope of geographical, as well as legal, jurisdiction to EUROCONTROL. The new

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[234] ***Supra***, Chapter I, note 4, at 20.

[235] ***Supra***, Chapter II, at P. 54*ff.*

[236] ***ICAO CASITAF/1, Background Paper no. 5***, May 24/26, 1994.

[237] As cited in Domogala Ph., "Europe Reschedules Integration"[March 1994] ***Jane's Airport Review*** 8 at 8.

EUROCONTROL in some opinion[238] could serve as an interesting model for any future changes in ICAO.

Accordingly, this writer believes that the arrangements for a wider delegation of authority over larger areas without compromising State responsibility are ideal. The creation of such an entity could be accomplished through an ICAO mechanism such as a separately financed agency based on Chapter XV of the Chicago Convention. It must be kept in mind that the new EUROCONTROL is not yet in operation and it is not clearly defined, only the time will tell if it is workable or not.

(b) Aviation's Dedicated System Concept

A dedicated system owned and operated exclusively by the aviation interests can be economically justified only if it will provide all aeronautical services such as communication, navigation and surveillance.[239] It may be more economical for civil aviation to have its own system tailored to its demands and under its control.[240] This writer sees this proposal as one of the most desirable and agreeable options from the point of view of the LDCs and the European Union. On the other hand, for a variety of reasons, *inter alia*, the frequency problems,[241] difficulties of funding to implement and maintain the system as well as the limited capacity which will be used exclusively by the civil aviation services, the above proposition may not be viable. As has been confirmed by ESA analysis, the establishment of a civil dedicated system for civil aviation will cost nearly as much as the GPS is costing the USA for establishment and yearly maintenance. Hence, one can ask whether the global civil aviation community still wants its own

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[238] Lambert, *supra*, Chapter II, not 111, at 364*ff*.

[239] Rosetti, *supra*, note 93, at 276.

[240] *ICAO FANS(II)/2-WP/48*, at 9.

[241] Featherstone D. H., "Specialist Providers Offer Cost-Effective Approach to Obtaining ATS Satellite Communications"[June 1993] *ICAO J.* 21 at 22.

system.[242] The Director of the ICAO Air Navigation Bureau stated that civil aviation is a very small user of satellites compared to maritime and land users.[243] Furthermore, the FANS Committee, in its fourth meeting, recognized that a dedicated civil aviation system is still far from reality.[244] As in a commentator's[245] view, mobile satellite communication dedicated for aeronautical purposes is not justified, even with the highest air traffic forecast possible.

Such a dedicated system would need a new international entity which would be responsible for the ownership, control and operations. In this writer's opinion, if that system were a reality, an *Agency* would be needed which must necessarily continue to be under ICAO supervision, and it would have to be separately financed through the user charges. The other option is to create a new international entity with its own legal personality and functions on the same basis as ICAO but with a strong tie to the latter, in order to give ICAO the authority to impose standards and policy. This writer sees the idea as a worthwhile option, although it is a challenging task because of the financial and economic constraints facing the aviation industry. It must also be made clear that such a civil system would allow civil users to exercise an adequate level of influence over the management and control of these features with regard to the obligations of civil aviation.

The concept of space segment sharing[246] with other users such as land and/or maritime users, offers economic benefits to the aviation industry. It also permits the industry to provide the service at low-cost without risking malfunction, service failure

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242 Sutton, ***supra***, Chapter II, note 185, at 51.

243 Dr. Fromme W. R., the Director of the ICAO Air Navigation Bureau, in his lecture to the students of the Institute of Air and Space law, McGill University, 1993.

244 ICAO, ***supra***, Chapter II, note 80, at 6-16.

245 Featherstone, ***supra***, note 241, at 22.

246 ***Id.***

or any fiscal damage to the space segments which will be expensive to repair.[247] Also, by sharing the costs of such systems, each participating State bears a smaller economic burden while maintaining access to the technical and scientific outcome.

One can envision that in the *long-term* the possible creation of an entirely dedicated civil aviation system is a remarkable idea.[248] This writer, however, has some reservations to this idea. The elements to keep in mind are the maintenance cost, and the necessity to keep-up with the technological revolutions. Also, as pointed out earlier,[249] radio frequencies are a limited natural resource, and the present frequency bandwidth allocated for aeronautical mobile satellite services is not sufficient. Also, maintaining such a system is a very costly and complex matter which would be a heavy burden for the aviation industry. Therefore, this writer does not see a dedicated aviation system as an attractive solution or alternative, although he does not reject it entirely. It would be prudent to keep it as an available option for the *long-term* period. It seems clear that planning for a universally acceptable civil GNSS service provision should begin immediately. Plans for successor GNSS services should have sufficient compatibility with existing systems, and they should naturally provide accuracy, availability and integrity assurance to support all civil aviation applications.

(c) Institutional Arrangements for Communication and Surveillance

As pointed out earlier[250] the same service techniques which have been observed in the immediate and middle term periods should be followed in the *long-term* period. With the increased participation of non-governmental entities in providing communication

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[247] As example INTELSAT, INMARSAT and EUTELSAT organizations their services are more efficient and economical than if such services were provided by individual national systems, see more details, ***supra***, at P. 274*ff*.

[248] See, *e.g.*, Al-Ghamdi, ***supra***, Chapter I, note 14, at 20; see also, Eydaleine, ***supra***, note 65, at 17*ff*.

[249] ***Supra***, Chapter VI, at P. 170*ff*.

[250] ***Supra***, at P. 323*ff*.

services this writer believes that in order for safety communication to be as reliable as possible, first ICAO SARPs' must be observed by all service providers in regard to communication, second their liability should be of strict unlimited nature in order to protect the airlines as the main users. As for the non-safety communication, a fault liability can be justified since this service does not cause damage to aircraft or loss of life, or damage to third parties on the ground. In other words, it does not have any effect on flight safety. However, this writer's vision for the communication and surveillance service providers liability regime will be represented in more detail in the next Chapter.

Concluding Remarks

The introduction of modern technology, and services in the aviation industry as pictured above in the transition period and on the *long-term* period definitely will create new relations and cooperative attempts between States, global/regional organizations, and private entities, manufacturers, operators and ICAO's roles of regulations. Each of the participants has its essential role to play and must take an active part in a coordinated schedule. The new systems will require an orientation towards continuing institutional frameworks and/or establishing of new arrangements, and should also preserve the following elements:

> *"universal accessibility; sovereignty, authority and responsibility of contracting States; responsibility and role of ICAO; institutional arrangements and implementation; civil global national satellite system...; technical co-operation; continuity and quality of service; airspace organization and utilization;* [and] *allocation of costs and liabilities."*[251]

It is this writer' view that the implementation of the new CNS/ATM systems must occur in two periods. The first period is basically the transition from the current to the new systems and could be, at least partly, on regional and/or State to State basis. Such a transition, as we suggested earlier should be subject only to the free market needs. Thereafter, the permanent period must take effect in which all the necessary new

[251] ICAO, *supra*, General Introduction, note 27, at 4.

regulatory instruments must be the governing body for the system(s) operation, and the chosen institutional mode(s) which perhaps could be regional, global or agency or international governmental or non-governmental as global or regional body.

While the implementation of the new systems will be evolutionary, it must furnish a practical, cost-effective cycle of advances that are in step with users' needs and achievements. This is to be done in a system combining the safety, capacity, efficiency, and needs of the 21*st* century. The systems must embrace a vast spectrum of users and various levels of avionics equipment.

The main element in the global introduction of sole means GNSS and AMSS is related to the provision of assurances to all users of the reliable quality of information and of assurances to sovereign States and that the service will be continuous. No matter what institutional model(s) are chosen, civil aviation authorities must be certain that minimum performance standards are met. There is a necessity to supply the facilities that provide the highways through which information is channelled between different regions. In this writer's opinion, this can work for CNS/ATM systems, since there will always be a need for a global system to provide services over the high seas and arctic areas, and between regions or in regions that do not have their own system. The global system is complex, and the achievement of such a system is more practicable with the participation of the entire aviation industry. The current political changes in the world could be a reliable indicator for a new era of East-West cooperation and for the creation of a global CNS/ATM system. This writer feels that the adoption of such global CNS/ATM systems could very well reflect the current trends of East-West cooperation.

Chapter VIII: This Writer's Choices and Propositions

Introduction

Problems are usually simple to recognize, but devising the right solution is difficult. Creating a scenario for CNS/ATM global applications in the late-1990s and the turn of the twenty-first century is difficult if one considers the technical, political, financial, legal and institutional obstacles that are to be overcome. Looking back to 1959 and the 1960's, Presidents Eisenhower and Kennedy called for global use of communication satellites; in 1964, INTELSAT came into being and by 1965, worldwide service was introduced.[1] That success story can be repeated with respect to satellites in the aviation industry, when a global cooperation between member States within ICAO can be achieved.

The global nature of aviation poses problems in management that go beyond existing mechanisms and require worldwide solutions. The Chicago Convention, in Articles 77-79, gives States considerable scope for organizing air transport on a regional basis. The provision of air navigation facilities and services is the responsibility of every ICAO contracting State, as spelled out in Article 28, but nothing prevents States from delegating these functions to a national or international public or private entity. That is already the case with some of the European countries such as Switzerland and New Zealand, in Africa and Central America where individual countries cannot provide services on their own.

One can remark that ICAO was approaching a political difficulty on the choice of either GPS or GLONASS when the USA and the former USSR announced in April 1989 that they would offer their systems for joint use for the benefit of the aviation community. This ensured a prime role for ICAO which should plan the political, financial, legal and institutional aspects of the new CNS/ATM systems in order to provide assurances for the international aviation community that no single state or group of states

[1] Pelton, *supra*, Chapter VII, not 2, at 410.

will have monopoly. Its management under ICAO's auspices would guarantee that the new systems service would not be cut *off* entirely or partially for a military emergency. The effectiveness of the system will ultimately depend on these detailed specifications.[2] As proclaimed in its Preamble, the Chicago Convention sought to guarantee that:

> *"...international civil aviation may be developed in a safe and orderly manner and that international air transport services may be established on the basis of equality of opportunity and operated soundly and economically."*

In reality, this equality of opportunity is only a bright promise for most LDCs. International air transport services, based on the principle of national sovereignty, reflect national interests extending far beyond the limits of air transport economics.[3] The challenge here is to find a solution for all these obstacles and at the same time to preserve an adequate coordination with current systems to permit service users to recover their investments.

This writer anticipates that the new CNS/ATM systems are essential for the international air transport industry, and will have a significant global effects, in financial and organizational terms, never before accomplished by the international civil aviation industry. This writer also considers that ICAO is the only international body that can conduct the complex task of managing the implementation of the modern systems. This does not mean that the Organization will be the actual systems operator. ICAO member States shall have the primary task of establishing the new systems. The Organization has been serving civil aviation satisfactorily for nearly fifty years; also, ICAO has ties with other organizations which are dedicated to civil aviation. For this and for other reasons related to either user concerns or to the complexity of implementing the new systems, this writer expects ICAO to play a crucial role in the *short-term* and *long-term* periods of implementing the new CNS/ATM systems.

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[2] Sochor, *supra*, General Introduction, note 13, at 26.

[3] *Ibid.*, at 74.

In the following, this writer presents his own view and his propositions trusting this could support ICAO in its task, and contribute acceptable techniques for solving CNS/ATM institutional arrangements and legal aspects in its *long-term* period's planning. Here we will comment on the likely proposition of ICAO being the "*Hub*" of the new CNS/ATM systems and the ATC and GNSS service providers liability propositions.

A. ICAO as the New CNS/ATM Systems' Hub

1. Institutional Proposal Overview

Some ICAO member States have recognized the fundamental need for its leadership. Also, the LDCs have a particular need for assistance. The ICAO 10*th* Air Navigation Conference in September 1991,[4] in its recommendation *no*.4/5, placed particular emphasis on the establishment of an ICAO mechanism to provide this coordination and assistance. As the ICAO's Council President has illustrated, there are two factors influencing the idea: one is that ICAO is designing modern organizational boundaries; and the second is that such a mechanism will demand extra resources. With the broad duties of the Organization it will not be able to uphold the modern mechanism in a extensive manner.[5] Accordingly, other techniques must be created to satisfy the needs of ICAO member States.

In this writer's opinion, consideration should be given to establishing a new mechanism within ICAO, or under its auspices, in order to manage the new CNS/ATM systems. ICAO is the only universal agency which can perform the duty of coordinating the implementation and creation of the new systems. This does not, however, mean that ICAO will actually run the systems; States and their public and/or private entities and intergovernmental organizations, where suitable, shall have the task of operating the new systems.

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[4] ***Supra***, General Introduction, note 17.

[5] Kotaite, ***supra***, Chapter VII, note 190, at 6.

ICAO is considered to be a service organization which sets international standards and operates an extensive technical assistance programme. It also serves as a forum to harmonise air transport policies among its contracting States.[6] Accordingly, in this writer's opinion, the institutional framework of CNS/ATM systems should be based on the Chicago Convention. ICAO participation is essential not only to set the ground rules but also to break new ground in global cooperation. As M. Milde[7] states, the Chicago Convention has passed the test of time:

> *"all the provisions of the Convention... have proved to be capable of providing a suitable legal framework for the accomplishment of the main aims and objectives of the Organization to promote generally the development of all aspects of international aeronautics."*

ICAO helped to establish a set of long-range radio aids to navigation (**LORAN**), as well as meteorological stations in Iceland, Greenland and the Faroe Islands for use along transatlantic routes. These services were financed jointly by the users. There are twenty-two countries who are party to this cooperative scheme which was developed over the years to become the central element of safe and efficient travel over the North Atlantic.[8] Within ICAO's own institutional framework, the joint financing agreements for air navigation services over the North Atlantic have given ICAO considerable experience in managing services on an international scale.[9] This writer supports the idea that ICAO should be at the center of States' attempt to institute the new CNS/ATM systems.

A global institution under ICAO's auspices will grant LDCs status to participate in the management and control of the new CNS/ATM systems. This will be helpful to them since they cannot afford a costly and sophisticated system on their own. Such an approach is based on ICAO's experience of over forty years of agreements for the

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[6] Sochor, ***supra***, General Introduction, note 13, at 56.

[7] Milde, ***supra***, Chapter III, note 74, at 126.

[8] ***Ibid.***, at 23*ff*.

[9] Sochor, ***supra***, General Introduction, note 13, at 30*ff*.

provision of ATC, communication and meteorological services on the North Atlantic, as well as on ICAO's role as a impartial organization with skill in the many disciplines needed for global civil aviation industry. The participation of ICAO will give aircraft operators the security they require regarding *User Charges*, which will be determined in a sound and equitable method and to arrange for a system of collection. More significantly, it will encourage the LDCs to join the implementation of the new system.[10]

Therefore, this writer recommends that ICAO create a new secretariat *unit* or *Section* to perform a *Governing Joint Support-type Committee*, to be financed in the same manner as are ICAO's costs of administering the DEN/ICE mechanism.[11] The establishment of such *Governing Joint Support-type Committee* would be in conformity with the Chicago Convention.[12] In fact, Chapter XV allows dynamic involvement by the ICAO Council in the arrangement, maintaining and adminstration of airports and air navigation facilities.[13] The ICAO Assembly *Resolution no.* A1-65[14] elaborates upon Chapter XV by defining primary principles and broad policies that are in harmony with financial and technical assistance through ICAO. This is for the additional provision of air navigation facilities and services suitable for the safe, regular, practical and economical operation of global services.

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[10] Kotaite, ***supra***, Chapter VII, note 190, at 7.

[11] ***Supra***, Chapter II, at P. 52*ff*.

[12] This idea also is supported by the view of M. Milde, ***supra***, Chapter I, note 2, at 98; also, according to ICAO's former Secretary General Y. Lambert:
"[t]*he organization will also remain alert so that new systems and technological improvements can be incorporated in the SARP's to make aviation an even safer, speedier and more efficient means of transport. We already have the first glimpses of what aviation will be like by the 21st century from the aerospace products and processes now in development: improved flight performance and greater fuel efficiency, longer range and higher capacity aircraft flying at grater speeds, technology to guide these aircraft safely along denser air routes and improved communications and surveillance by means of satellites.* "; see, "The Convention on International Civil Aviation: ...The First 40 Years"[1/84] ***ICAO Doc.*** E/P1/6000, at 4.

[13] *Chicago Convention*, ***supra***, General Introduction, note 5, Article 71.

[14] ICAO Doc., ***supra***, Chapter III, note 110, at IV-1-4.

ICAO's role in such approach would be similar to that under the DEN/ICE Joint Financing Agreements as following: the Secretary General in general terms should be responsible for supervising the service operation and inspecting it on a continuous basis; such supervision and inspection should, *inter alia*, guarantee the compliance with ICAO's relevant SARPs. The ICAO Council should be the governing body of the joint financing system and should act through the *Governing Joint Support-type Committee*. While the DEN/ICE system is based on the provision and operation of the services by the two States, Denmark and Iceland, the new CNS/ATM systems would be easily adjustable to the provision of other aeronautical systems and services operated by an entity other than a State. Regardless of who actually provides and operates the facilities or services concerned (which could be a State as the owner of satellite system, or group of States jointly operating a satellite system, the owner of the satellite system could also be an international organization or an *ad hoc* committee acting on behalf of a State or a group of States and finally could be some commercial or private entities) the entire scheme definitely will be under close international supervision. At present, it is hard to foretell the destiny of each service provider option, but at the present stage it is important to plan to avoid a situation in which the elaboration of any provision forms of satellite aviation service will be carried out without due concert and coordination.

To conclude, the DEN/ICE mechanism of the joint financing is the most suitable method to create a CNS/ATM global systems network. In M. Milde's view,[15] ICAO should concentrate on the joint financing offered by the Convention, rather than deliberating upon other models which may take the control of the new systems out of its hands. Accordingly, the idea which should be based on the mechanism mentioned above to administer and supervise the GNSS and AMSS services provided by the variety of service providers, to this writer is the most acceptable solution. Such a proposition is in need of an international agreement between the service provider(s) and ICAO which could give ICAO the autonomy to enforce its SARPs and carry out its new function satisfactorily.

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15 Milde, *supra*, Chapter III, note 83, at 439.

2. International Agreement Proposition for GNSS Service Provision Under ICAO Auspices

An internationally accepted legal framework which is deemed necessary for the provision of a *long-term* period must be responsive to the concerns expressed by the international community. Such a legal framework could take a form of an agreement between service providers and ICAO on global aspects of the GNSS to guarantee the accuracy, integrity and availability of the systems. ICAO functions should be defined within the framework of such an agreement. In this regard the agreement should address the following: the agreement should provide for consultations and cooperation between States parties and service provider(s). Such consultation could be undertaken on a regional or individual State basis. It is important to ensure that there is compatibility between the agreement and other international instruments, *inter alia*, the ITU Constitution and Convention and Outer Space Treaties. Accordingly, ICAO would be required to coordinate its activities as a regulatory agency with the ITU, WTO and other UN bodies dealing with the Peaceful Use of Outer Space and Ocean Area. Certification is the authorization to legalize the provision of aviation related safety services by service providers among a group of States. Civil aviation authorities must be certain that navigation services in their sovereign airspace are being provided in accordance with ICAO SARPs. These assurance would have to be provided by all service providers for the basic service that comprise GNSS, and for the augmentations to enhance system integrity and availability including that needed to meet civil aviation requirements for precision landing and airport surface operation. Compliance with these requirements must be ensured as the legally binding connection between ICAO and the service providers under such certification. Accordingly, the agreement should require that GNSS service providers must obtain a certification from ICAO, and they should as well provide the required documentation relating to the certification authorities.[16] K. Rattray, the

[16] ICAO, ***supra***, Chapter II, note 80, at 4G-3.

Rapporteur to ICAO Legal Committee,[17] has stated that the certification for any GNSS service provider should satisfy ICAO in respect of the matters contained in the ICAO guidelines recommended by the Legal Committee.[18] In this writer's opinion, certification should be also required from any AMSS service providers to ensure the same compatibility concerning AMSS services[19] regarding public entities, with general and specific guidelines. For safety and compatibility provisions, the certification of avionics equipment must be considered. This strategy takes into account the fact that States have an obligation to aviation safety service activities in their sovereign airspace.

The agreement should provide that ICAO Council would establish the criteria for the determination of *User Charges*, units of measurement, various types of utilisation, operating costs in order to ensure that these are non-discriminatory, directly related to the services and equitably apportioned among all categories of users.

This writer's opinion in regard to the GNSS service provider(s) liability is that the agreement should provide that liability shall be determined on the basis of the proposed agreement on the ATC and GNSS service providers liability propositions as will be illustrated below.

In order to give integrity to the system, there should be adequate machinery for the settlement of disputes which could arise between ICAO and service provider(s), or between ICAO and its contracting States or between user(s) and service provider(s) in regard to the interpretation and application of the agreement. Such disputes should be settled by negotiations between the parties concerned or by reference to some agreed dispute settlement procedures or should be settled by compulsory arbitration along the lines of the Annex to the INMARSAT Convention or any other compulsory method agreed on by the parties to the dispute.

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17 ***ICAO C-WP/9901***, on 10/02/94, at 7 (Attachment 1).

18 ***ICAO LC/29-WP/3-1***, Annex I at 9*ff*.

19 ***Ibid***, Attachment 1, Annex I, at 15*ff*.

3. Technical Cooperation and Training Considerations

There is a great need by the LDCs for ICAO coordinated assistance in CNS/ATM planning, cost-benefit analysis, systems specification and training. Since 1951, ICAO's Technical Cooperation Bureau (**TCB**)[20] has been providing its technical assistance to the majority of its member States in implementing ICAO's SARPs and Regional Air Navigation Plans. Funding for such assistance has been secured from the UNDP, the World Bank, other regional development banks, and from member States. The Statement of the ICAO Council of March 9, 1994 on CNS/ATM Systems Implementation/ Operation, stated that:

> "*ICAO shall play its central role in coordinating technical cooperation arrangements for CNS/ATM systems implementation;* [b]...*ICAO shall coordinate and monitor implementation of the CNS/ATM systems on a global basis, in accordance with ICAO's regional air navigation plans and the global coordinated CNS/ATM systems plan; and...*[c]..., *ICAO shall facilitate the provision of assistance to States with regard to the technical, financial, managerial, legal and co-operative aspects of implementation.*"[21]

This is a clear indication that ICAO should be a leader in the implementation of the new systems. In order for the TCB to fulfil its assigned tasks it:

> "*[n]eeds assessment surveys in developing countries; [e]valuation, preparation and demonstration of implementation options including cost/benefit analyses; [l]egal advice and assistance; [m]aster planning and transition planning; [s]ystems planning, procurement, installation, testing, commissioning; [p]lanning and implementation of training programmes; [and] [m]obilization and coordination of technical co-operation from multi/bilateral funding sources.*"[22]

The LDCs are in need of training and lack of training is one of the reasons given for the inability of LDC's to implement even the existing systems. While training is the responsibility of each State, many States will need assistance in this area. There are two

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[20] The current TCB originally was called Technical Assistance Bureau (**TAB**).

[21] As cited in, ***ICAO CASITAF/1, Mechanism Paper no.*** *3*, May 24/26, 1994, at 1.

[22] ***Ibid.***, at 2.

kinds of training: one which is at the *technical level* and will depend on specific system implementation; and the second is comprehensive training which will be required at the *managerial level* in order to address the new institutional, administrative, and economic issues associated with the transition to the new system. IATA suggested that ICAO create an agency with the specific task of helping LDCs with planning, trials, training and financing.[23] In November 1994, the ICAO Council in defining the ICAO policy on CNS/ATM systems implementation, stressed the need for an ICAO *Technical Cooperation Programme* and stated that:

> *"..., on a priority basis, ICAO undertake to take action to encourage multilateral and bilateral agreements and/or to secure the necessary funds to support technical co-operation programmes..., and encourage States and stakeholder to provide staff or other resources to support ICAO free of charge..."*[24]

The Council also agreed that, to the extent possible, the TRAINAIR Programme be used as a vehicle to address CNS/ATM training requirements raised by States and, as a priority, to support the continuation of CNS/ATM workshops and seminars in order to ensure a common understanding among CNS/ATM user States and also to assist States with limited financial resources.[25]

However, recognizing the limited resources of the TCB, the proposed CNS/ATM *Technical Cooperation Programme* will require extra budgetary resources to enable it to perform these additional functions. It is anticipated that the major part of the contribution for the CNS/ATM *Technical Cooperation Program* will come from what is requested by the Council to be established "the *Technical Cooperation Funding Mechanism*" as a means of ensuring more stable financial resources for ICAO's technical cooperation activities.[26] In addition, the *Technical Cooperation Programme* will be in need to make

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[23] *ICAO CASITAF/1, Mechanism Paper no. 2*, May 24/26, 1994.

[24] *ICAO C-DEC* **143/17.**

[25] *Id.*

[26] *ICAO C-WP/10117*, **3/2/95.**

use of the existing pool of resources and to attract supplementary funds from the traditional funding sources for ICAO such as UNDP, the global or regional development banks and international organizations and bilateral funding sources including ICAO member States, TRAINAIR Central Unit, which is funded as part of the ICAO regular programme; and also the Civil Aviation Training Centres (**CARCs**), which provide the majority of trained personnel operating national and regional air transport systems. Additionally, many States have their training facilities which could be used to provide training for the new systems to other States. This writer believes that the above training programmes should be coordinated through ICAO to ensure that the training provided is globally standardized and it is essential that ICAO fulfil its new tasks in the new mechanism as the CNS/ATM *Hub*.

B. The ATC and GNSS Service Providers Liability Propositions

Aviation technology has progressed considerably, as have ATC services and the equipment used by different ATC, primarily the satellite, computers, radars, and navigational aids. The increase in air traffic is enormous, and the process of evolution shows that the air transport industry is an important segment of every State's economy. Against this background, the significance of safe conduct in air traffic becomes more apparent.

As ATC services play an important role in aviation safety, the question of liability of ATC becomes relevant if the ATC commits an act which causes damage to the aircraft, passengers or their property, and to third-parties on the surface. As this writer illustrated earlier,[27] there is a need for an ATC uniform liability strategy. However, it will not be an easy task for ICAO to gain the support of the majority its member States. Given the globalization and privatization trends of the world, States should appreciate that a uniform legal system is a better compromise than heterogenous legal systems.

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[27] ***Supra***, Chapter VI, at P. 184*ff.*

Even though International Outer Space Conventions are applicable to the new CNS/ATM systems, they are not adequate enough to govern them because of their ambiguous terminologies, *e.g.*, the definition of damage under the Liability Convention, the dispute settlement procedures, and the claims made under such Conventions. This writer believes that this will cause great difficulty in the future with the global implementation of the new CNS/ATM systems. There is a need to amend the current International Outer Space Conventions and Treaties, at least for the *long-term* period. Presently, no legal instrument has been yet drafted for the new system's service providers liability. In this writer's opinion, regardless of the international instrument's form or status, the subject matter must include at least: *scope of application; definitions and interpretations; the liability system and its defences; the applicable jurisdiction; insurance and guarantees; dispute settlement mechanism.* Hence, the analysis of this subject raises various questions which must be considered briefly in the following.

The ATC agency should be precisely defined, and the scope of application of services under international instrument must be as broad as possible in order to include the service for area control, approach control, aerodrome control, air traffic advisory service, alert and information services.

The liability system, whether it is *strict liability* or *fault liability* each has its merit depending on the claimants and defendants preference of the concerned State. The service user States should be protected, since it will be very difficult for them to prove a failure or malfunction on the part of the service providers. This writer favours the *strict liability* system for various reasons. One being that a proof of fault does not effectively determine guilt because the evidence for determining the exact cause of the accident in aviation cases is difficult to obtain; also with expanding technology it becomes increasingly difficult if not impossible for either the victim or the government to establish the exact cause of the accident. From an economic point of view the proof of fault causes claims to be brought into court to prove fault instead of being settled outside court; that causes great delay and expense and may force the victim to accept settlement too easily for much too little; it is noticeable that there is trend in air law towards a non-fault regime.[28]

Another significant point is whether liability should be *limited* or *unlimited*. It seems that States would favour limits on liability in private air law conventions, and it is expected that many will rebel if this is not enclosed in an international instrument. Great difficulty in agreeing on any limit is anticipated from the USA, Japan and other developed countries which would not join any agreement based on *limited liability* unless the limit was very high. Therefore, there is a need for the anticipated limit to be clearly established in order to satisfy the wishes of those in favour of *limited liability* as well as those in favour of *unlimited liability*.

Although, this writer favours *unlimited liability* for the ATC and GNSS service provider(s), he also does not reject the concept of limitation of liability as long as the States have the right to provide for a "domestic supplement" analogous to the provision of Article 35A of the Guatemala City Protocol of 1971 which stated that:

> *"[n]o provision contained in this Convention shall prevent a State from establishing and operating within its territory a system to supplement the compensation payable to claimants under the Convention in respect of death, or personal injury,... ."*[29]

This is in order to adjust the limit to their specific needs beyond, and even authorize full compensation for the damage sustained. The basic principle is for the victim to be restored to the same status as before the damage, in other words, *unlimited liability* should mean a real compensation for actual damage. It is essential to be practical and to demonstrate the potential legal trend that could be anticipated in the near future in order to have a system of liability that is as unified as possible.

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[28] Zuzak C. A., ***Liability for Breaches of Aviation Security Obligations*** (LL.M. Thesis, McGill University, 1990) at *1ff;* see also, Sasseville H., "Air Traffic Control Agencies Fault Liability VS Strict Liability"(1985)X ***AASL*** at 239.

[29] Additional Protocol number 3 to Amend the Convention for the Unification of Certain Rules Relating to International Carriage by Air, signed at Warsaw on 12 October 1929, as Amended by the Protocol done at The Hague on 28 September 1955, signed at Guatemala City, on 8 March 1971, ***ICAO Doc.*** 9147.

It must be clearly indicated that no defence can be based on the State immunity principle regarding the damage resulting from its operation. In other words, States must consent to be sued by its nationals or foreigners. This writer is of the view that no exceptions should be made in favour of service provider States. However there are various defence against liability which must be accepted, *e.g.*, third-party act, *force majeure* and fault of the victim.

As to the jurisdiction which should be applicable, practice indicates that the majority of States favour that suits for negligence against them, as well as wrongful acts of omissions of their ATC, be brought before courts in their countries unless certain States consent to foreign jurisdiction in certain instances.[30] As indicated within the Rapporteur's report to the 29*th* Session of the Legal Committee any action should be brought before any of the following courts: the court where the ATC agency is located, the court where the damage occurred.[31] In this writer's opinion, regarding the GNSS service providers, the action could be brought before the court of the State's service provider or the principal place of business, which can also apply to international entities or any other service provider, or before the court where the damage occurred.

The guarantee concept is important for ATC as much as for GNSS service provider(s) in that they must ensure payment of claims in case of damage. While a State and its institutions or agencies provide a service, it is acceptable in practice to do so without insurance since in most cases States are self-insurers. However, with the current participation of private enterprise they must carry insurance to cover there business operation. Therefore, this writer strongly believes that it must be clear that private service providers must obtain sufficient insurance. That guarantee or insurance is very important for the service providers in order to support them in continuing their services, and for the creditors' confidence that they will be compensated.

The types of *injury* included in damages that may arise as a result of wrongful acts or equipment failures must be indicated clearly. With respect to GNSS, this writer's

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[30] Dahal, ***supra***, Chapter VI, note 102, at 17.

[31] ***ICAO LC/29-WP/7-3***, at 17.

opinion is that it must be clear that the definition of damage includes direct and indirect damage, damage which may be caused by electronic interference, or damage caused by transmission failure which could be considered as damage by distortion or the preclusion of transmission which carries valuable information that has economic value.

With regard to a dispute settlement mechanism: the current dispute settlement mechanisms either in the Chicago Convention or in the space law conventions are not adequate mechanisms as illustrated earlier in Chapter VI. However, the rapporteur to the 29*th* Legal Committee proposes that the rules in Articles 84 to 88 of the Chicago Convention should apply and suggests to introduce them into a draft convention, which would be aligned on the Chicago system.[32] In the Argentine preliminary draft on the liability of ATC agencies[33] in its Articles 35, 36 illustrates that in any disagreement between two or more contracting States the dispute should be settled by direct negotiation and under Articles 84 to 88 of the Chicago Convention; if there is no agreement, the parties should submit their difference to a Court of Arbitration.

However this writer's opinion is that there is a need for more binding techniques and a general forum is favoured, as well as a set of legal procedures for dispute settlement of within the GNSS system. Such disputes should be settled by negotiations between the parties concerned or by reference to some agreed dispute settlement procedures or should be settled by compulsory arbitration along the lines of the Annex to the INMARSAT Convention or any other compulsory method agreed on by the parties to the dispute.

All the above-mentioned points which have been raised regarding the GNSS service providers and ATC liability, also apply to satellite communication system liability, as illustrated earlier in Chapter VI, in order to protect service users in safety communication; a liability system based on fault would not be adequate. Accordingly, there should be strict and unlimited liability. Wi h regard to non-safety communication,

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[32] ***ICAO LC/29-WP7-3*, 13/3/94 at 18.**

[33] ***Ibid.***, at 19.

liability based on fault would be justified. However, in other views this will give too much protection to the service provider(s).

Concluding Remarks

ICAO is the most appropriate organization and has the capability to establish uniform regulation for the CNS/ATM systems. In this writer's opinion, apart from its regulatory and rule-making function for international standards, ICAO must play a key role in the transition period and the *long-term* period of the new CNS/ATM systems implementation on the basis of its competence in institutional arrangements. The institutional framework of the new systems for the *long-term* period should be firmly based on Chapter XV of the Chicago Convention. It is anticipated that the use of a mechanism within ICAO, on the basis of the DEN/ICE as illustrated earlier, to act on behalf of its contracting States would be the most acceptable mechanism for the majority of its member States.

Without an effective unification of law relating to ATC and CNS/ATM systems liability the *long-term* period would be chaotic and disruptive in terms of conflicts of law and jurisdiction. Settlement of claims would become unpredictable both for the civil aviation industry, CNS/ATM service providers and for passengers. Therefore, in this writer's opinion it is essential, at least for the *long-term* period, to have a unified instrument not only for ATC liability but also for GNSS service provider(s).

Both the legal and the commercial environments in which CNS/ATM systems' transponder contracts are going to be negotiated are subject to continuous change. Contractual issues and solutions can be expected to follow a corresponding pattern of change, this writer recommends to ICAO to develop a model text for the international agreement for GNSS service provision under its auspices, also to draft the basic structure of the model contract or agreement at the national level between the user States and the service provider(s).

Final Remarks

Current aircraft operations are so diverse and complex that protection must be provided against the possibility of a total system breakdown due to human error or failure of one system component. Fatalities, despite improving safety records, pose a significant hazard to the entire aviation industry unless the CNS/ATM mechanism is in place as soon as possible.

Yet the air traffic rate of increase will vary among regions of the world, with entire regions expected to continue increasing in air traffic demand into the next century. The CNS/ATM implementation as pointed out through this thesis will be a complicated, multifaceted and gradual process. Implementation of the ICAO CNS/ATM systems should be achieved in a coordinated way, compatible with regional demand. Accordingly, ICAO has asked the regions to generate plans for CNS/ATM implementation in conformity with the global scheme.

Furthermore, the standardization of the CNS/ATM systems is essential, and certainly will reduce costs for the user(s) or service provider(s). It will also decrease the time needed by the aviation industry to attain such systems. The organizational arrangements for CNS/ATM systems must be capable to tolerate the fact that various elements such as space segment, airborne facilities, earth stations and ATC facilities, will be furnished by various suppliers. This means that they must allow for competition among providers while meeting ICAO SARPs shaped by the FANS Committee Guiding Principle and Guidelines, and the requirements of national air traffic service authorities.

The new systems' implementation must be carefully monitored and coordinated. Advice and aid should be given to those responsible for implementation, the national authorities, so as to guarantee a well-timed, cost-effective and efficient transition to the new systems. Some States may have the ability to have their own system, but a haphazard strategy of implementation will not achieve the system's vast advantages. Rather it would splinter the global plan, add to implementation costs, and may threaten safety. ATM is more conducive to cooperation than to competition. Certainly, the civil aviation community has a definite stake in a globally coordinated strategy.

When it comes to implementation at the national level it is the States and their air traffic service providers who will have to carry out their own economic cost/benefit analysis. There will certainly be variations at the level of tangible and intangible advantages from one State to another. For LDCs CNS/ATM may furnish the chance to leapfrog into new systems technology; that is, to abandon current and future equipment and go directly to new CNS/ATM systems in their airspace management. For other States there will be elements such as the amortization of current equipment which will be deemed critical and which will affect the timing of financial outlay on new systems. But above all, it must be kept in mind that the new systems' financing is an international matter and is the result of a complex transaction. Nonetheless, evolution between States or regions should not lead to incompatibility among factors of the universal system, and the key to this will be global harmony.

The new systems' achievement on the *short-term* period should be gradual and limited to States which desire to have the service. The express consent by States, in the form of bilateral agreements or by any other form, will be required for their participation and the related assumption of duties with respect to the installation, operation and financial aspects of the new systems.

The institutional framework for the new aeronautical CNS/ATM systems for the *long-term* period should be based on the Chicago Convention. The general framework of the DEN/ICE agreement could serve as a good example from the financial and the institutional point of view as illustrated earlier.

The CNS/ATM technology demands global cooperation if it is to fulfil its potential for cost-saving, improved safety and economic benefit to individual States. ICAO faces a major leadership task in adapting its management and planning processes to cope with the reality of a completely new approach to the provision of the industry's CNS/ATM systems. Due to high costs, highly specialized technologies, and to the nature of satellite services, cooperative ventures on a regional or global basis are the most efficient and equitable method of utilizing satellite systems.

The CNS/ATM systems as subject to the application of various distinctive legal regimes. While the rules of air law acknowledging the sovereignty of the State over its airspace regulate aircraft navigation, the legal principles and codified rules of space law endorsing the freedom of navigation in the outer space apply to the activities utilizing outer space. As mentioned through this thesis the new systems are in conformity with the basic principles of outer space law, and are subject to the liability regime established by Outer Space Treaties and the Liability Convention. They are also in conformity with the law of telecommunications and public air law.

However, the introduction of satellite services and private service providers in the commercial aviation industry will demand further development in the regulation governing its activities. Liability is a significant legal issue affecting the operation of the new systems. Service providers' liability is governed by international law. The liability convention, with OST Article VII, establishes a legal regime under which the contracting States are liable for personal injury caused by governmental entities. However, system failure or malfunctions, delay, and other indirect damages are not expressly included under the definition of *damage* covered by the liability convention. Also, international governmental organizations may be able to avoid liability under the liability convention, although such action would shift any burden of liability on to its member States. Furthermore, national law may also govern claims against private service providers, and claims against the launching State. This is subject to the government agreement waiving its immunity prior to such claims, and must be done through diplomatic channels. Here, one can question whether it is possible and desirable to include the new CNS/ATM service providers' liability within one legal regime.

The CNS/ATM beginning requires a pooling of intellectual and material resources, and hence regional and global cooperation. Moreover, the nature of the problems which are facing the new systems cannot be solved by science and technology alone.

The political will and proper political action to tackle the problems with joint efforts are at least as essential as the economic, institutional, and legal aspects of introducing the satellite to the aviation industry. The efficiency of the present CNS systems is an essential factor as it has to consider application, and operating costs, and also the capability to meet the needs of aircraft operators. It is obvious that the changing environment worldwide has produced many challenges for the management of international civil aviation. Although the new environment contains substantial risks, it also presents enormous opportunities in the current movement towards using satellite for civil aviation purposes. The achievement of the new systems certainly will be to the advantage of the civil aviation operators, and will benefit the general public as users which are looking for secure and reliable air transport in the swift and dependable movement of passengers and freight.

For the legal scholars and the law-makers the introduction of the satellite-based CNS/ATM systems represents a major challenge to define a global regulatory regime; it also represents a dramatically new example of the mutual interaction between "*air law*", "*space law*" and "*telecommunications law*". It has been a gratifying task for this writer to attempt to find some legal solutions for these new problems.

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