Soon to be paperless, but nevertheless not lawless: legal challenges surrounding the publication of aeronautical information

by

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ABSTRACT

This thesis reviews the legal, political and technical aspects of aeronautical information, with a particular focus on the situation of aeronautical information in Europe. It portrays the evolution of aeronautical information and its current nature. It looks at the responsibility for the publication of aeronautical information and the evolution of that notion due to recent trends towards corporatisation to the detriment of full State ownership. It also examines the question of liability for the publication of aeronautical information, including the various legal regimes under which victims of defective aeronautical information can claim compensation, as well as the legal mechanisms underlying and implementing such compensation regimes. The final chapter is concerned with electronic aeronautical information and the specific legal challenges this technological revolution has brought about.

RÉSUMÉ

Ce mémoire passe en revue les aspects juridiques, politiques et techniques de l'information aéronautique, en mettant tout particulièrement l'accent sur sa situation en contexte européen. Il retrace l'évolution de l'information aéronautique et sa nature actuelle. Il s'attarde à la responsabilité institutionnelle de la publication de l'information aéronautique, de même qu'au contenu changeant de cette notion, modifiée par les récents mouvements en faveur de la « corporatisation » au détriment de la pleine propriété étatique. Ce mémoire porte également sur la responsabilité civile découlant de la publication de l'information aéronautique, y compris les divers régimes d'indemnisation ouverts aux victimes d'information aéronautique fautive, en plus de s'intéresser aux mécanismes juridiques qui sous-tendent ces régimes. Le dernier chapitre porte sur l'information aéronautique électronique et les enjeux juridiques propres que cette révolution technologique a entraîné dans son sillage.

À ma famille

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ABBREVIATIONS

AFTN	Aeronautical Fixed Telegraphic Network
AI	aeronautical information
AIC	Aeronautical Information Circular
AIRAC	Aeronautical Information Regulation and Control
AIP	Aeronautical Information Publication
AIS	aeronautical information services
ANS	air navigation service(s)
ASECNA	Agence pour la sécurité de la navigation aérienne en Afrique et à Madagascar
ASHTAM	NOTAM notifying the presence of volcanic ash at flight level
ATM	air traffic management
ATS	air traffic service(s)
CANSO	Civil Air Navigation Services Organisation
CNS/ATM	Communication Navigation Surveillance / Air Traffic Management
CRT	cathode ray tube
DFS	Deutsche Flugsicherung GmbH
EACD(s)	electronic aeronautical chart display(s)
EAD	European Aeronautical Information Services Database
e-AI	electronic aeronautical information
EAIP	European Aeronautical Information Publication
EATMN	European air traffic management network
EC	European Community
ECAC	European Conference of Civil Aviation
EUIR	European Upper Flight Information Region
Eurocontrol	European Organisation for the Safety of Air Navigation
FAA	Federal Aviation Administration
FIR	Flight Information Region
FMC	flight management computer
GNSS	Global Navigation Satellite System
HLG	High-Level Group
IAIP	Integrated Aeronautical Information Package
ICAN	International Commission for Air Navigation
ICAO	International Civil Aviation Organization
IFR	Instrument Flight Rules
LCD	liquid crystal display
NATS	National Air Traffic Services Ltd.
NOTAM	Notices to Airmen
par.	paragraph(s)
PIB	Pre-flight Information Bulletin
PRNAV	Precision Area Navigation
SARP(s)	Standard(s) and Recommended Practice(s)
sec.	section(s)
SES	Single European Sky
SNOWTAM	NOTAM notifying the presence of snow, slush, ice or standing water on pavement
UNCITRAL	United Nations Commission on International Trade Law
VFR OTT	Visual Flight Rules Over The Top

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Introduction

The twentieth century was the century of aviation. The twenty-first century is the century of the digital revolution. The subject of this thesis stands at the crossroads of both. 'Aeronautical information' incarnates the constantly-changing information aviators need to accomplish their daily endeavours. Contrary to the eternal and unchanging laws of aerodynamics, aeronautical information is more often than not a knowledge of the instantaneous, of the ever-changing, and this particular nature is reflected in the legal framework surrounding it.

The purpose of this thesis is to look at the legal, political and technical aspects of aeronautical information today, as well as to attempt to forecast the kind of ground in which the next generation of aeronautical information systems will set roots.

Throughout this thesis, a great deal of attention is paid to the situation of aeronautical information in Europe. This is a deliberate choice owed to the significant legal and technological developments having occurred on European soil in the past few years with respect to aeronautical information, making it an especially rich and attractive ground for analysis.

In order to achieve its purpose, this thesis traces the evolution of aeronautical information and portrays its current nature and legal environment. This is followed by a detailed look at what the responsibility for the publication of aeronautical information entails, and the shifting nature of this notion, a shift evidenced by, among others, the recent trend towards corporatisation and the progressive retreat from State control in this domain. The changes presently taking place in Europe regarding 'who' publishes aeronautical information and 'how' it is done, are extensively reviewed.

Next comes the crucial question of the liability for the publication of aeronautical information. Here are analysed the various legal regimes under which victims of defective aeronautical information can claim compensation, as well as the legal mechanisms underlying and implementing such compensation regimes.

The final chapter is concerned with the perhaps more 'edgy' and current aspect of aeronautical information, and that is electronic aeronautical information. Although it comes to the aeronautical community with its own specific legal challenges, electronic aeronautical information does not constitute a stand-alone legal topic. It dwells on the teachings and the framework of 'traditional' aeronautical information. Hence this author's attempt to place them both alongside herein, in the hope of pointing out the salient differences between the two and the technological evolution brought about by the new methods.

During the elaboration of this thesis, the limitations of the currently available material soon appeared. Therefore, the reader will not find here references to treatises or legal works of great magnitude, but rather to a number of regulations, studies, position papers, handbooks, etc., all attesting to the very concrete and sometimes highly technical nature of this rapidly evolving domain.

For want of specific legal literature, some subjects are studied in a comparative manner, by approximating known legal concepts or rules to topics for which no specific concepts or rules were found to exist. In so doing, great care was taken to compare only was is logically 'comparable'.

Finally, the inevitable reality of this kind of work could not be escaped: not everything can find its place and fit within a master's thesis. Choices had to be made, which left aside a number of subtopics even though they fell entirely within the purview of the main subject. Among them are copyright and aeronautical information intellectual property issues, to name but one.

It is hoped that such voluntary omissions will not cloud this author's attempt to present as relevant a portrait as possible of the legal challenges surrounding the publication of aeronautical information.

- I -

THE NATURE OF AERONAUTICAL INFORMATION

A) Origins of aeronautical information

'Aeronautical information' was not a household expression during the infancy of aviation, when a pilot's eyes were his only means of guiding his course. Had the expression yet been coined, it would then have referred to nothing more than basic aeronautical maps, styled 'charts' following the maritime practice.

The evidence of the parenthood of maritime law in early aviation concepts and vocabulary (most of these having trickled down to the present day intact) is abundant, as for example the use of the term 'chart' for designating aeronautical maps, irrespective of the fact that a given chart may depict nothing but a land mass, even though, technically speaking, "a chart should show more water than land"![1]

Though the first aviators often dispensed with proper aeronautical charts, the need for standardization in this field was quickly grasped by the members of the Aeronautical Commission of the 1919 Paris Peace Conference, whose work led to the adoption of the International Convention Relating to the Regulation of Aerial Navigation[2], on 13 October 1919.

Among the duties entrusted to the International Commission for Air Navigation (ICAN) – the permanent body set up by the Convention – was the one "to ensure the publication of maps for air navigation in accordance with the provisions of Annex F."[3] The need for uniformity was further stressed in the Final Provisions of the Convention, which stated that "the High Contracting Parties undertake as far as they are respectively concerned to co-operate as far as possible in international measures concerning ... the publication of standard aeronautical maps ... in accordance with the provisions of Annex F."[4]

As for Annex F itself, it contained a fairly elaborate section mandating standards for the "Design of the Sheets of Aeronautical Maps", although these quite predictably did not reach the level of detail found in current aeronautical information standards promulgated by the International Civil Aviation Organisation (ICAO). It is noteworthy that Annex F divided the map-publication burden between the States and ICAN (*e.g.* Basic Map). By contrast, the current international regulatory scheme reserves all chart publication

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1 Thomas A. Dickinson, *The Aeronautical Dictionary* (New York: Pitman, 1945) *s.v.* "map".

2 *International Convention Relating to the Regulation of Aerial Navigation,* 13 October 1919 (Washington: United States Government Printing Office, 1944) [*Paris Convention*].

3 *Ibid.*, art. 34 (f).

4 *Ibid.*, art. 35 (b).

activity to the States, and indeed ICAO has not followed in the footsteps of ICAN in this respect, as it does not itself publish any chart.

This is how Dr. Albert ROPER, one the acknowledged minds behind the 1919 Paris Convention, assessed the aspiration to uniformity that the Convention and its 'annexes system' embodied:

> It was often said that the usefulness of the Convention was to be found in its annexes; from a practical standpoint, this assertion is correct … . Indeed, in the absence of such a general convention, States would have had to establish their own national regulations … which, from the start, would have varied among themselves and which would thus have not lent themselves easily to ulterior attempts of unification. But in the field of aviation, unification is quite indispensable: … pilots could never fly a long range route if the aeronautical charts published by various States were not of a comparable design and bore symbols not comporting the same meaning everywhere.[5]

B) Chicago Convention framework

The core principle concerning the provision of air navigation services is laid down in Article 28 of the Convention on International Civil Aviation[6], which reads as follows:

> Each contracting State undertakes, so far as it may find practicable, to:
>
> (a) Provide, in its territory, … air navigation facilities to facilitate international air navigation, in accordance with the standards and practices recommended or established from time to time, pursuant to this Convention;
>
> …
>
> (c) Collaborate in international measures to secure the publication of aeronautical maps and charts in accordance with standards which may be recommended or established from time to time, pursuant to this Convention.

In keeping with the internal logic set forth in the Paris Convention, the language used in the articles of the Chicago Convention is voluntarily broad and leaves the minutiae of their implementation to separate

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[5] Albert Roper, *La convention internationale du 13 octobre 1919 portant réglementation de la navigation aérienne: son origine, son application, son avenir* (Paris: Librairie du Recueil Sirey, 1930) at 200-201 [translated by author].

[6] *Convention on International Civil Aviation*, 7 December 1944, 15 U.N.T.S. 295, ICAO Doc. 7300/6 (1980) [*Chicago Convention*].

annexes, which are to be amended on a regular basis as to remain coherent with the technological advances of the day.

One notes in passing that paragraph (a) of Article 28 refers to 'standards and practices' whereas paragraph (c) solely refers to 'standards'. The reason for this discrepancy (which is also found in the French version of the text) is unknown; but it is of no practical effect since the annex implementing paragraph (c) (*i.e.* Annex 4) contains both 'standards' and 'recommended practices', as is the case with all annexes of the Chicago Convention.

And it is indeed in the annexes that lies the true power of the Convention in respect of aeronautical information services (AIS), by virtue of Articles 37 and 38. As mentioned earlier, Article 28 doesn't require anything more from the States than their "collaboration", and even that they must provide only to the extent of what they find to be "practicable". To say that the burden placed on States by Article 28 is not an unduly heavy one is an understatement.

This being said, the combined effect of Articles 37 and 38 allows for some measure of enforcement of the international standards, because States thereby undertake to adhere to ICAO's standards and procedures, unless they notify ICAO with national departures from such standards (which they are bound to do). Such departures carry a 'political' price in that they are communicated to all other States, thereby exposing a State's failings on a worldwide level. However, the primary purpose of reporting differences is to promote safety and efficiency in air navigation "by ensuring that governmental and other agencies, including operators, concerned with international civil aviation are made aware of all national rules and practices ..."[7]

ICAO's formal involvement in the field of AIS dates back to 15 May 1953, when the Council adopted the first AIS Standards and Practices, nowadays embodied in Annexes 4[8] and 15[9] of the Chicago Convention.

C) Current formats of aeronautical information

ICAO defines 'aeronautical data' as "a representation of aeronautical facts, concepts or instructions in a formalized manner suitable for communication, interpretation or processing."[10] For its part, 'aeronautical

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7 ICAO, *Aeronautical Information Services Manual*, 6th ed., Doc. 8126 AN/872 (Montréal: ICAO, 2003) at 1-2, 1-3 [*Aeronautical Information Services Manual*].

8 See *infra*, note 20.

9 ICAO, *Annex 15 to the Convention on International Civil Aviation – Aeronautical Information Services*, 11th ed. (Montréal: ICAO, 2003) [*Annex 15*].

information' is defined as the "information resulting from the assembly, analysis and formatting of aeronautical data."[11]

Therefore, by logical deduction, an 'Aeronautical Information Publication' (AIP) is:

> A publication issued by or with the authority of a State and containing information of a lasting character essential to air navigation, resulting from the assembly, analysis and formatting of aeronautical data, which is a representation of aeronautical facts, concepts or instructions in a formalized manner suitable for communication, interpretation or processing.[12]

Author T. ABELA describes the importance of AIP as follows:

> The AIP is the basic aviation document intended primarily to satisfy international requirements for the exchange of permanent aeronautical information and long duration temporary changes essential for air navigation. For example all the Departure and Arrival Procedures for each runway, the list of Navigational Aids and their related data and all the Communications Frequencies for each airport of the State are found in the AIP. ... This is the sort of Aeronautical Bible for each State where to find the Rules, Procedures and Information for all aviation operations in that particular State ... It is a reasonable sized book, which normally costs anything up to [USD$500] depending on the State size and aeronautical facilities.[13]

An 'Integrated Aeronautical Information Package' (IAIP) constitutes a wider array of documents and represents the common form under which aeronautical information is issued[14]. It is issued on a national basis (normally one IAIP per State being issued) and contains the following (see Figure 4-1[15] on page 13):

- AIP, including amendment service;
- AIP Supplements;
- NOTAM and PIB;

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10 *Ibid.*, at 2-1.

11 *Ibid.*

12 *Ibid.*

13 Tony Abela, "Dossier Aviation: Air Traffic Services – Part I" (1 October 2003), online: <http://www.maltastar.com> [*Abela*].

14 "Aeronautical information shall be published as an Integrated Aeronautical Information Package." (*Annex 15, supra* note 10, sec. 3.1.7)

15 *Aeronautical Information Services Manual, supra* note 7, at 4-3.

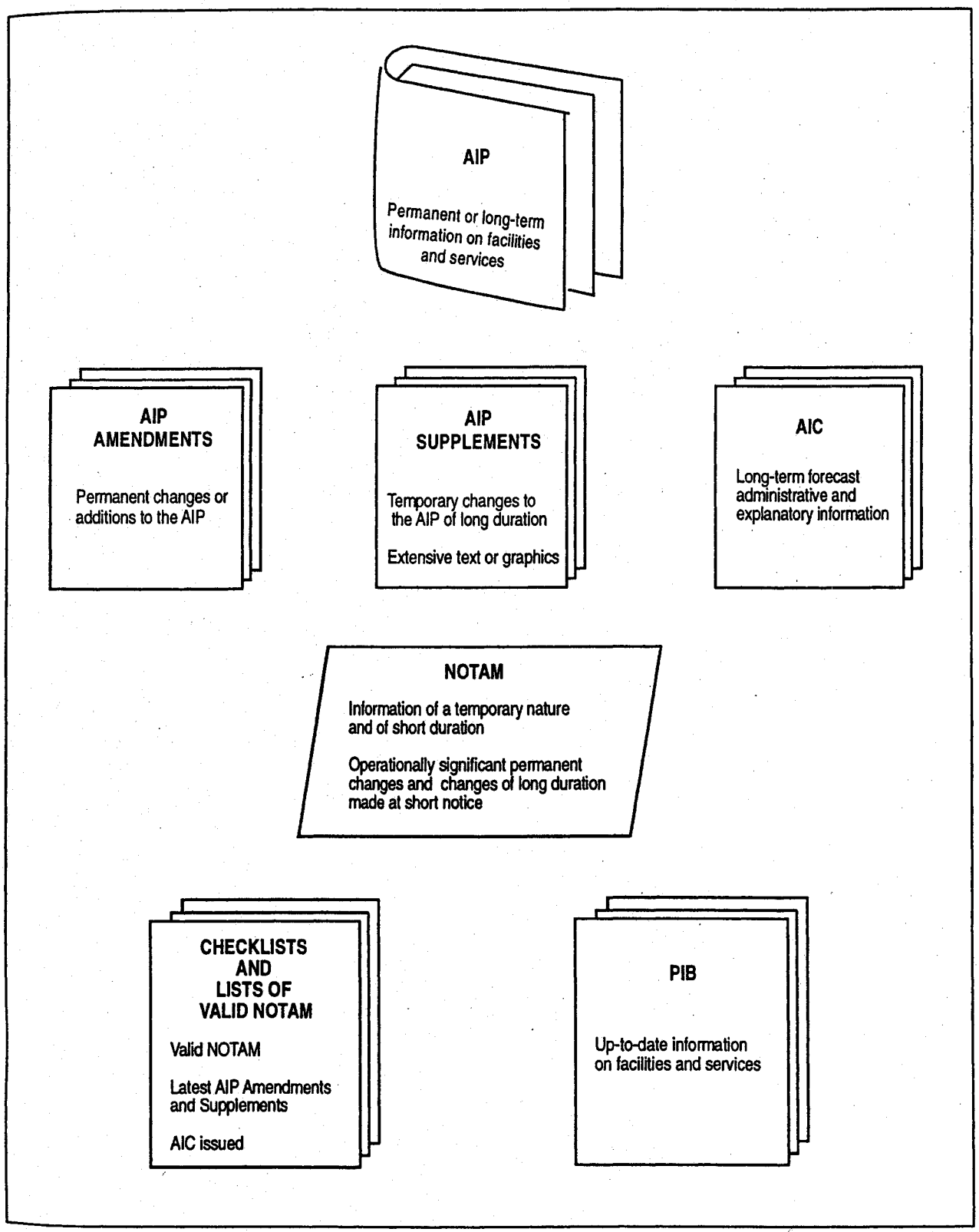

Figure 4-1 Integrated Aeronautical Information Package

- AIC; and

- checklists and lists of valid NOTAM. [16]

▪ An AIP is generally published at a rather long interval, *e.g.* every five years. The ongoing updating process of this AIP is thus implemented through AIP Amendments, which reflect operationally significant **permanent** changes. For their part, AIP Supplements reflect **temporary** changes of long duration (three months and longer) and information of short duration which consists of extensive text and/or graphics, supplementing the permanent information contained in the AIP. They are published by means of special pages.[17]

▪ Notices to Airmen (NOTAM) are notices distributed by means of telecommunication[18] containing information concerning the establishment, condition or change in any aeronautical facility, service, procedure or hazard, the timely knowledge of which is essential to personnel concerned with flight operations. Special NOTAM may be issued as ASHTAMs (warning of volcanic ashes) or SNOWTAMs (warning of snow and/or ice).

▪ The Pre-flight information bulletin (PIB) is a presentation of current NOTAM information of operational significance, prepared prior to flight.

▪ The Aeronautical Information Circular (AIC) is a notice containing information that does not qualify for the origination of a NOTAM or for inclusion in the AIP, but which relates to flight safety, air navigation, technical, administrative or legislative matters. It can be seen as an official letter addressed to the aircrew the authorities of a country. Usually, this information is "of an administrative nature and not directly concerned with the present conduct of airborne operation."[19]

'Aeronautical charts', although they are dealt with by a distinct annex of the Chicago Convention (Annex 4)[20], are highly intertwined with aeronautical information. The reasons for this are many:

- Both AIPs and charts are meant to provide essential data for the safe conduct of air navigation.

- The obligation put on States by Annex 4 to produce and publish charts is stated in terms practically identical to the obligation to produce aeronautical information (AI) laid down by Annex 15: "Annex 4

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16 *Annex 15, supra* note 10, at 2-1, 2-2.

17 *Abela, supra* note 13.

18 Usually through the Aeronautical Fixed Telegraphic Network (AFTN).

19 *Abela, supra* note 13.

20 See ICAO, *Annex 4 to the Convention on International Civil Aviation – Aeronautical Charts*, 10th ed. (Montréal: ICAO, 2001) [*Annex 4*].

requires each Contracting State to ensure the availability of the required charts either by producing the charts itself, or by arranging for production with another Contracting State or by an agency ..."[21];

- In the vast majority of cases, both emanate from the same national authority or corporation;

- From a dissemination of information standpoint, charts (whether in electronic or paper form) usually act as the physical support on which AI is presented; *e.g.* navigational aids and communication frequencies are printed on a sectional chart. This everyday reality is also recognized by Annex 15 SARPs:

> 4.1.3 The aeronautical charts ... shall, when available for designated international aerodromes/heliports, form part of the AIP, or be distributed separately to recipients of the AIP ...
>
> 4.1.4 Charts, maps or diagrams shall be used, when appropriate, to complement or as a substitute for the tabulations or text of Aeronautical Information Publications.
> *Note. – Where appropriate, charts produced in conformity with Annex 4* – Aeronautical Charts, *may be used to fulfil this requirement.*[22]

Therefore, in the present thesis the use of 'aeronautical information' (absent contrary context) is meant to cover both AI *per se* and aeronautical charts.

In many ICAO States, most of aeronautical information is still available only in paper form, though the use of electronic means of dissemination is increasing. But it remains that, at present, no State makes it AI available solely by electronic means.

- *Language*

AI is typically released in two or more languages, being English and the national language(s) of the State of publication. In any case, publication in English is mandated through Annex 15, where such publication is destined for out-of-the-country distribution:

> Each element of the Integrated Aeronautical Information Package for international distribution shall include English text for those parts expressed in plain language.[23]

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[21] ICAO, *Aeronautical Chart Manual*, 2nd ed., ICAO Doc. 8697-AN/889/2 (Montréal: ICAO, 1987) at par. 1.3.2 [*Aeronautical Chart Manual*].

[22] *Annex 15, supra* note 10, at 4-1 [italics in original].

[23] *Annex 15, supra* note 10, sec. 3.6.1.

The predominance of English as the preferential language for aeronautical communications is attested by a recent recommendation that the European Upper Flight Information Region (EUIR) AIP (the genesis of which is discussed below) be published exclusively in English, for, given the commonality and widespread use of English in the skies nowadays, "there is no need to provide the EUIR AIP in any other language."[24]

[24] STASYS, *Single European Sky – Provision of Aeronautical Information for the European Upper Flight Information Region (EUIR) – Phase Three Report: Detailed Description of the Preferred and Alternative Solutions* (Brussels: European Commission, 2004) at 87 [*EUIR III Report*].

- II -
THE RESPONSIBILITY FOR THE PUBLICATION OF AERONAUTICAL INFORMATION

A) Introduction

Annex 15 of the Chicago Convention posits the principle of responsibility of the State for the aeronautical information it publishes or that is published on its behalf. Indeed sec. 3.1.1 thereof states that an ICAO Contracting State shall: (a) provide an aeronautical information service, or (b) agree with one or more other Contracting State(s) for the provision of a joint service; or (c) delegate the authority for the provision of the service to a non-governmental agency, provided that Annex 15 SARPs are adequately met. Whatever channel the provision of aeronautical information may take, "the State concerned shall remain responsible for the information published." Moreover, "[a]eronautical information published for and on behalf of a State shall clearly indicate that it is published under the authority of that State."[25]

One might wish to reflect on the meaning of the term 'responsibility', as conveyed by Annex 15. 'Responsibility' is in fact the global – and not strictly legal – concept of answering for one's or another's conduct (which is consistent with the Latin root of the word[26]) which includes the more technical and legal concept of 'liability". This distinction is consistent with the definition of 'liability', which is the "quality or state of being legally obligated or accountable, [the] legal responsibility to another or to society, enforceable by civil remedy or criminal punishment."[27] It is also consistent with the official French and Russian versions of the text, both of which use a single word to cover both meanings ("responsabilité" in French; "ответственность" in Russian).

As an important institutional actor in the field of air navigation services (ANS) reminds us, "[a]lthough the State is responsible for the operation of air navigation services according to the Chicago Convention, it is not necessarily liable for damage caused by these services."[28] The present section looks at the general principle of State responsibility for ANS provision in recent history; how liability arises and operates is discussed further below.

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25 *Annex 15, supra* note 10, sec. 3.1.1.1.

26 See Bryan A. Garner, ed., *Black's Law Dictionary*, 8th ed. (St. Paul: West Group, 2004) *s.v.* "responsalis".

27 *Ibid., s.v.* "liability" [author's emphasis].

28 CANSO, "Information Paper: Single European Sky – Functional Blocks of Airspace" (11 November 2003) at 6.

As for the term 'responsibility' as used, but not defined, in Annex 15, it is suggested that it subsumes the following notions:

- *Responsibility acts as a liability-channelling device.* In situations where determining the legal liability relating to AI proves to be impossible or unduly difficult, Annex 15 clearly identifies the State as the invariable responsible, thereby not leaving the claimant without an entity towards which he may direct his claim. In this respect, it lays down a principle akin to the well-known European directive on product liability, which provides that "where the producer of the product cannot be identified, each supplier of the product shall be treated as its producer unless he informs the injured person, within a reasonable time, of the identity of the producer or of the person who supplied him with the product."[29] In a comparable perspective, where AI is involved, the State is always the 'ultimate producer'.

- *Responsibility has a character of permanence.* The State 'is' always; should it cease to exist, its obligations would most likely (although not always systematically) by assumed by a new or another State by way of succession. Establishing State responsibility is thus the safest way to ensure that no claim remains unfulfilled for lack or disappearance of an appropriate respondent – which, on the other hand, could happen should responsibility for AI provision be entrusted to a private law entity, as corporate existence of same may come to an end at some point in time.

- *Responsibility has a character of exclusivity.* The counterpart to the heavy burden placed on the State is that the State may assert its exclusive control over national AI, as a way to reduce the risk to which the activity of multiple and concurrent AI providers would otherwise expose the State. States can thus invoke this interpretation as a rational justification for national legislation implementing such exclusivity. But this remains a somewhat audacious proposition, for Annex 15 is generally thought not to confer a right on States as much as forbidding States to walk away from the consequences brought about by AI which they have undertaken to provide.

B) The corporatisation movement and the challenge to State responsibility

For the greater part of the 20th century, the nature and structure of ANS providers followed a 'classical' scheme: "For reasons of convenience, practicability, and politics, States ... traditionally elected to perform operational ANS functions themselves through government agencies."[30] But the past decade has seen a

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[29] EC, *Council Directive 85/374/EEC of 25 July 1985 on the approximation of the laws, regulations and administrative provisions of the Member States concerning liability for defective products* [1985] O.J. L. 210, art. 3(3) [*EC product liability directive*].

[30] "The Creation of a Single European Sky: The Shrinking Concept of Sovereignty" (2000) XXV Ann. Air & Sp. L. 239, at 250 [*Schubert I*].

strong movement towards corporatisation of ANS which has placed under unprecedented scrutiny, the principle of State responsibility for the AI. In the context of this thesis, it is of prime importance to retrace these developments, for aeronautical information is an integral part of what air navigation services as a whole are understood to be, and because national organisations charged with delivering ANS are almost always entrusted with issuing AI as well. Thus the corporate organization of ANS has a direct impact on the delivery of AI.

The word 'corporatisation' itself seems to be the subject of multiple interpretations. In 1999, two high-level ICAO officials wrote:

> ICAO has chosen to use the term "autonomous authority" to reflect the fact that commercialisation of air navigation services does not necessarily mean that the organisation has to move out of the scope of government jurisdiction, or that the government can abdicate its responsibility for the provision of air navigation services as laid down by the [Chicago Convention] ... By 'autonomous', ICAO means that the organisation should have greater freedom from the government in conducting its financial affairs, infrastructure funding, etc., and it should be self-financing, subject to the usual business taxes, and be required to seek a return on capital.[31]

In the same document, the Secretary General of the Civil Air Navigation Services Organisation (CANSO), a worldwide interest group representing ANS providers, wrote:

> It is important first to define what is meant by a "corporatised body". It is one that exists outside of the Government Civil Service and has certain commercial freedoms to act in the provision of services. It must be emphasised that these freedoms are limited by the contract or licence which the service supplier holds from the Government in question. CANSO prefers to use the term Corporatised Body rather than the ICAO use of Autonomous Organisations to emphasise that the autonomy is limited and the States concerned retain the responsibility to ensure that ANS are supplied to meet the requirements of the Chicago Convention.[32]

The year 1999 marks a period during which the various corporatisation projects taking place around the globe were characterized by both novelty and uncertainty, which goes to explain in part why a semantics

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[31] Gunnar Finnsson and Vladimir Zubkov, "The ICAO view on commercialisation of air navigation services" [*Finnsson/Zubkov*], in CANSO, *Corporatisation of Air Navigation Services – A Special Report* (Geneva: CANSO, 1999) at 4 [*CANSO report*].

[32] Derek McLauchlan, "The advantages of corporatisation", *ibid.*, at 7.

debate was taken up as an opportunity to pass along policy-based messages. For ICAO, it was indispensable to affirm the principle of ultimate State responsibility posed by the Chicago framework; for its part, CANSO sought to put forward the manoeuvring space and independence many ANS providers sought to conquer through corporatisation.

But already through this debate appeared the real issue: how would corporatisation affect the hitherto clear responsibility of the State for the provision of ANS services and, more specifically, aeronautical information.

In 2002, deploring that "[i]n the context of changes in ownership and management in the provision of ... air navigation services, a number of terms and phrases are currently being used with different meanings,"[33] ICAO attempted to put back some etymological order by providing specific definitions of privatization-related terms. Thus according to ICAO 'corporatisation' should convey the following meaning:

> ... creating a legal entity outside the government to manage ... air navigation services, either through a specific statute or under an existing general statute such as company law. ... Normally, ownership of the corporation remains with the government. However, in a corporatized body, private sector participation is possible. ... Corporatization is a legal organisational structure in which ... air navigation services are vested for operation and management.[34]

As such, corporatisation is to be distinguished from outright privatization. Nonetheless, the present analysis shall focus on all situations where government has retracted from the direct provision of ANS, whether through corporatisation, privatization, or setting up of a trust.[35]

Of course, Annex 15 does not prohibit corporatisation. Indeed it even permits means of ANS-provision than are even more remote from the State's managerial control than corporatisation itself, such as the delegation of functions to partially or fully private entities, or to another State. As one author puts is: "Article 28 of the Chicago Convention stipulates only that member States must deliver air traffic services, with no provision concerning how ATC services must be carried out. It is generally recognized that States

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[33] ICAO, *Privatization in the Provision of Airports and Air Navigation Services*, Cir. 284 AT/120 (Montréal: ICAO, 2002) at par. 2.5, 2.6 and 2.7.

[34] *Ibid.*

[35] *E.g.* Nav Canada.

are free to choose the structure and legal form of their respective ATC services."[36] Of course these comments also pertain to ANS and AIS, as all three types of service stem out of the same obligation laid down by Chicago Convention.

Corporatisation is in fact encouraged by ICAO, which urges governments to explore the possibility of establishing autonomous authorities to operate ANS, where it is in the best interests of providers and users.[37] This policy is "based on over fifty years monitoring which has shown that where such autonomous bodies have been established the financial situation of the ... air navigation services concerned has generally improved."[38] The prospect of an additional financial burden always being a most compelling argument, national governments are not keen on being "left with the sole responsibility for funding [their] air navigation system[s]", because "political expediency or public sector borrowing limits can mean that insufficient funding is available for creation of a safe, efficient and evolving infrastructure."[39]

Hence the enthusiasm with which States have embraced and materialised the concept of corporatised ANS. A study conducted in 2000 by a high-level group set up by the European Commission to investigate air traffic management (ATM) in Europe reported that, out of the 14 countries surveyed, eight had corporatised their national ANS, two were on the verge of doing so, and only four had maintained ANS as a either a government department or a 'State or semi-State' enterprise.[40] The report noted that "Member States [of the European Community] service providers (such as navigation services, meteorological information ...) are becoming increasingly independent from governmental structures. The reasons for this evolution vary from easier access to investment capital, responsiveness to user requirements and increased autonomy."[41]

Corporatisation of ANS initially raised interrogations as to the financial benefits it would yield, but it also posed a challenge to the principle of State responsibility, as already hinted above. Who would bear responsibility for the actions (or inaction) of the newly corporatised organisations?

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36 Wilhelm Stoffel, "The Privatization of Air Traffic Control in Germany" (1996) XXI-II Ann. Air & Sp. L. 279, at 289 [footnotes omitted] [*Stoffel*].

37 See ICAO, *Statements by the Council to Contracting States on Charges for Airports and Air Navigation Services*, 5th ed., Doc. 9082/5 (Montréal: ICAO, 1997).

38 Gunnar Finnsson, "The responsibilities of government in the provision of airports and air navigation services – A perspective" (Presentation to the Aviation Symposium•99, November 1999), at 1 [unpublished] [*Finnsson*].

39 *Finnsson/Zubkov, supra* note 31, at 3.

40 The actual number of corporatised ANS providers is higher since the 2004 enlargement of the European Union, at least two of the new Member States' ANS being already corporatised.

41 European Commission, Directorate-General for Transport and Energy, *Single European Sky – Report of a high-level group* (Brussels, November 2000) at par. 28 [*HLG Report*].

In the face of such interrogation, ICAO was quick to reaffirm the principle of State responsibility as laid down in the Chicago Convention. In the comprehensive study on the corporatisation of ANS published by CANSO, and previously quoted above, FINNSSON and ZUBKOV made ICAO's position known in no uncertain terms:

> ICAO ... emphasises that it is the State that in the final analysis is responsible for air navigation services and that, therefore, in reality, autonomy can never be complete. ... ICAO also warns that States should not see commercialisation[42] as a means of passing responsibility for the provision of air navigation services to the service provider. Ultimately that responsibility rests with the State as a signatory to the Chicago Convention and ICAO urges that States considering commercialisation should ensure that the government retains a sufficient level of expertise to both regulate and oversee the performance of air navigation services providers, in terms of safety, economy and user satisfaction. ... [L]egal and administrative arrangements will have to ensure that the State's responsibility to uphold the relevant articles of the Chicago Convention are maintained.[43]

In 1999, G. FINNSSON, then Chief of ICAO's Airport and Route Facility Management Section, reiterated his views on the matter, in a conference held in Reykjavik (Iceland):

> [U]nder Article 28 of the Chicago Convention, the charter of ICAO, each Contracting State undertakes to provide in its territory ... air navigation facilities, and to adopt and put into operation appropriate standard systems of operational practice and rules as recommended or established pursuant to the Convention. Since it is the State that has ratified the Convention, the responsibility quoted in Article 28 rests with the State and it cannot delegate that responsibility to a private entity. However, the State can of course delegate to or contract with a private entity to actively operate facilities and services but the **responsibility** for their provision, including the quality of the provision, and safety oversight, ultimately rests with the State.[44]

Although G. FINNSSON's views did not formally constitute ICAO's official position, they certainly are relevant in that they emanate from a high-level ICAO official, and are informed by ICAO's long-standing policies and practice.

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[42] Although the specific term used here is 'commercialisation', this passage is applicable to 'corporatisation', even more so given that corporatisation constitutes a further step towards privatization.

[43] *Finnsson/Zubkov, supra* note 31, at 5-6.

[44] *Finnsson, supra* note 38, at 2 [emphasis in original].

The European Community (EC) recently entrenched the principle of State responsibility in a Regulation relating to the provision in ANS in the context of the Single European Sky initiative (this initiative is discussed further below). The preamble of this Regulation reads in part: "Member States are responsible for monitoring the safe and efficient provision of air navigation services and for the control of compliance by air navigation service providers with the common requirements[45] established at Community level"[46] (the Regulation contains provisions more specifically implementing this principle).

The onus on European States who elect to delegate ANS provision is now double: to ensure that the chosen providers comply with ICAO SARPs; and that they comply with EC requirements.

Even if the existence and the extent of the principle of State responsibility is rather firmly established, its relevance is in doubt where it relates to States which have delegated the delivery of ANS ('non-provider States'). F. SCHUBERT reflects on this question in the context of Global Navigation Satellite System (GNSS) provision, but his words apply to AI provision as well, both services being provided under the umbrella of Article 28 of the Chicago Convention:

> Accepting the ultimate liability of non-provider States for the events transpiring over its territory, and caused by GNSS failure, would imply that such States must compensate victims regardless of the actual perpetrator at fault for the occurrence of damage. ... Thus, the main effect of this theory would be to lay responsibility beyond the mere duties of regulation and supervision upon the non-provider State for GNSS activities. That State would remain ultimately responsible and liable for damages caused by the negligence of foreign signal providers, irrespective of its own fault or negligence, while reserving all rights to indemnify itself at the expense of other parties. The doctrine of ultimate liability for non-provider States is not universally accepted. The opposing doctrine would deny all responsibility for non-provider States, unless the damage could be directly related to an act or omission of a civil servant. ... At the extreme position, it may be argued that non-provider States should not bear any liability, since they have neither involvement nor control in the provision of GNSS services or signals.[47]

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45 See Booz Allen Hamilton Ltd., *Study on Common Requirements for the Provision of Air Navigation Services – Final Report* (Brussels, 6 August 2003) [author's footnote].

46 EC, *Commission Regulation 550/2004 of 31 March 2004 on the provision of air navigation services in the single European sky* [2004] O.J. L. 6/10, preamble [*Service provision regulation*].

47 Francis P. Schubert, "An International Convention on GNSS Liability: When Does Desirable Become Necessary?" (1999) XXIV Ann. Air & Sp. L. 245, at 257.

In 1968, BOSSELER wrote that "all countries have accepted the principle that the responsibility for the provision of [air traffic] control services falls to the State"[48]; this has remained true to this day. Notwithstanding opposing views, it is now clear that States do and must retain ultimate responsibility over ANS provision and that there are means at their disposal in order to do so (among them is regulation and certification, which is examined below). But reservations based on the applicability of this principle are not always the only hurdles facing corporatisation and privatization initiatives, for same may sometimes be limited or prohibited by national legislation.

C) Legislative obstacles to corporatisation/privatization

In 1999, the President of the ICAO Council, in his foreword to the CANSO study, wrote: "A previously unthinkable thing is happening in the world of air navigation services. What used to be considered an untouchable, purely governmental function is being assigned to authorities having administrative and often financial autonomy."[49] SCHUBERT concurs with the President of the Council when he writes that: "The view was commonly shared that ATC was rooted too deeply into the sovereign functions of a State to be entrusted to any foreign entity outside of the formal government structure. ... [T]he idea of corporatization was long considered to be unthinkable."[50]

Both men pointed to one of the core questions surrounding corporatisation: do ANS constitute an inherently governmental function, one of these powers exercised by the Sovereign which may not be the subject of a delegation outside the perimeter of the State *per se*? As the speed with which the ANS corporatisation was implemented worldwide does *not* suggest, this debate has not definitely been settled and the various answers given may either hasten or slow, even stall, corporatisation endeavours.

In 1990, the German federal government tabled a proposal to transform the Federal Board for Air Traffic Control Services (*Bundesanstalt für Flugsicherung*) into a state-held private company: Deutsche Flugsicherung GmbH (DFS). The required legislative amendments were passed, but the Federal President refused to sign them into law, raising a constitutional impediment. Indeed Article 87(d) of the Federal Constitution provided that aviation administration was to be carried out as a federally-owned administration. Moreover, "the common opinion was that a private ATC company could not be charged with sovereign powers."[51] Only a constitutional amendment could solve the impediment, and the

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48 C. Bosseler, "International Problems of Air traffic Control and Possible Solutions" (1968) 34 J. Air L. & Com. 467.

49 *CANSO report, supra* note 31, at 2.

50 *Schubert 1, supra* note 30, at 243.

51 *Stoffel, supra* note 36, at 291.

legislative initiative was suspended for almost two years, while such an amendment made its way through both houses of the federal parliament. The result was a redrafted Article 87 of the Federal Constitution which "opens the possibility of a private law entity operating within the legal framework of the [Constitution] ... Sovereign powers are transferred to private entities that are owned by the Federal Republic ..."[52]

This case clearly illustrates the reluctance of the State to delegate sovereign or police powers. This is even truer when one considers that a constitutional amendment was required, not to transfer State functions to a privately owned entity (which would still be impossible even in the new framework), but merely to transfer State assets and functions to a State-owned entity organised under the law of corporations.

A report on the regulation of airspace management in view of the Single European Sky commissioned in 2001 by the European Commission drew a portrait of national legislations relating to delegation of ANS provision. Given the diversity of this portrait, it is fitting to quote this report extensively:

> Our survey sought to identify the types of bodies to whom Member States would be willing to delegate service provision tasks and the limits they would place on the responsibilities of these bodies. ... Not much consensus was found as regards delegation to a privately owned entity (either national or foreign). Only a small number of states including for example Finland, Italy and the United Kingdom allow such delegation. The laws of states such as the Netherlands and Portugal clearly prohibit delegation to an entity with private ownership. The situation in other states is much less clear. Spain for example noted that its national laws do not address the issue. In both Germany and Switzerland, ATS provision is delegated to companies organised under private law wholly owned or controlled by the respective governments.[53]

The report reveals an ambiguous situation, marked on one side by the eagerness of States to embrace the corporatisation model (and the substantial consequential budgetary benefits), and the notion of ANS as a "State-exclusive" function which is still entrenched to some degree in the European bureaucratic 'psyche'. This is reflected in the EC's Service Provision Regulation[54], which mentions the principle in a cautious way, and only for the purposes of excluding the application of Treaty competition rules: "The

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[52] *Ibid.*

[53] Wilmer, Cutler & Pickering, *Study for the European Commission on the Regulation of Airspace Management and Design* (Brussels: EC, 2001) at 15-16.

[54] See *infra*, note 88.

provision of air traffic services, as envisaged by this Regulation, *is connected with*[55] the exercise of the powers of a public authority, which are not of an economic nature justifying the application of the Treaty rules of competition."[56] Though corporatisation has made considerable 'inroads' in a quite short period of time, the prospect of seeing the majority of European States making that 'next step' and delegating the delivery of ANS and AIS to entirely privately held corporations, seems unlikely at this time.

The United States situation offers a striking contrast to the European one: *i.e.* the absence of any formal project to either corporatize or privatize ANS, which are at the present time solely provided by a governmental entity: the Federal Aviation Administration (FAA). Reflecting on this topic and advocating privatization, author J. TREANOR writes:

> Although monitoring of air safety is inherently a governmental function, air traffic control is not. "The federal government deems a function to be 'inherently governmental' if the public interest mandates the performance of that function by government employees, such as a function."[57] These inherently governmental functions usually refer to decision-making functions that require government authority or rendering of value judgements. ... Thus, air traffic control is not an inherent governmental function.[58]

It is believed that this point of view encompasses AIS, as these fall within the scope of air traffic guidance, and not within the scope of air safety oversight.

- Government-imposed restrictions and national control

Should a State choose to transfer its ANS activities to a privately-held corporation over which it would not exercise a majority shareholder's control, such State might nevertheless impose certain conditions effectively restricting the absolute corporate freedom that this entity would otherwise have enjoyed in virtue of the general law of corporations. Although the ongoing debates with respect to national ownership rules has usually focused on the ownership of airlines, ANS constitute a domain where the stakes raised by

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55 This indirect language shows an unwillingness to settle the debate [author's emphasis].

56 *Service provision regulation, supra* note 46, preamble.

57 Buel White et al., "Budget Limitations Spur Privatizations: Continued Federal Belt-Tightening Will Lead to the Refinement of Existing Outsourcing Techniques and New Forms of Privatization" *Nat'l L.J.* (27 May 1996) B10.

58 Janie Lynn Treanor, "Privatization v. Corporatization of the Federal Aviation Administration: Revamping Air Traffic Control" (1998) 63 J. Air L. & Com. 633, at 676-677.

national ownership issues are equally high.[59] As well, similar arguments appear in both domains in favour of national ownership rules, these arguments typically revolving around national security considerations.[60]

A State's placing of such restrictions (either of a national ownership nature or otherwise) appears highly reasonable given the unavoidable responsibility burden falling on the State's shoulders – as discussed at length above.

An example of this is found in the legal framework presiding over the existence of National Air Traffic Services Ltd. (NATS), the entity entrusted with the provision of ATS, AIS and ATM in the United Kingdom. NATS is a public private partnership where 51% of the capital is owned by private corporations and individuals, and 49% by the U.K.'s government. Nevertheless, under the *Transport Act 2000*, the government holds a 'golden share', which is a "a share which can be held only by the Crown and which gives the shareholder the right to prevent certain events by withholding consent."[61] Moreover, in case of "actual or imminent hostilities or of severe international tension or of great national emergency", the Secretary of State for Transport is empowered to order NATS to provide ATS "in a specified manner or for specified purposes."[62]

It is foreseeable – and, ultimately, desirable as long as Article 28 imposes the same liability burden on States as it now does – that those States which will be willing to relinquish a measure a financial and managerial control over their national ATS/AIS providers will still wish to retain some form of control over these providers, in accordance with what such States perceive to be their highest national interests.

- *Sovereign immunity*

The great diversity of national perceptions on the granting and recognition of sovereign immunity makes it impossible to predict at which point a corporatised ANS body would, in the eyes of court of law entertaining the claim of a plaintiff, cease to be regarded as a public service or State's entity and thus lose the sovereign immunity of which it would have otherwise benefited had it remained a 'pure' governmental

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[59] Perhaps even more so, if one considers that an ANS organisation must spend heavily on immoveable, non-resalable assets, thereby decreasing the liquidity of a potential investor's collateral and, consequently, the organisation's attractiveness in the eyes of private capital, whereas airlines, even hampered by national ownership rules in their quest for foreign capital, can still offer investors a fairly high realization value on the assets as a way to assuage the investors' hesitations.

[60] The U.S. Civil Reserve Air Fleet program (whereby civil air carriers may be called upon to provide lift capacity at the request of military authorities) is often quoted as one of the key reasons behind the U.S. government's reluctance to open up to a greater extent the capital of U.S. airlines to foreign investment.

[61] *Transport Act 2000* (U.K.), c. 38, sec. 51 (7).

[62] *Ibid.*, sec. 91 (1)(a) and (3)(b).

department.[63] But it is suggested that the loss of such 'governmental umbrella' may be beneficial in that it acts as a safety-inducing catalyst for corporatised ANS providers, which will thence strive to minimize their liability exposure by maximizing safety-enhancing practices.

D) Aeronautical information in European context

1. – European Union

In 1999, a third of all flights taking off or landing in Europe were not on time; the average delay was of 20 minutes – a figure which routinely crept up to several hours during peak periods. The total economic cost of these delays was estimated to be in the order of 10G€ per annum.[64] Airspace fragmentation caused by national borders as well as antiquated methods and tools of ATM were identified as being the leading causes of this state of affairs. Confronted with what it described as a "disastrous situation"[65] and forecasting that it would "worsen still further over the next five years,"[66] the European Commission[67] called for the advent of the urgent structural reforms needed "to permit the creation of a single European sky by way of integrated management of airspace and the development of new concepts and procedures of air traffic management."[68] Among the main solutions proposed by the Commission were the accession of the EC to Eurocontrol, and the setting up of a high-level group (HLG) asked to bring forward proposals for the reform of ATM within European airspace.

The report submitted by the HLG in November 2000 reaffirmed the desirability that "the Community becomes a full member of Eurocontrol as soon as possible; this will ... help to align the regulatory approaches and the priorities of the Community and Eurocontrol."[69]

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[63] In some cases though, this 'umbrella' is left in place through legislation. By way of example, art. 15 of the German *Aviation Act 92* indemnifies DFS from liability by obliging the Federal Republic of Germany to compensate every third party damage occurring in relation to the exercise of its functions. See *Stoffel, supra* note 36, at 292.

[64] EC, *Communication from the Commission to the Council and the European Parliament: The creation of the single European sky* (Brussels, 6 December 1999) at 1 [*EC Commission communication no. 1*].

[65] *Ibid.* at 3. Two years later, in a somewhat amusing 'revisionist' hindsight, the Commission described the same situation as having been "catastrophic"! See EC, *Communication from the Commission to the Council and the European Parliament: Action programme on the creation of the Single European Sky and Proposal for a Regulation of the European Parliament and of the Council laying down the framework for the creation of the Single European Sky* (Brussels, 30 November 2001) at 2 [*EC Commission communication no. 2*].

[66] *EC Commission communication no. 1, supra* note 64, at 2.

[67] The Commission's competence in matters of aviation is derived from Article 80(2) of the *Treaty establishing the European Community*, 25 March 1957 (Consolidated version) [2002] O.J. C. 325/33, at 325/64.

[68] *EC Commission communication no. 1, supra* note 64, at 6.

[69] *HLG Report, supra* note 41, at par. 48.

In so stating, the HLG was well aware that, on 28 January 2000, the 29 transport ministers representing the Member States of the European Conference of Civil Aviation (ECAC)[70] had convened at the Meeting on the Air Traffic System in Europe and launched the comprehensive *ATM 2000+ Strategy*. The objective of this strategy is to enable "the safe, economic, expeditious and orderly flow of traffic, through the provision of ATM services which are adaptable and scalable to the requirements of all users and areas of European airspace."[71] Especially important to the HLG was the fact that the ECAC ministers had put the implementation of the bulk of the *ATM 2000+ Strategy* in the hands of Eurocontrol. From then on, Eurocontrol was to be the *de facto* 'grand architect' of ATM renewal, and if the EC were to play a significant part in the design of the future of ATM in Europe, it didn't have much choice but to get as close as possible to Eurocontrol's decision-making process, which would be best achieved by the EC acceding to Eurocontrol.

The response of the Commission to the HLG report came through an action programme, doubled by a proposal for a regulation from the European Parliament.[72] This programme put the emphasis on support for technological development, aiming for a "rapid introduction of new technologies and new working methods in air traffic management."[73] It also suggested a stronger regulatory involvement of the Community in ATM activities and, once again, advocated for accession of the EC to Eurocontrol.

2. – Eurocontrol

The European Organisation for the Safety of Air Navigation (Eurocontrol), an intergovernmental organisation, was born in 1960, only three years after the Rome Treaty had laid down the foundations of the European Community. In order to establish a uniform European air traffic management system, Eurocontrol's six founding member States agreed to strengthen their co-operation and to develop their joint activities in the field of air navigation.[74] Today the organisation has 34 Member States, all of which are European, but forming a jurisdictionally complex patchwork: some being members of the EU[75], some

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70 ECAC, established in Strasbourg in 1955 under the auspices of the Council of Europe, is one of the regional civil aviation bodies set up by ICAO pursuant to Art. 55 of the Chicago Convention.

71 Eurocontrol, *Overall Objective of the ATM 2000+ Strategy*, online: <http://www.eurocontrol.int/ardep-arda/html/atm2000.html>.

72 See *EC Commission communication no. 2, supra* note 65.

73 *Ibid.*, par. 4.2.

74 *Protocol consolidating the Eurocontrol International Convention relating to Co-operation for the Safety of Air Navigation of 13 December 1960, as variously amended*, 27 June 1997 (London: HMSO, 2002) preamble.

75 Austria, Belgium, Cyprus, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, Malta, The Netherlands, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden and the United Kingdom.

being candidates to the EU[76], and some being neither[77]. The only common trait is that all Eurocontrol members are among the 41 member States of the ECAC.

Eurocontrol was heralded as an early example of international cooperation in the provision of aviation related services, following only sixteen years in the footsteps of the ICAO. The legal nature of this intergovernmental institution was described as being "much more advanced than that of the other aeronautical organisations."[78]

Today Eurocontrol's tasks are many; suffice it to mention that the Organisation:

- strives to achieve a uniform European air traffic management system through technical harmonisation of methods and equipment;
- is entrusted with the implementation of the Single European Sky;
- administers the European common route charges system through its Route Charges Office;
- coordinates and manages all traffic movements through its Central Flow Management Unit;
- analyses ATM problems through its Central Office for Delay Analysis and its Statistics and Forecasts Service;
- provides ATC services for upper airspace in the Benelux States and the northwestern part of Germany, as well as for the lower airspace of Belgium, through its Maastricht Centre.[79]

It is to be noted that the Organisation's functions are both civil and military in nature, and coordinated through its Civil/Military Interface Standing Committee

Although both Eurocontrol and the EC stemmed out of the same desire to reinforce political and technical ties among European countries in the aftermath of World War II (and though, during their first years of existence, their membership was almost identical), there were never formal ties between the two organisations before a 1980 exchange of letters. This changed when the EC acceded to Eurocontrol's 1997 Revised Convention[80] in October 2002. This accession allowed to "pool the EC's political and legislative

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76 Albania, Bulgaria, Croatia, the Former Yugoslav Republic of Macedonia, Moldova, Romania, Turkey and Ukraine.

77 Bosnia and Herzegovina, Monaco, Norway and Switzerland.

78 Jacques Naveau et Marc Godefroid, *Précis de droit aérien* (Brussels: Bruylant, 1988) at 90.

79 These tasks are effectively carried out by the Eurocontrol Agency, which is one of the three organs composing the Organisation, the others being the General Assembly and the Council.

80 *Supra,* note 74.

competence and Eurocontrol's experience and expertise in the field of air traffic management."[81] The final step in the came in the form of a cooperation agreement between Eurocontrol and the European Commission, signed in December 2003. This agreement was announced as allowing Eurocontrol, from then on, to contribute to the Single European Sky.[82]

3. – Practical impact of the administrative framework: why is this important for aeronautical information?

The above-described context of increased integration, over the past few years, of the aviation activities of the EC and Eurocontrol proved to be a boon for accelerated research and redesign regarding AI publication (and especially e-AI). Already in 2000 the HLG had pointed to e-AI as one of the innovations that would shape the future of European ATM, writing that the implementation of a "pan-European reference database of quality-assured aeronautical information" would improve safety "by guaranteeing quality, integrity and timely availability of information."[83] This ongoing impulse in favour of AI development is reflected in a number of ways:

(1) The 2003 EC/Eurocontrol Memorandum of Co-operation specifically covers the issue of AI provision:

> **4. Areas of cooperation**
>
> Without prejudice to other issues that may require more importance or require immediate attention and action ... the priority areas are:
>
> 4.1 With regard to the implementation of the Single European Sky and, in particular with a view to the development of relevant implementing rules, ...
>
> - provision, common management and publication of aeronautical information.[84]

For its part, Article 5 of this Memorandum lists eleven ways in which the cooperation may take form, including "coordination of studies, programmes and activities" and "provision of expert advice and

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81 Jean-Jacques Sauvage, "Cooperation agreement between EUROCONTROL and the European Commission" *Skyway* 32 (Spring 2004) 34.

82 European Commission, Press Release, "Air transport: European Commission and Eurocontrol sign a co-operation agreement" (Brussels, 22 December 2003).

83 *HLG Report, supra* note 41, at 53.

84 EC, *Memorandum concerning a framework for cooperation between the European Organisation for the Safety of Air Navigation and the Commission of the European Communities*, 22 December 2003, online: <http://europa.eu.int/comm/transport/air/single_sky/doc/eurocontrol/2003_12_22_memorandum_en.pdf>, art. 4.1.

support."[85] One can grasp the tremendous acceleration of the development of electronic AI that close cooperation between organisations of such magnitude is bound to yield.

(2) Eurocontrol has included "Electronic AIPs" among the "ATM 2000+ enablers", that is: among the elements of its research and development programme undertaken for the purpose of implementing the ATM 2000+ Strategy[86], with which the ECAC States have entrusted Eurocontrol.

(3) The efforts surrounding the pooling of European electronic AI resources, alluded to by the HLG, have intensified. Indeed, air navigation service providers from a majority of Eurocontrol Member States have "agreed to establish a consolidator for processing and distributing aeronautical information, the European Aeronautical Information Data Service Base (EAD). The primary aim of the EAD Programme is to develop and implement a central repository for all Aeronautical Data related to the ECAC area."[87]

(4) Finally, the European Union has enshrined electronic AI as an essential component of a seamless European ATM system through the "Single Sky Regulations". On 10 March 2004, the European Parliament and Council adopted four Regulations which provide the regulatory framework for the implementation of the European Single Sky. These regulations relate to: the framework[88], the service provision[89], the airspace[90] and the interoperability[91]

The Framework Regulation defines 'aeronautical information service' as "a service established within the defined area of coverage responsible for the provision of aeronautical information and data necessary for the safety, regularity, and efficiency of air navigation."[92]

The Interoperability Regulation concerns the "interoperability of the EATMN [European air traffic management network]"[93] and aims at "ensuring the coordinated and rapid introduction of new agreed and

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85 *Ibid.*, art 5.

86 See Eurocontrol, "ATM R&D Project Synopses – List of ATM2000+ Enablers", online: <http://www.eurocontrol.int/ardep-arda/jsp/Ardep018.jsp>.

87 SOFRÉAVIA, *Study on institutional issues concerning joint developments in the field of Flight Data Processing Systems – Final Report* (Brussels: EC, 2002) at 83 [*SOFRÉAVIA Report*].

88 EC, *Regulation 549/2004 of 31 March 2004 laying down the framework for the creation of the single European sky* [2004] O.J. L. 96/1 [*Framework Regulation*].

89 *Service provision regulation, supra* note 46.

90 EC, *Regulation 551/2004 of 31 March 2004 on the organisation and use of the airspace in the single European sky* [2004] O.J. L. 96/20 [*Airspace Regulation*].

91 EC, *Regulation 552/2004 of 31 March 2004 on the interoperability of the European Air Traffic Management network* [2004] O.J. L. 96/26 [*Interoperability Regulation*].

92 Framework Regulation, supra note 88, art. 2 (3).

93 *Interoperability Regulation*, supra note 91, art. 1 (1).

validated concepts of operations or technology in air traffic management."[94] The Regulation goes on stating that the EATMN "shall meet essential requirements,"[95] among which stands "accurate, timely and consistent aeronautical information [to] be provided progressively in an electronic form ..."[96]

Thus, the evolution of the provision of AI towards the electronic format is now a legislatively-mandated course of action. The reader will find below a discussion as to the shape this evolution might take.

All these steps have contributed to propel SES as the most advanced and complete initiative concerned with the provision of ANS and AIS currently standing in the world today.

4. – The European Upper Flight Information Region

Of all the legal challenges brought about by the entry in force of the Single Sky Regulations, one is of particular importance with respect to aeronautical information: the establishment of the European Upper Flight Information Region. The idea of the EUIR was put forward by the European Commission in November 2001:

> The Single European Sky must ... be conceived as a single airspace without frontiers. ... This requires that a unique flight information region[97] is created by merging the 15 regions into a single portion of airspace. Therein air traffic services will be provided according to the same rules and procedures. As a first step the Commission proposes to take this important move with regard to the upper airspace where the majority of international flights are operated. To achieve this, a common airspace design and strategic management at European level with the support of EUROCONTROL is needed.[98]

The establishment of the EUIR entails the provision of consolidated aeronautical information for that FIR, in the form of a single European AIP (EAIP) covering the upper airspace.[99] The data referring to

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94 *Ibid.*, art 1 (3).

95 *Ibid.*, art 2.

96 *Ibid.*, Annex II, par. 7.1.

97 "A Flight Information Region (FIR) refers to a portion of the airspace where air traffic services are provided. Traditionally lateral limits coincide with the borders of states; each FIR is subject to specific rules by the state responsible." [original footnote]

98 EC, *Communication from the Commission to the Council and the European Parli*ament *on the implementation of the Single European sky* (November 2001) par. 3.1.

99 Excluding PIBs.

lower airspace would remain in national AIPs.[100] The first question raised by this prospect is: will the EAIP substitute itself to the AIPs currently published on a national basis by European States participating in the EUIR (insofar as these AIPs deal with upper airspace), or will both publications henceforth coexist?

Nothing in the EC Single Sky Regulations prevents States from continuing to publish their national AIPs. But Annex 15 generally mandates against data duplication: "Each AIP shall not duplicate information within itself or from other sources."[101] In reality, data duplication routinely occurs in AIPs, often for sound operational reasons: "... a [navigational beacon] near a State border may appear in another State's AIP if it [is] used for navigation within that State's territory. A procedure is often represented twice, once textually and another graphically which is another form of duplication."[102]

Even if it may not be entirely avoided, the occurrence of data duplication must be minimized. For one, maintaining upper airspace data in national AIPs would defeat the very purpose of the common EAIP. Moreover, a further legal question appears: which version will hold legal value and take precedence over the other one? ICAO SARPs do not seem to allow for competing AIPs for the same given airspace. To answer, if at all, this question, one must look at the greater issue of delegation of service and joint operations in ANS.

a) Delegation of service under Annex 15

As seen previously, section 3.1.1 of Annex 15 explicitly permits delegation of service and joint operations in ANS. But it is unclear at this time whether the EAIP project complies with these Annex 15 provisions.

In December 2003, the European Commission commissioned a study to, among other purposes, "review ... the current state of rules, standards and recommendations for the provision of aeronautical information stemming from international provisions and national legislation in the Community and elsewhere [with] a clear focus on ICAO SARPS and the provisions of Annex 15 (AIS) and Annex 4 (Aeronautical Charting)."[103] The ensuing study raises many questions concerning the compatibility between the EUIR project and the Annex 15 rules:

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[100] STASYS, *Single European Sky – Provision of Aeronautical Information for the European Upper Flight Information Region (EUIR) – Phase Two Report: Analysis of Possible Solutions for the Provision of the EUIR AIP* (Brussels: European Commission, 2004) at 43 [*EUIR II Report*].

[101] *Annex 15, supra* note 10, sec. 4.2.1.1.

[102] *EUIR II Report, supra* note 100, at 43.

[103] EC, *Study TREN/F2/08-2003 concerning: Study on the provision of aeronautical information for the European Upper Flight Information Region (EUIR) – Specifications* (Brussels: European Commission, 2003) at par. 2.6.1.

> Firstly, would the EUIR AIP be provided under [Annex 15, sec. 3.1.1] clause b)[104] or c)[105]?
> Secondly, if b) can the EC, as the body responsible for the provision of the EUIR AIP, albeit delegated through competition to another body, be considered a Contracting State as it is not a State in the classical sense and has not signed the Chicago Convention?
> Thirdly, if it is the final clause, c), which is used, the EC is a governmental agency not, as specified, a non-governmental one.
> Finally, again if clause c) is used, the statement: "*delegate the authority for the provision of the service...*" has proved to be unclear. Some States take this to mean that part, or all, of their service may be delegated whilst other States have interpreted this as meaning the entire service.
> In this later case, some States do not see that they are able, under the terms of the Chicago Convention to delegate part of their service to the publishers of the EUIR AIP.
> ICAO has undertaken to research these issues.[106]

That ICAO minds have to be put to the task goes to show that the interrogations raised by the EAIP are not simple ones! But the choice between paragraphs (b) and (c) of section 3.1.1 is perhaps not as mind-boggling as the authors of the study suggest.

In particular, it may be asserted that the EC is a 'non-governmental agency' in the context of Annex 15, thereby allowing the par. (c) mechanism to enter into play. Indeed, given the emphasis placed by Annex 15 on the State and its responsibilities, the concept of 'government' as used –but not defined – therein relates to a State and the instrumentalities through which it implements its policies. In this sense, *non-governmental agency* is a broad expression signifying any entity other than a governmental department or corporation. The European Commission being no more a government than the European Community is a State (as the study's authors rightly state), it does qualify as a non-governmental agency, and the delegation of service provision under par. (c) is therefore permissible.

On first look, this does not seem to necessarily exclude the application of par. (b). But par. (b) must be understood as referring to the provision of a joint service *for* States *by* States. To read it otherwise would make the existence of par. (c) moot as same specifically refers to a service provision performed by an entity external to the State. Paragraph (b) thus does not constitute an appropriate framework for the EAIP, as this service is to be provided by an entity other than *any* of the participating States.

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[104] Agreement between States for the provision of a joint service.

[105] Delegation of the service provision to a non-governmental agency.

[106] *EUIR III Report, supra* note 24, at 37.

Remains the objection raised by certain States to the partial delegation of AIS provision: it's all or nothing, say they. It is respectfully submitted that policy and practice suggest otherwise. To begin with, ICAO points out "that an autonomous air navigation services organisation needs not be confined in scope to a single State. Nor is its essential that all services within a State be provided by an entity of that State. International cooperation in providing services can be highly desirable ..."[107]

In addition, a partial delegation of AIS is already in place on European soil: "Belgium receives its NOTAM messages from Deutsche Flugsicherung GmbH (DFS) in Frankfurt. This arrangement is not captured formally and operates by way of a 'gentleman's agreement'"[108] Issuance of NOTAM is of course one of the tasks entrusted to a national AIS (it is dealt with by Chapter 5 of Annex 15). In this instance, Belgium only delegates this portion, but performs itself the remaining components of its AIS.

Generally speaking, interstate collaboration in the field of AI is already a reality in Europe. In answer to the question "Does your AIS operate in conjunction with another State ?," 19% of European States declared that they did, though none answered by the affirmative to the question "Is your AIS provided by another State or a commercial vendor either in full or part ?"[109] Commenting on the first question, the authors of the study noted that "a few States [do] operate in conjunction with other States"[110] and broke down these States into three categories:

- States where the processing / publication of their AIP is delegated to another State;
- States where AIS are responsible for the processing and publishing the aeronautical information for overseas territories; Denmark and France are examples of this;
- States who share the processing of NOTAM messages; Finland and Sweden have shared the processing of NOTAM messages since 1990.[111]

No clear legal answer emerges out of the debate concerning the delegation of service. While it may be true that the 'severability' of the provision of AIS is not a firmly entrenched, long-standing notion, on the other hand there is likewise no strong policy or operational reason that effectively prohibits a partial service provision delegation being made pursuant to sec. 3.1.1 par. (c).

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[107] *Finnsson/Zubkov, supra* note 31, at 5 [author's emphasis].

[108] STASYS, *Single European Sky – Provision of Aeronautical Information for the European Upper Flight Information Region (EUIR) – Phase One Report: Review and Analysis of the Current Situation* (Brussels: European Commission, 2004) at 20 [*EUIR I Report*].

[109] *Ibid.*, at 19-20.

[110] *Ibid.*, at 35.

[111] *Ibid.*, at 20.

b) Responsibility of the delegating States

Even assuming that the EAIP would be the result of a partial service delegation under Annex 15, sec. 3.1.1, par. (c), the largest legal hurdle to its implementation remains: responsibility.

The EUIR legal framework was laid down in April 2004, through Article 3 of the EC Airspace Regulation:

> 1. The Community and its Member States shall aim at the establishment and recognition by the ICAO of a single EUIR. ...
> 2. The EUIR shall be designed to encompass the airspace[112] falling under the responsibility of the Member States ...
> ...
> 4. Member States shall retain their responsibilities towards the ICAO within the geographical limits of the upper flight information regions and flight information regions entrusted to them by the ICAO on the date of entry in force of this Regulation.
> 5. Without prejudice to the publication by Member States of aeronautical information and in a manner consistent with this publication, the Commission, in close cooperation with Eurocontrol, shall coordinate the development of a single aeronautical information publication relating to the EUIR, taking account of relevant ICAO requirements.[113]

Under the provisions of Annex 15, the publication of an AIP is a responsibility falling on each individual State. Therefore the use in the Airspace Regulation of the wording "Member States shall retain their responsibilities towards the ICAO" points to a situation where an individual State would need to take full responsibility and answer for the portion of the common EAIP that relates to its national territory (or beyond, depending on the extent of the FIRs entrusted to that State).

Here, the comparison with the *Agence pour la sécurité de la navigation aérienne en Afrique et à Madagascar* (ASECNA) may prove useful. Founded in 1974, ASECNA regroups 16 member States, being 14 Western and Central African States, Madagascar, and France. It is responsible for providing ATS, ANS and AIS on a 16,100,000 km^2 territory (1½ times the size of Europe), comprising five FIRs. Under its founding convention, ASECNA is required to provide a number of aeronautical services in

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[112] The division level between upper and lower airspace has been set at 25 000 feet above the mean sea level. See *Airspace Regulation, supra* note 90, art. 2 [author's footnote].

[113] *Ibid.*, art. 3.

common to its member States, including AIS.[114] It may also be called upon by a member State to operate or manage a given aeronautical facility or function, under a distinct contract intervened between such State and ASECNA.[115]

The founders of ASECNA set forth a liability allocation scheme which takes into account the two different headings under which it may perform its functions. Thus, where ASECNA's liability is raised by reason of an aircraft accident attributable to a common service or facility provided by ASECNA to its members States, it shall implead all the member States in the ensuing judicial proceedings. Conversely, should the impugned service or facility having been provided or operated under a distinct contractual arrangement, ASECNA shall implead the State on the territory of which the accident occurred.[116]

Although ASECNA's example does yield all the answers needed to solve the legal and institutional problems raised by the EAIP, it points to a mechanism that the EC should consider as a starting point for solving these issues: a liability allocation scheme intervened by and between the Member States. Such a scheme, while not addressing the thorny issues of national responsibility and sovereignty,[117] would settle the most practical issue, the one which the flying public is most concerned about, and this is the liability issue. The scheme could be elaborated in a way which accounts for a variety of factors, *e.g.* the proportionate degree of fault of the actors involved, the location where the damage occurred, the proportionate contribution of each Member State to the total operation costs of the EUIR and the EAIP, and so on. This appears as the indispensable 'next step' if the EUIR concept is to stand on sound legal foundations.

E) Certification of European aeronautical information providers

1. – Personnel

ICAO Annex 1 regulates the licensing of a various civil aviation staff roles, but does not provide for the specific licensing of AIS staff. For its part, Annex 15 defines the requirements placed on AIS personnel in terms of skills and competencies to perform specific functions, within the context of a quality

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[114] *Convention et Statuts de l'Agence pour la sécurité de la navigation aérienne en Afrique et à Madagascar*, Dakar, 25 October 1974, art. 2.

[115] *Ibid.*, art. 10 and 12.

[116] *Cahier des charges relatif à la gestion des installations et services de l'Agence pour la sécurité de la navigation aérienne en Afrique et à Madagascar*, Dakar, 25 October 1974, art. 13.

[117] "States ... will want to be reassured that the Single European Sky initiative will not infringe upon their national sovereignty." (Francis Schubert, "A view from a service provider from a non-European Union Member State" *Skyway* 7:32 (Spring 2004) at 52)

system, but does not lay down SARPs as such, relying instead on the approval of such quality system by a third-party ISO certification entity.

For want of ICAO standards, some States have enacted and implemented their own AIS personnel licensing rules. In 2004, 29% of ECAC States did, while 71% did not. Although this is a relatively small percentage, "it is significant given there is currently no requirement from ICAO for such licensing. ... [I]t is [thus] not surprising that States have created and implemented their own standards."[118]

The ongoing lack of ICAO standards is in itself surprising, considering that, in 1999, a member of the ICAO Secretariat wrote: "With the influx of new technologies and requirements that are changing the way AIS/MAP personnel perform their jobs, the AIS/MAP Divisional Meeting of 1998 identified a need for such standards in the future."[119] He then added that ICAO would develop new provisions for an AIS/MAP license for inclusion in Annex 1, focusing on establishing international standards for those jobs in an AIS/MAP organisation that are considered safety-critical.[120] It appears that these intentions remain unfulfilled at the present time.

2. – Organisations

In his speech to the Aviation Symposium•99 on "The responsibilities of government in the provision of airports and air navigation services", G. FINNSSON reminded his audience that: "Because of the safety-related responsibilities of the State under Article 28 of the Chicago Convention and also because of the strong impact of airports and air navigation services on a State's economy it is imperative for the State to establish a strong regulatory presence."[121]

This view is shared by the European Community: its Single European Sky initiative has regulation and certification of ANSPs as one of its major tenets. Early on, the high-level group on SES insisted on a framework that would distinguish between regulation and service provision, "both being seen as two distinct activities and organised accordingly. This distinction must as an absolute minimum be achieved at the functional level."[122]

This call for reform was in part due to the perception that there existed some degree of confusion as to the exact purview of each functional component of European ANS. On this, the HLG felt that "[t]he

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118 *EUIR I Report, supra* note 108, at 34.

119 Mitchell A. Fox, "Standards for licensing of AIS/MAP personnel go hand-in-hand with technological change" *ICAO Journal* 54:4 (May 1999) at 24.

120 *Ibid.*

121 *Finnsson, supra* note 38, at 6.

122 *HLG Report, supra* note 41, at 29.

current tendency of Eurocontrol and service providers to act as legislator, customer, designer, certification and operator undermines transparency and creates conflicts of interest and risks for the development of new systems."[123]

This view was apparently shared by ANSPs through the voice of CANSO: "... States do not always distinguish between the separate natures of service provision and regulation ... CANSO, as the representative organisation for many of the independent air navigation service providers, believes that the industry would benefit from both a common understanding of the benefits of separation and a consistent implementation of the concept."[124]

The HLG's conclusion of the need for strong regulatory bodies was taken up by the European Commission, which elaborated an implantation scheme whereby the European Community legislator laid down the rules defining the essential requirements. The execution of such rules would be entrusted to the Commission, assisted for this purpose by a "Single Sky Committee" composed of representatives of the Member States.

Among the four 'SES Regulations' discussed above, the Service Provision Regulation sets out the fundamental principle: "The provision of all air navigation services within the community shall be subject to certification by Member States."[125] Such certification is to take place upon compliance by the ANSPs with the common requirements.[126] These common requirements are the object of a draft implementing rule[127] which is circulated for public consultation and has yet to be adopted. They deal with numerous aspects of ANSPs' activities, among which are: technical and operational competence; systems and processes for safety and quality management; reporting systems; quality of services; financial strength; liability and insurance cover; ownership and organisational structure; human resources, and security. Accordingly, the enquiry lead by a national certification authority in view of certification would normally touch upon all or most of these requirements. The purpose of these common requirements is, of course, to harmonize the standards by which the various national certification authorities will assess the suitability of ANSPs applying for such certification.

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123 *HLG Report, supra* note 41, at 28.

124 CANSO, "Position paper: Relationship between service provision and regulation (October 2000) at 1.

125 *Service provision regulation, supra* note 46, art. 7(1).

126 *Ibid.*, art. 6 and 7(3).

127 European Commission, Directorate-General for Energy and Transport, *Draft commission regulation laying down common requirements for the provision of air navigation services* (Brussels, 20 July 2004).

The Regulation also provides for mutual recognizance between the certifications issues by different Member States' authorities.[128]

[128] *Service provision regulation, supra* note 46, art. 7(8).

- III -

THE LIABILITY FOR THE PUBLICATION OF AERONAUTICAL INFORMATION

A) Introduction

A study of the legal aspects of aeronautical information publication would not – could not – be complete without an exhaustive analysis regarding what is perhaps the paragon of legal issues: liability. Such an analysis proves even more necessary because the publication of AI, as systematized and standardized as it is in its technical aspects, remains significantly unsettled and somewhat unpredictable as to its liability aspects. Indeed, no international regime prevails, and the outcome of liability questions is left to be determined through the inconsistencies of various national laws.

In such a context, one might wonder how to offer guidance regarding the eventual liability of an AIP publisher,[129] without resorting to a painstakingly systematic study and comparison of all relevant national legislations. Yet, there is some common ground on which to lay the discussion, due in large part to the American 'jurisprudential supremacy', which provides, for want of a formal approximation of national laws, at least an informal common approach, the authority of which rests with the economic dominance of the U.S. aeronautical market.[130] This phenomenon is very clearly described by SCHUBERT, who, while writing in respect of ATC, sets a core argument that applies equally to AI:

> ATC liability is to a very large extent a matter of national legislation. With very few exceptions of marginal incidence, no international arrangements exist to rule the matter. It may consequently seem impractical to generalize legal liability issues and discuss them as an homogeneous topic. Further, very few countries have any practical experience in this field, the overwhelming majority of court cases being provided by United States jurisdictions. However, Air Traffic Management worldwide is regulated by universal rules enacted by ICAO in the form of Standards and Recommended Practices and Procedures for Air Navigation Services, which form the reference material for courts confronted with ATC liability cases. An overview of existing cases indicates that courts have been very consistent in the interpretation and application of these rules, as well as in deriving consequences with regard to the allocation of liabilities between air traffic controllers and

[129] "Publisher" is used here in the most generic sense, contemplating all the parties involved in the production process leading to the final AI product: data collectors, data formatters, printers, bodies under the authority of which the AIP is made available, etc.

[130] One might surmise that this "jurisprudential supremacy" is also owed in part to the zealousness of U.S. litigation attorneys!

> pilots. In particular, the jurisprudence developed by American courts has inspired other jurisdictions around the world. For this reason, while the arguments ... are essentially based upon decisions rendered by American courts, the latter can be viewed as reflecting reasonably standard principles. Although they employ different terms, the philosophies supporting liability rules in common law and in Roman law show strikingly similar features. ... In both concepts of legal liability, the notion of liability itself is closely connected to the concept of duties or responsibilities, in the sense that legal liability follows statutory responsibility.[131]

B) The various avenues of damage compensation

The victim of defective AI may claim compensation under an array of diverse legal theories, although the availability of such theories may be circumscribed by the particulars of the instant case. Generally speaking, two criteria govern the availability of a given legal theory on which to base a case:

- whether the nature of the relationship between the AI provider and the victim is contractual or extracontractual; and
- whether the object of the relationship is the provision of goods or services.

1. – Contractual liability

Contractual liability arises when defective AI is provided within the framework of a contract, or of a situation which the law deems to be equivalent to a contract.[132] The outcome of the liability claim is usually framed by the contract itself, which in most cases prescribes the precise body of law to be applied (or the means of determining such body of law) and the mechanism for adjudicating the claim. Should the contract remain silent as to these aspects, the national rules on choice of law will govern.

There are reasons to believe contractual liability is the theory under which AI claims are least frequently pursued. First, of all the transactions through which aeronautical information is provided, a high proportion are not contractual in nature. For example, many national authorities make their NOTAM freely available to the public through the simple and anonymous browsing of a website – no contract is entered into before the user is allowed to access the information. Secondly, contractual clauses tend to restrict the nature and/or the scope of the remedies available to an AI user. A telling example of this is

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[131] Francis Schubert, "Pilots and Air Traffic Controllers: Allocating Legal Liabilities in a Free Flight Environment" (2001) XXVI Ann. Air & Sp. L. 197, at 205-206.

[132] *E.g.*, New Zealand law imposes a *de jure* contractual relationship between ATC and the operators of civil aircraft. See *SOFRÉAVIA Report, supra* note 87, at 85.

found in the contractual limitations laid down by Jeppesen Sanderson, Inc., the world's largest private seller of aeronautical charts and data. Indeed the terms and conditions of its online charts sales are, from an objective standpoint, restrictive:

> NOTICE SPECIFIC TO CHART SERVICES AVAILABLE ON THIS SITE. ... The chart services and software are delivered "as is" ... and are not guaranteed to be free from errors or defects. ... The ... obligations and liabilities of Jeppesen and remedies of User set forth herein are exclusive. ... User hereby waives, releases and renounces all other ... obligations and liabilities of Jeppesen, with respect to ... any non-conformance or defect in the ... charts, data, documentation ..., including but not limited to, ... any obligation, liability, right, claim, or remedy in tort, whether or not arising from the negligence of Jeppesen, and any obligation, liability, right, claim or remedy for loss of or damage to any aircraft.
>
> EXCLUSION OF CONSEQUENTIAL AND OTHER DAMAGES. If Jeppesen's ... limitation of liability set forth herein shall for any reason whatsoever be held unenforceable or inapplicable, User agrees that Jeppesen's liability shall not exceed US $ 100.[133]

Nonetheless, the victim of losses or injuries resulting from defective AI purchased under a contract does not always have to bear the brunt of such restrictive clauses, for the national or state law often limits or prohibits similar exclusions or limitations of liability, or limitations on the *quantum* of recoverable damages. Nevertheless, even then, the contractual liability recourse remains an uncertain and potentially costly avenue for such a victim to choose, if only because the AI provider is afforded the opportunity to wage a lengthy and costly litigation over the precise scope of the legislative prohibitions of contractual exclusions of liability.[134] Only thereafter can the case actually proceed to the merits, provided that all the contractually-stipulated bars to the action have been levelled. Thus in most cases, contractual liability is not the most direct (and therefore, not the most desirable) channel of damage compensation.

2. – Product liability

Extracontractual liability presents the advantage of not restricting the plaintiff to the remedies (if any) that would be afforded in an underlying contract. It puts a remedy at the disposal of the product user who, for lack of privity of contract between him and the producer or seller, would otherwise have none. The two

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[133] Jeppsen Sanderson, Inc., "Terms and Conditions of Use", online: <http://www.jeppesen.com/wlcs/index.jsp>.

[134] Even when the theory on which the case is based, is undisputed, the process may be arduous. One commentator writes: "In every instance, Jeppesen has litigated the case vigorously and appealed any adverse decision. The results have been strenuous legal battles that reaged for many years." (David L. Abney, "Liability for Defective Aeronautical Charts" (1986) 52 J. Air L. & Com. 323, at 325 [*Abney*]).

main incarnations of extracontractual liability are (1) liability based on negligence and (2) strict product liability. Liability based on negligence does not require further explanations, for it is perhaps the most universal legal concept, known in common law jurisdictions as well as in civil (or Roman) law jurisdictions – where it is often labelled as 'civil responsibility based on fault'. Suffice it to say that from a plaintiff's perspective, it presents a significant disadvantage: the requirement that the negligent conduct of the defendant be proven. This in itself explains that, with respect to American cases of defective aeronautical charts, "[w]hile the recovery theories have ranged from breach of warranty to negligence, the greatest success has come under strict product liability."[135]

a) United States case law

The concept of strict product liability was formally written down by the American Law Institute in 1965, as a reflection of what was then perceived as "a number of recent decisions ... [that] have extended the rule of strict liability to cover the sale of any product which, if it should prove to be defective, may be expected to cause physical harm to the consumer or his property."[136] Although the Restatements are not formal legislative instruments, they carry a high persuasive value, and their contents is usually integrated in state statutory or common law. The seminal section on strict product liability provided as follows:

> **§ 402A. Special Liability Of Seller Of Product For Physical Harm To User Or Consumer**[137]
>
> (1) One who sells any product in a defective condition unreasonably dangerous to the user or consumer or to his property is subject to liability for physical harm thereby caused to the ultimate user or consumer, or to his property, if
>
> (a) the seller is engaged in the business of selling such a product, and
>
> (b) it is expected to and does reach the user or consumer without substantial change in the condition in which it is sold.
>
> (2) The rule stated in Subsection (1) applies although
>
> (a) the seller has exercised all possible care in the preparation and sale of his product, and
>
> (b) the user or consumer has not bought the product from or entered into any contractual relation with the seller.

As the American Law Institute declares it, "[t]his Section states a special rule applicable to sellers of products. The rule is one of strict liability, making the seller subject to liability to the user or consumer

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[135] *Ibid.*

[136] *Restatement (Second) of the Law of Torts* § 402A (1965), comment *b*. See also *Greenman v. Yuba Power Products, Inc.* (1963) 59 Cal. 2d 57.

[137] This section has since been superseded by the *Restatement of the Law Third, Torts: Products Liability.*

even though he has exercised all possible care in the preparation and sale of the product."[138] No proof of negligence by the seller is therefore required on the part of the victim of the defective product, which explains the enthusiasm with which plaintiffs embrace this theory as the basis of their cause. This being said, the product liability theory is nevertheless restrictive in its own right, as it sets conditions that the elements of a specific case must imperatively meet, if this case is to give rise to the application of the theory. Numerous scholar studies of section § 402A extensively review these conditions, as well as the intricacies of that section. For fear of being drawn away from the purpose of this thesis, the following concentrates solely on the conditions that are principally relevant to defective AI cases.

- The 'seller' must be a professional seller

This is possibly the most theoretical of the § 402A conditions, because aeronautical information is systematically sold by a person "engaged in the business of selling such product."[139] The cost and complexity of collecting and formatting AI makes it virtually impossible that it be done by a "casual" or "amateur" provider; at the very least, it can be said that the case law provides no example of the contrary. Broadly speaking, on a global basis, all AI is provided either by national governments or delegates thereof, or by large private corporations such as the oligopolistic Jeppesen Sanderson, Inc.[140]

- There must be a 'sale'

There must exist a counterpart – monetary or otherwise – to the providing of AI. Therefore, defective AI provided free of charge (such as NOTAM made available through free-access websites) does not entitle the victim of damage to claim compensation under strict product liability.

- A 'product' must have been sold

Section § 402A refers to a 'product', without offering a formal definition for this term, save to mention that the section applies "to any product sold in the condition, or substantially the same condition, in which it is expected to reach the ultimate user or consumer;"[141] this qualification alone certainly embraces AIPs. Yet, beyond this first step, the observer cannot help but wonder if aeronautical charts are truly 'products'; after all, their very purpose resides in their intellectual contents, not in their physical incarnation, *i.e.* the

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[138] *Supra, note* 136, comment *a.*

[139] The term 'seller' encompasses any manufacturer, wholesaler, retail dealer or distributor of the product. See *ibid.*, comment *f.*

[140] According to one source, Jeppesen provides "navigational charts to approximately 80 percent of the world's airlines and a similar share of the general aviation market, which includes corporate and recreational air traffic". See Hewlett-Packard, Press Release, "Jeppesen Adopts Color Print-on-demand Technology from HP for Creating Airway Manual Charts and Pilot Manuals" (12 October 2004).

[141] *Supra, note* 136, comment *d.*

sheet of paper on which they are printed. To say the truth, charts, as well as all other AI components, are information. And whether, as such, they are subject to the rules of strict product liability has fostered a number of judicial debates.

As one observer puts it: "Analytically, the Restatement phrase 'sells any product' may be divided into: (1) a product analysis which centers on whether an article should be viewed as a product; and (2) a transaction analysis which examines whether a given transaction involves the sale of a product or the rendering of a service."[142] In the case of aeronautical charts, the question was always answered in the affirmative: "Aeronautical charts are the only communication media ever judged by any court to be 'products' and the only communication media ever deemed subject to 'strict product liability'."[143] Even the Restatement has formally addressed the question:

> One area in which some courts have imposed strict products liability involves false information contained in maps and navigational charts. In that context the falsity of the factual information is unambiguous and more akin to a classic product defect. However, the better view is that false information in such documents constitutes a misrepresentation that the user may properly rely upon.[144]

To fully understand the roots of this rather consistent line of judicial determinations, it is crucial to retrace the evolution of the relevant case law.

Aetna Casualty v. Jeppesen[145]

The first of a line-up of cases addressing the issue of whether aeronautical charts constitute a 'product', this case actually contributed little to the substance of the debate: "The judicial conclusion that the Jeppesen chart was a 'product' for purposes of Section 402A strict liability was never seriously challenged in the *Aetna Casualty* cases."[146]

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[142] Gary T. Walker, "The expanding applicability of strict product liability principles: how is a 'product' defined?" (1986) 22 Tort & Ins. L.J. 1, at 4 [*Walker*].

[143] Robert B. Schultz, "Application of strict product liability to aeronautical chart publishers" (1999) 64 J. Air L. & Com. 431 [*Schultz*].

[144] *Restatement (Third) of Torts* § 19(d) (1998).

[145] This case spans six reported opinions, but the final decision of the Court of Appeals for the Ninth Circuit is found at: 642 F.2d 339 (9th Cir. 1981) [*Aetna Casualty*].

[146] *Abney, supra* note 134, at 327.

Times Mirror Co. v. Sisk[147]

This case stands out as the only one in which the categorization of charts as 'products' for product liability purposes was held in doubt – although not rejected. Indeed the court expressed "serious misgivings"[148] in this respect (without detailing them); but owing to other aspects of the case, the resolution of this question ultimately proved unnecessary.

Saloomey v. Jeppesen & Co.[149]

An aeronautical chart is doubtless a tangible product, even though the only danger to which its user is exposed is perhaps a paper cut!... Of course, the true question is whether the information conveyed on that paper is a 'product'. In this case, the AI publisher alleged that its publication constituted "a service rather than a product and that the paper the map was printed on was merely the method by which the information was conveyed to subscribers."[150] Struggling with this argument, the court refused to make "any automatic or sweeping assumption," acknowledging that "[w]hether a transaction involving the sale of a map constitutes the rendition of a professional service or the sale of a tangible product poses a difficult question of semantics since there is an element of service in all 'goods' whether maps or consumer durables."[151]

The court went on to consider the underlying policies of the strict product liability doctrine, one of which is to counterbalance, in favour of the consumer, the 'superior knowledge' held nowadays by the manufacturer as a result of the mass production, mass marketing and mass distribution of products.[152] Thus the court held that "[g]iven that Jeppesen mass produced and distributed its charts, its activity comes within the scope of the rationale of § 402A and should not be insulated from a strict standard of liability ... Jeppesen mass produced and distributed thousands of charts on the aviation market. Implicit in their

147 593 P.2d 924 (Ct. App. 1978).

148 *Ibid.*, at 927 (Howard J.).

149 707 F.2d 671 (2nd Cir. 1983) [decision of the Court of Appeal].

150 *Halstead v. United States*, 535 F. Supp. 782 (D. Conn. 1982) at 789 [*Saloomey I*] [decision of the District Court].

151 *Ibid.*

152 "As handicrafts have been replaced by mass production with its great markets and transportation facilities, the close relationship between the producer and consumer of a product has been altered. Manufacturing processes, frequently valuable secrets, are ordinarily inaccessible to or beyond the ken of the general public. The consumer no longer has means or skill enough to investigate for himself the soundness of a product ... The manufacturer's obligation to the consumer must keep pace with the changing relationship between them ..." (*Escola v. Coca-Cola Bottling Co.*, 24 Cal. 2d 453 (1944) at 467 (Traynor, J.)

presence on the market was the representation that the purchaser could rely on their information safely. Exposing defendant Jeppesen's conduct to strict products liability is thus entirely appropriate."[153]

This ruling has attracted some criticism:

> While mass production and product liability insurance are often touted as justification for the doctrine of strict product liability, they do not answer the question of whether the flight data communicated on a chart is a product or whether strict liability should apply. ... While the paper and chart binders are mass produced, they are the basis for liability. On the other hand, it is illogical to say the information that is the basis for liability is also mass produced. Only the media is mass produced, not the message.[154]

The Brocklesby case[155]

The *Brocklesby* case pushed the boundaries of the problem further by enquiring whether a chart publisher may be held liable for accurately communicating information that is inherently flawed – a question which the court answered in the affirmative. This case derives from an aircraft crash attributed to a defective approach procedure developed and promulgated by the U.S. Federal Aviation Administration, and faithfully reproduced by Jeppesen on the chart it sold to the plaintiff airline.

The court first reiterated a *Saloomey*-type analysis premised on the mass production of the chart in order to hold that the latter constituted a 'product'. Jeppesen believed it unfair to be exposed to strict liability for accurately republishing a government regulation,[156] to which the court replied: "Jeppesen's charts are more than just a republication of the text of the government's procedures. Jeppsen converts a government procedure from text into graphic format and represents that the chart contains all the necessary information. ... Indeed, Jeppesen's charts are distinct products."[157] This reasoning is akin to one put forward – although without much emphasis – years before in *Aetna Casualty*, in which case the court had also pointed out the distinctiveness of the Jeppesen product: "... the purpose of the chart was to translate this information into an instantly understandable graphic representation. This was what gave the

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153 *Saloomey 1, supra* note 150, at 791.

154 *Schultz, supra* note 143, at 439.

155 *Brocklesby v. United States*, 767 F.2d 1288 (9th Cir. 1985) [*Brocklesby*].

156 *Ibid.*, at 1297.

157 *Ibid.*, at 1298.

chart its usefulness – this is what the chart contributed to the mere data amassed and promulgated by the FAA."[158]

Then the court dismissed Jeppesen's contention that strict liability would be inappropriate, for the design of the approach procedure was entirely beyond its control:

> Jeppesen had both the ability to detect an error and mechanism for seeking corrections.[159] ... More fundamentally, however, existing products liability law is contrary to Jeppesen's position. Jeppesen's chart was a 'product in a defective condition unreasonably dangerous to the user' within the meaning of section 402A (1). Section 402A (2)(a) provides that strict liability is appropriate even though 'the seller has exercised all possible care in the preparation and sale of his product.' A seller is strictly liable for injuries caused by a defective product even though the defect originated from a component part manufactured by another party.[160]

This approach is in line with another underlying policy of products liability, which is that mass production allows for the spreading of the risk of loss (and compensation costs) over a wide base of consumers. Therefore, "[n]oting that Jeppesen could seek indemnity from the government, the court hoped to indirectly further the policy of creating an economic incentive to prevent defects."[161]

The *Brockelsby* case provides a clear and legally sound solution for its own specific set of facts. But it does not do much in the way of providing a more general guidance in the field of AI products liability (in this respect, it is a quite 'distinguishable' case). It has also attracted its share of criticism for having, among others, stated that had Jeppesen merely published the original FAA procedure (in text form) without formatting it in any way, it would not have been strictly liable. Commentator R. SCHULTZ is of the opinion that:

> ... the act of converting the text form to graphics somehow subjected the publisher to liability, not only for its form but also for defects in the procedure itself. The court does not

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158 *Supra*, note 145, at 342.

159 The relevance of this determination is questionable, as it touches upon the notion of reasonable care exercised by the defendant, a notion with which strict product liability should not be concerned, at least in theory. This being said, for its part, the effective *ratio decidendi* of the case stands on solid legal grounds: the seller of a product must answer for the latter's defect, no matter how far back in the production chain lies the effective culprit for such defect. The fact that such culprit happens in the instant case to be the government (and thus possibly shielded from an indemnification recourse by a sovereign immunity) should be a matter for concern for the publisher, not for the consumer.

160 *Brocklesby*, *supra* note 155, at 1296.

161 *Walker, supra* note 142, at 13.

> justify this added burden by any policy argument. ... According to the [court], reformatting government regulations to make them more readable and advertising that fact subjects the publisher to strict liability, not only for the manner in which it makes the regulation more readable, but also for defects in the government regulations themselves.[162]

To this, one might add that *Brockelsby* does not lay down a standard relating to the extent of the reformatting required for the AI product to pass from "mere republication" to "distinct product".

Fluor Corp. v. Jeppesen & Co.[163]

The accident at the origin of this case occurred when a plane crashed into a hill adjacent to the airport which was not depicted on Jeppesen's approach chart. Here the California Court of Appeals overruled the trial judge's ruling that strict products liability should apply only to "items whose physical properties render them innately dangerous, e.g., mechanical devices, explosives, combustible or flammable materials, etc."[164] In an often-quoted passage, the higher court rebutted that approach:

> [T]he policy reasons underlying the strict products liability concept should be considered in determining whether something is a product within the meaning of its use ... rather than ... to focus in the dictionary definition of the word. ... [A]lthough a sheet of paper might not be dangerous, per se, it would be difficult indeed to conceive of a saleable commodity with more inherent lethal potential than an aid to aircraft navigation that, contrary to its own design standards, fails to list the highest land mass immediately surrounding a landing site.[165]

This case's judicial analysis walks in the footsteps of *Saloomey* and *Brockelsby*, and thus gives grounds to believe that the notion that aeronautical charts are 'products' for strict liability purposes, is now entrenched in United States law. But it must be noted that the foregoing cases were decided on the basis of common law strict products liability, not on the ground of statutory products liability. When such a case will arise, its analysis

> ... will be very different from those previous decisions based on common law. When a legislature has spoken, the courts are limited to interpreting the law based on the rules of

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[162] *Schultz, supra* note 143, at 442.

[163] 170 Cal. App. 3d 468 (1985).

[164] *Ibid.*, at 475.

[165] *Ibid.*

> statutory construction, not based on their common law power to make and change the law. The primary issue will be legislative intent, not public policy.[166]

One should therefore not be surprised should a future case of strict liability for defective aeronautical charts be resolved in favour of the producer, on the account that AI products will have been statutorily excluded from the definition of "products" by the local legislature. And so the relatively unpredictable outcome of any strict products liability dealing with aeronautical charts seems bound to live on, notwithstanding the apparently consistent trend that emerges from the most recent line-up of cases.

- The product must be 'defective'

What exactly constitutes a 'defective' AI product is a highly factual question. The case law does not yield indications, even less guidelines, as to which characteristics a defect must bear for the purposes of establishing liability. One may nevertheless attempt to extract similarities out of the factual situations depicted by these cases.

In *Aetna Casualty*, the defect consisted of:

> ... the fact that the graphic depiction of the profile, which covers a distance of three miles from the airport, appears to be drawn to the same scale as the graphic depiction of the plan, which covers a distance of 15 miles. In fact, although the views are the same size, the scale of the plan is five times that of the profile.[167]

Therefore the discrepancy between the information conveyed by words and the information conveyed by numbers was a source of confusion, deemed "unreasonably dangerous" (and ultimately fatal) and thus to constitute a defect.

In *Times Mirror Co.* and *Fluor*, the alleged defects were of the same nature: the failure of the chart to depict the highest elevation point in the vicinity of the crash site. While the court in *Fluor* found this to be indeed a defect and the proximate cause of the crash, such was not the case in *Times Mirror Co.*, where the court "concluded that the pilot was so far off the track that the chart was not the actual cause of the crash."[168]

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[166] *Schultz, supra* note 143, at 448.

[167] *Aetna Casualty, supra* note 145, at 342.

[168] *Abney, supra* note 134, at 329.

In *Saloomey*, the incriminated chart incorrectly portrayed the airport as having a full-fledge Instrument Landing System, whereas the latter only provided a localizer. "The attempt to land in reliance on the presence of a full instrument landing [system] ended abruptly when the plane descended too far too fast and crashed into a ridge."[169]

Defective information may be logically categorized in one of three groups according to whether the information is communicated accurately and whether the information is dangerous. That is, the information communicated by the chart may be (1) accurate but misleading, (2) accurate but dangerous, or (3) simply inaccurate.[170] But further than these broad academic categories, there are no judicially developed standards allowing one to define what precisely defective aeronautical information is. Defectiveness is and will remain an eminently factual, case by case, issue.

b) European context

The cornerstone of European products liability law is Directive 85/374, adopted by the European Council on 25 July 1985,[171] and in turn implemented in the national laws of member States.[172]

The U.K. has also seen the struggle the define the term "product" and especially to determine if an AI product constitutes one. Noting that in the USA, "strict product liability has been extended beyond the accepted meaning of product"[173] British author A. CLARK notes that "[t]his products/services dichotomy is also important in United Kingdom law."[174] He goes on:

> Product liability problems posed by "information" products were also mentioned ... Clearly, loss caused by reliance upon the written word may trigger liability for mis-statement, but the printed page is a product and the publisher is its producer. It will take some nimble footwork for the United Kingdom courts to find an escape route for the publisher of written works such as computer software. Courts will certainly be tempted to find an exception for "information products" ... The approach of some of the United States courts, based upon the mass-produced nature of the information, and the policy reasons behind the common law development of strict liability, is quite convincing. ... Arguably,

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169 *Ibid.*

170 *Schultz, supra* note 143, at 435-436.

171 *Supra*, note 29.

172 *E.g.*, in the United Kingdom: the *Consumer Protection Act 1987* (U.K.), 1987, c. 43; in France: Title Four *bis* of the Civil Code ("*De la responsabilité du fait des produits défectueux*").

173 An affirmation which he bases on the *Brocklesby* and *Fluor* cases.

174 Alistair M. Clark, *Product Liability* (London: Sweet & Maxwell, 1989) at 60 and 63 [*Clark*].

> however, Lord Denning's marine hydrographer,[175] who omits a reef from the published chart causing a ship to sink, will not be liable in negligence but the publishers may find themselves liable under the 1987 [Consumer Protection] Act.[176]

Thus, the U.K. characterization of AI products as "products" subject to liability follows the characterization developed by the U.S. courts. However, the extent of the application of this concept is much more restricted in the U.K. Indeed, the U.K. products liability scheme applies only to products "of a type ordinarily intended for private use or consumption" and if "used by the injured person mainly for his own private use or consumption." In our context, any service-product of a type represented by the provider for use by private pilots in General Aviation would qualify.[177] All AIPs destined to air transport professionals and effectively used by them are therefore denied the benefit of the European products liability regime.

Europe has seen some movements towards the codification of product liability standards, "in sharp contrast with the rulings of the American law courts", where such issues are left "to be decided case by case."[178] Although, at this point in time, no universal treaty or convention has been adopted by the international community of nations. There are, however, agreements of a slightly more restricted range, such as the Strasbourg Convention of 1977,[179] sponsored by the Council of Europe, which covers product liability in case of personal injury or death.

Thus, in relation to AIPs, European products liability rules do not conceptually diverge with those applied in the U.S.A., with the important exception of the substantially more restrictive field of application of these rules.

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175 See *Candler v. Crane, Christmas & Co.* (1952), 2. K.B. 183.

176 *Clark, supra* note 174, at 65.

177 *SOFRÉAVIA Report, supra* note 87, at 116.

178 I. H. Ph. Diederiks-Verschoor, *An Introduction to Air Law*, 7th ed. (The Hague: Kluwer, 2001) at 134.

179 *European Convention on Products Liability in Regard to Personal Injury and Death*, Strasbourg, 27 January 1977. For most practical purposes, it has been superseded by the very similar Directive 85/374 (*supra*, note 29).

c) Electronic aeronautical information and product liability

Conceptually speaking, there is no difference between paper AI and computer software or electronic AI: both appear to the user under a visual form, and their tortfeasing potential appears equivalent. But is it? As early as 1986, the debate surrounding the classification of aeronautical charts as 'products' also extended to the electronic versions of AI:

> Computer software may be considered a product, since it is usually received in the form of a program stored on a magnetic disc, tape, or cartridge, and thus may be classified as a good. However, computer software is developed by experienced programmers, who thus render professional services in the compilation of each program. These dual features of software make it difficult to determine whether the consumer receives a product or a service. ...
>
> Relying on traditional products liability analysis, courts may be expected to impose strict liability where there is a mass production of an item, with mass distribution and mass marketing. When the software is developed by a consultant who tailors the program to the consumer's needs, the application of strict liability principles is not warranted. ... This use of professional skills should shield manufacturers of computer software from strict liability analysis, especially when the computer software program has not been distributed on a massive scale.[180]

But the technological evolution[181] of the past two decades made inevitable that electronic AI (now widespread) would eventually be analysed as forming a 'product':

> Generally, the software or the database utilized in a computer system is considered a service and not goods. Therefore, an action for strict products liability is not normally available for a defect in the software or database. However, the courts, rather than relying on a strict dictionary definition, have adopted an expansive interpretation of the term "product" which will serve the policy reasons underlying the strict products liability concept.[182]

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[180] *Walker, supra* note 142, at 13.

[181] "Technological advances often present difficult questions of whether particular defendants have sold a product, furnished a process, or provided a service. If, in these situations, the court believes that public policy will best be served by protecting a particular industry or profession, then the defendant's activity will be considered a service. However, if a court favors protection of the consumer rather than the industry or profession involved, then the defendant will have manufactured or sold a product." *Ibid.*, at 2.

[182] George M. Moore and James D. Caven, "Free Flight Technology Requirements and Liability Issues That May Arise For Equipment Manufacturers" (1997) J. Air L. & Com. 687, at 718 [*Moore*].

The author goes on raising the hypothesis of a mid-air collision provoked by a faulty database (in spite of air traffic controller monitoring). He concludes that "an accident of this nature would probably result in a court ruling that the software/database is a product, not a service, based on the policy reasons stated in the aeronautical chart cases", *i.e.* the protection of defenceless victims of manufacturing defects.

As seen earlier, British author CLARK is even more assertive: the law should not treat misleading electronic publications more favourably than printed material:

> Should manufacturers of computer software be viewed as supplying a product and hence be subjected to strict liability standards? ... It will take some nimble footwork for the United Kingdom courts to find an escape route for the publisher of written works such as computer software.[183]

The 1997 *Cali* crash case[184] provides an example of judicial analysis of a situation where the design of an AI database was partly at fault. Here, this issue proved to be peripheral and not determinative of the disposition of the case, but nevertheless it is worthy of being reproduced extensively, for it gives an insight into the human/machine interaction problem, which is bound to be an even more frequently litigated in the upcoming years, owing to the ever-increasing use of wireless technology in the cockpit, including that related to AI:

> Flight 965 was equipped with a flight management computer. ... The FMC ... can be used to translate data received from [navigational aids] into a map-like pictorial view of the aircraft's position in the sky. This view appears on electronic ... screens that are located opposite each pilot on the cockpit's main instrument panel. FMC inputs are made on a device known as a CDU, which resembles a calculator with a key pad and a small digital screen. Some or all of a pre-programmed flight plan, or the approach and arrival paths for particular airports, may be called up by the pilots from the computer's database simply by making certain keystrokes on the CDU. In other words, if a pilot elects to follow a particular [Standard Terminal Arrival Route (STAR)] for an arrival, he need not type separately all of the waypoints that make up that STAR; instead, he may simply call up the STAR by its identifier(s). Similarly, all the waypoints along a desired approach path may be called up by typing the appropriate identifier. Once these steps are taken, the computer can be instructed to fly the aircraft automatically along the selected route ...

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183 *Clark, supra* note 174, at 62 and 65.

184 *In re Air Crash Near Cali, Columbia on December 20, 1995*, 985 F.Supp. 1106 (S.D. Fla. 1997) [*Cali case*].

> [O]ne of the pilots sought to program the FMC to fly automatically to the Rozo [non directional beacon] by typing the letter "R," which he apparently thought was the identifier for Rozo, into the CPU keypad. A total of twelve waypoints appeared on the screen of the CPU; the first of these was a beacon known a Romeo, located approximately 132 miles to the northeast of the aircraft's position. It was the identifier for this waypoint that the pilot executed, sending the aircraft on a prolonged, and pronounced, turn to the left, towards the east and the mountains.[185]

The precise legal implications of the growing massive transition[186] from paper-based AI to e-AI appear unpredictable. Even though most commentators express none or little doubt that courts will reiterate their previous determination, *i.e.* that aeronautical charts always constitute 'products' for products liability purposes, not all jurisdictions will necessarily entertain that view. In such case, there will be a need for a standard (judicial or legislative) allowing a distinction between the massively-distributed AI database (a 'product') and the tailor-made AI database (a 'service'), said standard being based on the degree of 'customization' of the latter.

If there is general agreement that the evolution of the information format should not fundamentally alter the existing dynamic between defective AI and the law of torts, there is nonetheless a characteristic specific to e-AI that could have an impact on a negligence-based suit against the manufacturer. Indeed, as compared to a printed chart, an electronic AI database presents the characteristic of being updated/amended at a much higher frequency, sometimes even in 'real time', if a permanent data link is maintained between the data provider and the data user. This presents some definite advantages in terms of timeliness, efficiency and cost reduction,[187] but it also heightens the manufacturer's obligations to promptly rectify any mistake that he may have (or should have) become aware of, and to use the technological tools at his disposal to do so. While the producer of a paper document can allege that the cost of prematurely reprinting a complete batch of a given chart (ahead of the scheduled new edition of the said chart) overweighs the expected benefit of such rectification, the minimal cost of rectifying an input in an electronic database is so minimal as to substantially minimize a manufacturer's ability to plead such a defence where e-AI is concerned. The extent of a manufacturer's liability being, among others, proportionate to his ability to prevent the occurrence of the damage, it is in the interest of e-AI producers

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185 *Ibid.*, at 1111, 1112 and 1119.

186 A good indication of this being the increasing penetration rate of electronic AI products on the general aviation market.

187 "[A]n AIP amendment affecting several pages can incur a significant cost in shipping costs alone." See *EUIR I Report*, *supra* note 108, at 42.

to be acutely aware of the potentially increased liability burden carried by these technological improvements.

This being said, the easy 'updatability' of e-AI, and particularly electronic charts, may lessen a State's liability burden with respect to out-of-date charts. The presence of such outdated material in cockpits and sometimes even at points of sale constitutes a safety and liability hazard serious enough for ICAO to issue a warning in its *Aeronautical Chart Manual*:

> It is important that a State should take every practicable measure to prevent the sale of out-of-date charts. These measures should include prompt restocking of up-to-date editions of the charts concerned and advice to sales agents of the obsolescence of charts for which the State has production responsibility and of the need to withdraw immediately the obsolete charts from sale.[188]

This hazard is also warned against by the National Aeronautical Charting Office (an entity of the FAA), which posts the following notice on its internet website:

> **USE OF OBSOLETE CHARTS OR PUBLICATIONS FOR NAVIGATION MAY BE DANGEROUS.** Aeronautical information changes rapidly, and it is vitally important that pilots check the effective dates on each aeronautical chart and publication to be used. Obsolete charts and publications should be discarded and replaced by current editions.

The precautionary procedures recommended by ICAO are easier to implement in an electronic environment. For example, an entity offering e-AI for sale on its transactional website may simply cease to give access to a given product once same becomes out-of-date, without any need to physically repatriate unsold merchandise from retailers. Also, an e-AI product (*e.g.* a database) may be programmed in such a way that it will itself warn the user once it has reached its validity period. Therefore, the apparently exclusively technical characteristics of e-AI may actually have a significant impact on the extent of the liability risk incurred by its producer.

C) Standards by which negligence is assessed

By which standard is a defendant's liability for providing defective AI, assessed? Again, this is very much a question to be answered by the trier of fact. At the base of all liability cases, whether sounding in negligence or in strict products liability, lie the reasonable expectations of the victim: should the

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[188] *Aeronautical Chart Manual, supra* note 21, at 6-4.

manufacturer have prevented this defect from occurring? Was he in a position to do so? Was the user legitimately entitled to be provided with a safer product?

At the top of the 'liability tree', we find the State's obligations, as pledged towards the international community. To this effect, Annex 15 states:

> Each Contracting State shall take all necessary measures to ensure that the aeronautical information/data it provides relating to its own territory, as well as areas in which the State is responsible for air traffic services outside its territory, is adequate, of required quality and timely.[189]

The State's obligations in respect of aeronautical charts are of a similar nature:

> A Contracting State shall take all reasonable measures to ensure that the information it provides and the aeronautical charts made available are adequate and accurate and that they are maintained up to date by an adequate revision service.[190]

These general standards relate to two aspects of AI. Indeed, accuracy measures the degree of conformity of the information to the standard or the true value; it gives the user the assurance that the AI provided faithfully corresponds to reality. For its part, adequacy is in relation to a specific purpose; it translates the necessity that the format under which the AI is provided allows the user to make an actual and useful use of that AI, with respect to the needs of that user.[191] To put simply, States are held to a duty of providing AI that is both faithful to reality and useful.

Of course, this is an obligation imposed on States, and thereby has no direct bearing on private law issues. Nevertheless, in the event that a court wishes to assess the liability of a State or State-owned provider of defective AI presented under the form of a chart, this standard, because it relates specifically to the issue of AI publication, may assist in providing a more refined and relevant interpretation than the otherwise generally applicable standards of local tort law.

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189 *Annex 15, supra* note 10, sec. 3.1.1.2.

190 *Annex 4, supra* note 20, sec. 1.3.3.

191 This requirement is made explicit by sec. 3.1.6 of Annex 15: "An aeronautical information service shall ensure that aeronautical information/data necessary for the safety, regularity and efficiency of air navigation is available in a form suitable for the operational requirements of :

a) flight operations personnel including flight crews, flight planning and flight simulator; and

b) the air traffic services unit responsible for flight information service and the services responsible for pre-flight information."

Moreover, the State being the ultimate responsible authority for the publication of AI by virtue of section 3.1.1.1, there is no reason why the private entity to which the State may choose to delegate the operational implementation of that responsibility, should be held to a lower standard than the State itself. This reinforces the relevance of ICAO standards as negligence appreciation standards, even with respect to disputes arising between two private parties under private law.

The Chicago Annexes lay down specific requirements in terms of the thresholds of information accuracy that must be attained.

D) Liability allocation

Just as it is often said that an air accident rarely derives from a single cause, the judicial proceedings arising out of an air accident seldom conclude to the tortious liability of a single party or a single actor in the events. Of course a well-thought body of law will usually allow for apportion of the blame (and the obligation to make due to the victim) in a way that is commensurate with the actions of each tortfeasing party. Air accidents often represent complex liability cases: this is when liability allocation must come into play.

An air accident may have been caused by AI because (a) the AI itself was intrinsically ill-designed or defective, or (b) the pilot did not put this AI to use in accordance with established procedures. Of course a combination of (a) and (b) causes is quite possible, in which case the final apportionment will rest with the trier of facts.

The situation in (a) is fairly 'classical' in that liability will be channelled towards the AI manufacturer or provider, regards having been had for the contributory fault of a component manufacturer, if applicable.[192] In all probability, the pilot – the AI user – will not be concerned by this liability apportionment.

Such is not the case in (b), where the pilot's conduct is directly involved. In the *Cali* case, the trial judge had to balance the pilots' negligent conduct (which, through vicarious liability principles, would result in their employer's being found liable) with the defective characteristics of the onboard AI equipment. He wrote:

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[192] "The manufacturer of a product is strictly liable for defects in that product even though the defect can be traced to a component part supplied by another. Thus if you [the jury] find that Jeppesen's instrument approach chart is defective and that the defect was a proximate cause of the accident, you must find Jeppesen liable even if the defect exists only because you find that the F.A.A. designed an approach procedure that you find is itself defective." (*Brocklesby, supra* note 155, at 1295).

> American [Airlines] maintains that ... the acts of misconduct by the pilots were foreseeable to Jeppesen and Honeywell [*Note*: the AI equipment manufacturers], and therefore these parties, not American Airlines, are wholly responsible for the Plaintiffs' injuries. ... American attempts to shift the focus away from the conduct of its employees and toward the FMC and the database. ... American asserts that Jeppesen engineers "had been aware of this design defect in their database for many years," but continually postponed taking steps to remedy the problem. [American Airlines] adds that Honeywell, like Jeppesen, knew about the problem of so-called duplicate identifiers, but knowingly incorporated the defective database into the FMC [and] failed to warn carriers like American about the problem ...[193]

The judge concluded on this matter as follows:

> [T]ort law concepts of contribution, comparative fault and apportionment may provide the Defendant with a vehicle to litigate the relative culpability of Jeppesen, Honeywell and other entities. But if the misconduct attributable to American Airlines was a substantial factor in bringing about the demise of Flight 965, and the aircraft's eventual fate was neither bizarre nor unforeseeable, then the possibility that the prior acts of other entities contributed to the accident is of no moment, even if those entities seem more blameworthy than the single Defendant the Plaintiffs have chosen to sue.[194]

The apportionment of liability between pilots and ATC controllers has been discussed in quite some length. The interplay between the pilot's negligence and the AI's defectiveness has not been the object of nearly as much scholarly comments, but useful thoughts can be drawn from the ATC literature.

The idea of an international convention with respect to the liability of ATC agencies was considered by ICAO's Legal Committee as early as 1968. Such convention would have dealt, among others, with the allocation of liability based on fault. Many national delegations felt no need for such instrument, as "they believed that the liability of air traffic control agencies should be regulated by domestic legislations."[195] Even the delegations who thought such a convention might be desirable to achieve a certain degree of legal uniformity had to renounce to this endeavour, faced with the hard reality that plagues all attempts to reach uniformity on an international level: "the differences among existing national legislations on the

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[193] *Cali case, supra* note 184, at 1147.

[194] *Ibid.*, at 1148-1149.

[195] ICAO, Legal Committee, *Report on the 25th Session*, Doc. 9397-LC/185 (1983) 5-1.

liability of air traffic control agencies and, in general, the diversity of national liability systems were already substantial enough as to create a major obstacle for reaching an international agreement."[196]

Had it reached fruition, such a convention could have served as a model, *mutatis mutandis*, for assessing the liability of AI providers, and the apportionment of liability between the providers, the users, and other actors potentially liable.

At times, the principle of pilot-in-command was seen as forcing the allocation of an unfairly high share of the liability burden on the pilot in case of accident. This principle is laid down by Annex 2 of the Chicago Convention: "The pilot-in-command of an aircraft shall have final authority as to the disposition of the aircraft while in command."[197] SCHUBERT disagrees, seeing the pilot-in-command rule as "neither intrinsically fair nor obsolete with regard to the present aviation context."[198]

With respect to this question, the various ATC/pilot negligence cases show an 'ebb and flow' of sorts, ranging from a strict interpretation of the pilot-in-command rule, whereby the pilot must bear a very high share of liability for the accident, notwithstanding the misleading information he was provided with,[199] to the more 'lenient' cases, where the collaborative nature of ATC/pilot interaction[200] is taken in consideration to a great extent and reflected in a commensurate apportionment of liability among both negligent parties.[201]

Of course air accidents cases turn upon very factual elements which vary in each particular case, therefore explaining the variety of outcomes. But it is felt that the better view (and the one which seems to be making its way in more recent ATC/pilot liability cases) is the one which sets aside the sometimes unilateral effect of the pilot-in-command rule, and acknowledges that liability should be imposed on the party which at the time of the events was in the best position to prevent the damage from occurring.

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196 *Ibid.*, at 5-2.

197 ICAO, *Annex 2 to the Convention on International Civil Aviation – Rules of the Air*, 9th ed. (Montréal: ICAO, 1990) sec. 2.4 [*Annex 2*].

198 *Supra*, note 131, at 212.

199 *In re Air Crash at Dallas/Forth Worth Airport on August 2, 1985*, 919 F.2d 1079 (5th Cir. 1991); *First of America Bank-Central v. United States*, 639 F. Supp. 446 (W.D. Mich. 1986).

200 "Both the pilot and the air traffic controller owe a duty of care to passengers in an airplane. Negligence by the pilot does not, in and of itself, absolve the [ATC] of liability. Each is responsible for the safe conduct of the aircraft and the safety of its passengers. Thus, there may be concurrent liability." (*Remo v. United States Federal Aviation Administration*, 852 F.Supp. 357 (E.D. Pa. 1994) at 365).

201 *Foss v. United States*, 623 F.2d. 104 (9th Cir. 1980).

By way of example, a pilot on approach to land is not in a position to foresee that a local radio frequency printed in an AIP has been changed, or to presume that a taxiway is closed to traffic when in fact the NOTAM fail to so indicate. In these cases, only the AI provider should be held liable for any damage, as the pilot was not in a position to 'know better': he appropriately relied on information he was entitled and expected to rely on.

Conversely, a pilot about to taxi to the runway is in the best position to evaluate the snow accumulation on the ground, and he would engage his liability if damage arose because he had chosen to disregard his own observations and consider exclusively the more 'rosy' information contained in an official SNOWTAM issued 40 minutes earlier. In this case AIS may not be entirely blameless (perhaps they could have issued SNOWTAM at a more frequent interval on that particular day because of the quick-changing conditions), but the strict application of the pilot-in-command principle would in these circumstances be warranted.

- *Sophisticated user defence*

In the United States, an AI provider might escape being found liable by relying on the 'sophisticated user' doctrine, according to which there is no duty to give a warning to members of a trade or profession against dangers generally known to that group.[202] This doctrine has:

> ... a recognizable tangency with a conclusion that, should the experienced worker, knowledgeable of the risks inhering in the use of a product not itself inherently dangerous, proceed incautiously to attempt to use the product, the later claim of failure to warn will be barred for lack of any causal connection between the injuries sustained and the lack of warning.[203]

This defence would not necessarily exonerate an AI provider where, for example, same furnishes a chart or AIP containing an erroneous and misleading element of data, for even a seasoned pilot may not be able to detect such error. But it might find application in the case where an element that is always present on, say a PIB, is suddenly missing altogether. Should damage ensue, the AI provider will be at liberty to claim that a properly trained pilot would have noticed the absence of such information and not proceeded with his flight without first obtaining it.

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[202] David G. Owen, M. Stuart Madden and Mary J. Davis, *Madden & Owen on Products Liability* (May 2004), at par. 9:8 (WL).

[203] *Ibid.*

- IV -

THE CHALLENGES POSED BY ELECTRONIC AERONAUTICAL INFORMATION

> *Aeronautical information services, whether they be operated by ICAO Contracting States or commercial enterprises, are undergoing a period of rapid change as a result of the processes and products of the electronic information revolution.*[204]

A) Advent and advantages of electronic aeronautical information

The interest towards the use of electronic technologies in the field of aeronautical information is not new; indeed, as early as 1980, a number of States had indicated "an interest in the subject of AIS automation as a means of increasing efficiency."[205]

On 23 March 1998, the Aeronautical Services/Aeronautical Charts Division of ICAO's Air Navigation Commission met in Montréal. At the opening, the President of the Air Navigation Commission declared:

> ... the previous AIS/MAP meeting took place thirty-two years ago, quite a long period of time during which the world we live in has changed considerably. ... [D]uring that time we have ... seen how the information technologies, basically computers and telecommunications, have revolutionized both our professional lives and our everyday lives. ... The interchange of digital data, databases, intranet networks, the Internet and many other new concepts are now making things possible which were unimaginable a scant five years.[206]

He then set the course that the introduction of new technologies has allowed the stakeholders to undertake: "the ultimate goal of aeronautical information services is to make *quality* information available

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[204] David Lewtas and Imad Balkis, "ICAO air navigation planning database to support several initiatives" *ICAO Journal* 54:1 (May 1999) 6.

[205] ICAO, *Measures to improve the Aeronautical Information Services*, Circular 156-AN/100 (Montréal: ICAO, 1980) at 1.

[206] ICAO, *Aeronautical Information Services/Aeronautical Charts (AIS/MAP) Divisional Meeting (1998) – Report*, Doc. 9733 (Montréal: ICAO, 1998) at ii-5 [*AIS/MAP Meeting*].

to *all* users[207] at *any* time. And this goal is simply not possible to achieve without the aid of automation and telecommunication networks."[208]

Summing up the outcome of this meeting, ICAO staff member A. PAVLOVIC retraced the sharp evolution which transformed, within less than a decade, the technologies associated to AI: "The 1990s have witnessed a revolution in the way aeronautical information is processed and presented to pilots and other users, and today the technology is available to display an electronic chart in the cockpit."[209] He also summarized the benefits that the aeronautical community is to expect from these: reduction of cost, increase of AI production speed and efficiency, reduction of paper waste, 'selectability' by flight crews of information desired.

A report commissioned by the European Commission (Directorate-General Energy and Transport) and published in 2004 emphasized the advantages brought about by e-AI:

> The traditional passing of information from point-to-point by paper is no longer considered suitable for today's technologically advanced world. The use of paper and the consequential need to re-enter data on numerous occasions has been proven to an area of risk, resulting in a reduction of the integrity of the data. In the future the provision of data by Data Originators to Data Collectors must be made using electronic media. The benefits offered include:
> - Avoidance of need to retype data and hence the introduction of errors;
> - Ability to protect data against corruption;
> - Faster dissemination;
> - Lower production and distribution costs.[210]

Putting things in the reverse perspective, a Eurocontrol paper outlined the disadvantages of the *status quo*:

> The current paper-based AIS is archaic and incompatible with the increasingly automated flight and air traffic management systems, which largely relay on timely, accurate and

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[207] Data users typically comprise the following: chart producers, navigation database providers, flight planners, airline operators, ANSPs, general aviation, military, airport operators and government.

[208] *AIS/MAP Meeting*, *supra* note 206, at ii-6 [emphasis in original].

[209] Aleksandar Pavlovic, "1990s have witnessed revolution in processing and presentation of aeronautical information" *ICAO Journal* 54:4 (May 1999) 4 [*Pavlovic*].

[210] *EUIR II Report, supra* note 100, at 9 [author's emphasis].

> quality assured aeronautical data. The paper-based AIS is source of integrity errors, incoherence and distribution delays and, last but least, is not environmentally friendly.[211]

Furthermore, the costs of reproducing a paper AIP is significant, "especially as it is usually presented double-sided and presented in a specially designed binder." On the other hand, "a CR-ROM, issued each AIRAC cycle, containing a full AIP can be produced for a very small cost," that is a production and shipping cost of about 1 € per unit.[212]

Beyond this economic efficiency, the decrease in the risk of outputting erroneous data is perhaps the most valuable benefit that e-AI can bring, for it is in direct relation to the most fundamental purpose of the international civil aviation 'system' and its components: safety.

From a legal standpoint, by adopting data integrity protection and enhancement technologies, States are assuming to a higher degree their international obligations of providing *accurate* AI. Moreover, "[t]he eAIP provides the only current method whereby all data necessary for the electronic transfer of AIP data may be made whilst maintaining the easy use of the data by a wide range of users,"[213] thereby increasing the *adequacy* of AI that States undertake to furnish to the aeronautical community.

Moreover, the lesser cost incurred in providing e-AI facilitates the exchange of AIPs between States, thereby furthering the objectives of Annex 15 in terms of unfettered access to information that is critical to international aviation operations.

The obvious advantages yielded by e-AI undoubtedly explain the increasing enthusiasm with which States rely on it. Evidence of this is found in the answer to a question put in 2004 to all States member of the ECAC: "Does your AIS have a presence on the Internet?", to which 77% of countries replied in the affirmative.[214] The authors of the STASYS report concluded that "[m]any States have now elected to provide their AIP in an eAIP format, several already having achieved this implementation," and consequently recommended that "the EUIR AIP be produced through the merging of eAIP produced by each ... Member State. Furthermore, the resultant AIP should also be issued in the form of an eAIP."[215]

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[211] Eurocontrol, *Paperless AIS Project – Projet Overview* (Brussels, 23 March 2000) at 2.

[212] *EUIR I Report, supra* note 108, at 42.

[213] *EUIR II Report, supra* note 100, at 16.

[214] *EUIR I Report, supra* note 108, at 32.

[215] *EUIR II Report, supra* note 100, at 16.

B) Electronic aeronautical information provided by States

This increased willingness of States to embrace e-AI, combined with the evident benefits of the latter, prompted Eurocontrol to launch, in June 2003, the European Aeronautical Information Services Database (EAD). EAD is intended to provide a single reference database of aeronautical information (worldwide NOTAM, FIR and route data and the AIP data of all ECAC States) covering the entire ECAC area. This initiative was designed in large part to circumvent the failings associated with 'old-style' AI production:

> NOTAM and AIPs have traditionally been processed, quality-assessed and corrected individually by each national AIS so that, in effect, the same job is carried out independently by dozens of different organisations. This fragmented system has often resulted in incomprehensible cross-border aeronautical information, inconsistent data quality throughout the ECAC area, the growth of systems that cannot operate with one another, and, most seriously, a systemic failure in ensuring the timely distribution of aeronautical information updates to all stakeholders.[216]

The previous passage illustrates the paramount preoccupation towards data integrity, a preoccupation which EAD is designed to address in the most stringent manner:

> The service is a guaranteed source of the highest data quality, which is achieved by consistently checking data, including cross-border data and is therefore a secure channel for timely and efficient electronic distribution of aeronautical information ... [217]

Although at present the EAD does not contain all the information necessary for the production of the AIP,[218] the speed with which it was conceived and implemented is testament to the extent of the failings of the previous non-electronic AI system, and to the need for such new tools.

The United States' FAA also provides some e-AI products, although the offering is more of a piecemeal one and is not of the magnitude contemplated by the EAD. Some of these products are the National Flight Database, which can be used as a basis to support GPS navigation, and the Digital

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[216] Eurocontrol, Press Release, "EAD: Successful take-off for the world's largest aeronautical information system" (18 September 2003).

[217] *Ibid.*

[218] *EUIR II Report, supra* note 100, at 17.

Aeronautical Information CD, which contains the NAVAID Digital Data File, the Digital Obstacle File and the Digital Aeronautical Chart Supplement.[219]

C) Data integrity

As previously seen, the necessity to protect and enhance data integrity permeates all thoughts and actions in relation with AI. Data integrity and quality is characterized by:

a) the accuracy of the data;

b) the resolution of the data;

c) the confidence that the data is not corrupted while stored or in transit (termed 'assurance level');

d) the ability to determine the origin of the data (termed 'traceability');

e) the level of confidence that the data is applicable to the period of intended use (termed 'timeliness');

f) the confidence that all of the data needed to support the function is provided (termed 'completeness').[220]

1. – Current situation

There is ample evidence that, at the present time, in most cases the required levels of data integrity and quality are not reached to a level sufficiently high to support many electronic AI applications, the operation of which necessitates precision data. As recently as March 2004, the Eurocontrol AIS Team found that "data integrity [is] vulnerable to human input error and ... studies [have] shown that this could occur at each transaction point," and identified "an alarming high number of data inconsistencies."[221]

The Team undertook a number of studies to quantify the extent of the problem. It was felt that "today's processes are based upon well established techniques that cannot, in many cases, deliver required data quality," that the current "integrity of AI is considerably below ICAO requirements" and that "the requirements of ICAO Annexes are not currently being met." A data quality study noted more than 1500 inconsistencies in navigation data in AIPs published in ECAC States during 2002. The following were found to be substantial contributing factors to this state of affairs:

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[219] Federal Aviation Administration, *Aeronautical Information Manual*, online: < http://www.faa.gov/atpubs/aim/ >, sec. 9-1-4.

[220] Eurocontrol, *Integrity of aeronautical Information – Data & Quality Management*, Doc. AIM/AISD/DI/0007 (Brussels: Eurocontrol, 2003) at 9.

[221] Eurocontrol, *Minutes of the EATM Aeronautical Information Services Team (AIST-20) meeting* (Brussels, 23-25 March 2004) at 19.

- Inconsistencies between States;
- Incorrect use of labels and identifiers;
- Poor survey practise and management;
- Repeated manual extraction/input of data.

This survey concluded with the need to "remove the human from the loop,"[222] thereby highlighting once again that "[t]he principle benefit of the eAIP is that the data does not require re-entry in any way, as the published document is generated automatically without manual manipulation."[223]

Such deficiencies in themselves constitute an impediment to the introduction of more efficient air traffic management techniques:

> [a] number of EUROCONTROL studies have demonstrated that Aeronautical Information does not currently have the integrity values required to meet specific applications such as Precision Aera Navigation (PRNAV) ... [224]

2. – Current regulatory framework

Annex 15 of the Chicago Convention lays down the general standard applicable with respect to data quality/integrity:[225]

> Contracting States shall ensure that the integrity of aeronautical data is maintained throughout the data process from survey/origin to distribution to the next intended user. Aeronautical data integrity requirements shall be based upon the potential risk resulting from the corruption of data and upon the use to which the data element is put [by the end-user]. Consequently, the following classification and data integrity level shall apply:
> **Critical Data, integrity level $1x10^{-8}$** (maximum error rate of 1 in 100,000,000): there is a high probability when using corrupted critical data that the continued flight and landing of an aircraft would be severely at risk with the potential for catastrophe;

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[222] Eurocontrol, *Stakeholder Consultation Meeting: Improve End to End Integrity of Aeronautical Information* (Brussels: Eurocontrol, 2003) at 11-13, 18-19 and 25.

[223] Eurocontrol, *Integrity of Aeronautical Information – Data Publication*, Doc. AIM/AISD/DI/0008 (Brussels: Eurocontrol, 2003) at 8.

[224] Eurocontrol, *Integrity of Aeronautical Information – Principle and Guidance*, Doc. AIM/AISD/DI/0006 (Brussels: Eurocontrol, 2003) at 1.

[225] Data quality requirements, in some cases almost identical, are also found in Annexes 4 (Aeronautical Charts), 11 (Air Traffic services) and 14 (Aerodromes), as well as in ICAO Doc. 9674 (World Geodetic System – 1984 Manual) and ICAO Doc. 8168 (Aircraft Operations).

> **Essential Data, integrity level $1x10^{-5}$** (maximum error rate of 1 in 100,000): there is a low probability when using corrupted essential data that the continued flight and landing of an aircraft would be severely at risk with the potential for catastrophe; and
> **Routine Data, integrity level $1x10^{-3}$** (maximum error rate of 1 in 1000): there is a very low probability when using corrupted routine data that the continued flight and landing of an aircraft would be severely at risk with the potential for catastrophe. [226]

Annex 15 also specifies the need for the protection of the integrity of aeronautical data whilst stored or in transit to another system. As well it mandates the use of cyclic redundancy check (CRC), with a 32- or 24-bit algorithm, as monitoring methodology.[227] The CRC is a sophisticated formula that mathematically takes all the information in a computer file and converts it into bits and bytes. It then creates a number and stores that number with the file. The reason for a CRC is to ensure that information in a file that is transmitted is the same information that is received at the other end. It is an integrity check and is included with virtually every file that that is transmitted or sent via email or copied from one computer to another.

The objective of full data quality/integrity is further implemented through the obligation placed on States to introduce a "properly organized quality system containing procedures, processes and resources necessary to implement quality management at each function stage ..."[228]

This standard is accompanied by the recommendation that such quality system should be in conformity with "the International Organisation for Standardization (ISO) 9000 series of standards."[229] By way of example, the Aeronautical and Technical Services of Geomatics Canada (an emanation of the Department of Natural Resources), which are responsible for the processing and dissemination of aeronautical information and maintaining the Canadian Aeronautical Charting System database, are operating according to a quality management system designed according to the ISO 9001 standard. It is also noted that "to date several ECAC States have implemented ISO 9001:2000 in answer to this [Recommended Practice], however, several States do not yet have this certification and some do not intend to seek it."[230]

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[226] *Annex 15, supra* note 10, sec. 3.2.8.

[227] *Ibid.*, sec. 3.2.10.

[228] *Ibid.*, sec. 3.2.1.

[229] *Ibid.*, sec. 3.2.2.

[230] *EUIR I Report, supra* note 108, at 47.

ICAO's Aeronautical Information Services Manual stresses the paramount importance of data quality/integrity:

> An AIS does not normally originate the information it processes and ultimately issues. The "raw data" must be provided by those responsible for the operation of the various air navigation facilities and services.
>
> ...
>
> The need, role and importance of aeronautical information/data have changed significantly with the evolution of the [CNS/ATM] systems. The implementation of area navigation (RNAV), required navigation performance (RNP) and airborne computer-based navigation systems has brought about exacting requirements for the quality of aeronautical information/data.
>
> The users' dependence on the quality of certain aeronautical information/data is evident from Annex 15 ...
>
> States must establish a quality system and put in place quality management procedures at all stages (receiving and/or originating, collating or assembling, editing, formatting, publishing, storing and distributing) of the aeronautical information/data process. The quality system must be documented and demonstrable for each function stage, ensuring that the organisational structure, procedures, processes and resources are in place in order to detect and remedy any information/data anomalies[231] during the phases of production, maintenance and operational use.
>
> ...
>
> Frequent audits form part of the quality system to ensure consistency and conformity. Where non-conformity is detected, action must be taken to determine the cause and to correct the anomaly.[232]

Thus the importance of these provisions should not be underestimated, especially given that "Data Originators often have little knowledge of the ICAO requirements for publication of information by the AIS."[233] Moreover, there are at present no SARPs that govern the storing, accessing, transferring and archiving of e-AI.[234] Thus there is evidence of a need for both heightened awareness of the existing

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231 Errors may be broken down into three categories: random errors, systematic errors and blunders. Thus they are not all of the same magnitude and do not hold the same potential for data integrity/quality disruption.

232 *Aeronautical Information Services Manual, supra* note 7, at 1-2, 1-3.

233 *EUIR I Report, supra* note 108, at 21.

234 *Pavlovic, supra* note 209, at 4.

standards on the part of AI producers, and elaboration of more complete standards for the purposes of regulating the whole 'chain' of e-AI production and publication.

The Norwegian case illustrates how, in the late 1990s, that country's AIS department improved the integrity of the aeronautical data under its care. First of all, Norway resurveyed the coordinates of all aerodrome and en-route points, and entered them in an AIS database. All safety-critical data elements part of the AIS database are updated in accordance with a 'triple entry' procedure, whereby three different operators enter the same data, and the database will accept the record only when these entries are identical. The human-machine interface is designed so that if an AIS specialist makes an error during production, it will usually be necessary to restart the process.

Thus the Norwegian officials took notice of an Eurocontrol study, which had found that "the existence of discrepancies in data sets dictates that the end-to-end management of data must be made substantially more robust if the required integrity level for critical data is to be achieved and maintained," and brought the necessary corrections. The efforts appear to have paid off as the above-described procedures now meet the requirements for AIP production.[235]

3. – Future Regulatory Framework

In June 2004, France's Directorate General for Civil Aviation made a blunt finding: "The database production process and the release of databases to operators should be carried out with a regulatory framework and guarantees that do not exist at the present time."[236]

An AI stakeholders' meeting taking place a few months earlier had agreed on the need to "harmonise procedures and data formats across Europe where necessary, thus ensuring interoperability."[237]

At that point, the Regulatory Unit of Eurocontrol had introduced an Advanced Notice of Proposed Rule-making (A-ENPRM) on the matter, which stated:

> The provision of Aeronautical Information of sufficient quality, accuracy, timeliness and granularity is a recognised key enabler of the present and future Air Traffic Management (ATM) systems. A number of Eurocontrol studies have concluded that aeronautical information does not currently meet the integrity values required to serve specific

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[235] Goerg Raaum and Trond V. Nordeng, "Integrity of data is enhanced by modern procedure for producing AIP amendments" *ICAO Journal* 55:4 (May 2000) at 30 and 38.

[236] Direction Générale de l'Aviation Civile (France), Service de l'information aéronautique, *Aeronautical Information Circular A 18/04* (17 June 2004) at par. 4.3.

[237] *AIS/MAP Meeting*, *supra* note 206, at 27.

> applications. ... The Eurocontrol organisation is therefore considering the introduction of regulatory provisions to achieve the necessary aeronautical data accuracy and integrity performance particularly covering the data chain from origination to publication, as required by ICAO.
>
> ...
>
> Eurocontrol recently conducted a survey of States to obtain a detailed understanding of the processes involved from data origination to publication. The results of that survey demonstrate that a variety of non-standard data processes and procedures are currently used and that there is a wide gulf between the States in terms of regulation of the process. Other studies ... provide clear evidence to question both the accuracy and integrity of published Aeronautical Information. ... [These] provide strong evidence to suggest that regulatory requirements are not being complied with in full by States. This is particularly true of, but not limited to, ICAO Annex 15.
>
> ...
>
> A 'Do Nothing' option is not considered acceptable given the evidence of problems with data accuracy and integrity and the need for far greater accuracy and integrity levels to support future ATM applications ... Despite the existence of extant ICAO requirements for many years, these have not been properly implemented by States.[238]

Thus Eurocontrol proposed the enacting of a rule that would strengthen (rather than override) the requirements of Annex 15 by mandating "the full implementation of the [its] existing provisions ... for ensuring Aeronautical Information quality (accuracy, resolution and integrity)."[239] More specifically, the provisions of such rule would address:

- the use of appropriate software, allowing the logging of survey data and the calculation and validation of coordinates;
- means through which data can be forwarded for processing and encryption standards;
- validation of the data for completeness.[240]

It therefore appears that, far from establishing an entirely new and exhaustive regulatory framework, the proposed rule would make reference to or incorporate existing standards, such as those of Annex 15.

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[238] Eurocontrol, Regulatory Unit, *Advanced Eurocontrol Notice of Proposed Rule-making (A-ENPRM): Aeronautical Data End to End Integrity* (Brussels, 5 May 2003) at 4, 8-9.

[239] *Ibid.*, at 9.

[240] *Ibid.*

Another probable source of such standards would be the European Organisation for Civil Aviation Equipment (EUROCAE)'s documents ED-76, 'Standards for Processing Aeronautical Data', and ED-77, 'Standards for Aeronautical Information'. The former is concerned with "data quality assurance and quality management requirements to provide the end user with the necessary confidence that the delivered aeronautical data is of a standard commensurate with its intended use,"[241] and is already implemented through the recommended practices of the Joint Aviation Authorities.

D) Mandatory format of aeronautical information

Although Annex 15 does not explicitly state so, there is reason to believe that it mandates the issuance of AI in paper-based form. Such belief is inferred from the presence of indications in the text of the Annex, such as the use of the term "loose-leaf", or the presence of specifications regarding page size or chart size. At the same time, Annex 15 does not ignore the existence of electronic AI, or the valuable contribution such format can bring, stating that "AIP, AIP Amendments and AIP Supplements shall be made available by the most expeditious means,"[242] a statement which tacitly acknowledges one of the core qualities of e-AI.

In fact, the 1998 AIS/MAP Meeting had foreseen the increase in the use and availability of e-AI, then finding that "[w]ith the use of the electronic environment it [is] realistic to expect that in the future, aeronautical information [will] be provided to users on-line and in real time."[243] Yet at the same time the Meeting had recognized that "a large sector of the aviation community ... required, and would continue to require, aeronautical information in the hard copy format," and that "many States may introduce electronic provision of aeronautical information and continue to provide paper copy aeronautical information, and this may remain the case for some time into the foreseeable future."[244] In the end, the Meeting had discussed amendments to Annex 15 which would reflect the fact that "both paper and electronic environments would need to operate in harmony and in parallel."[245]

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[241] Joint Aviation Authorities, *Administrative & Guidance Material* – Leaflet no. 9: Standards for processing aeronautical data (Hoofddorp: JAA, 2000) at 9-1.

[242] *Annex 15, supra* note 10, sec. 4.5.

[243] *AIS/MAP Meeting*, *supra* note 206, at 1.2-1.

[244] *Ibid.*

[245] *Ibid.*, at 1.2-2.

The issue of "cohabitation" between paper AI and e-AI was thoughtfully debated during a meeting of Eurocontrol's EATM Aeronautical Information Services Team:

> The requirement for a State to publish AIP is an ICAO Standard. Whether the AIP is published in paper form or in an electronic format does not impact its legal status by virtue of Annex 15 of the Chicago Convention.
> The issue of the legal value of an electronic AIP would become relevant in the case of dispute resolution, in particular before a court of law.
> States should therefore include in their publication of an electronic AIP a statement on the legal value they accord to it.
> ...
> However, should a [user] require a paper version, it is the State AIS obligation to provide this paper version.[246]

Although the Team's argument is solid, it does not bring convincing evidence that a State can, pursuant to Annex 15, be compelled to produce paper-based AI. But in reality, States must and still do provide the users with paper AI, for a variety of reasons:

- The high number of deficiencies and integrity concerns regarding e-AI does not warrant, at this point in time, that it entirely substitutes itself for the hard copies;
- Not all users have at their disposal the technical means that would allow them to make use of AI published exclusively in an electronic format, *e.g.* an electronic aeronautical chart display (EACD);
- Providing AI exclusively in an electronic format may force a user, say a recreational pilot, to reprint the said AI on paper through household printing means. This would likely result in a document lacking the precision, readability and granularity afforded by professional printing, thereby resulting in an increased safety risk for such user.

But sometimes, it is the State which compels itself or its agent to publish AI under paper format at all costs. Such is the case in Canada, where the *Civil Air Navigation Services Commercialization Act*[247] provides as follows:

> **11.** [Nav Canada] is hereby designated as the authority in Canada responsible for providing:

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[246] *Supra*, note 221, at 23.

[247] S.C. 1996, c. 20.

> (a) aeronautical information services for the purposes of Annexes 4 and 15 to the Chicago Convention; ...
>
> **9.** [Nav Canada] shall ... provide all users with the civil air navigation services that the Department of Transport provided immediately before the transfer date and shall do so to the same extent as the services were provided by the Department of Transport.

In short, if Transport Canada, before 1996, provided AI users with paper versions – which it did – then so must its successor, Nav Canada. Therefore, aside from any debatable interpretation of the obligations laid down by ICAO Annex 15, Canadian AI users have an unambiguous entitlement to hard-copy AI.

E) Obligation to carry paper charts

Are pilots legally obliged to bring charts onboard their aircraft?

A FAA advisory circular on pre-flight preparation states that "[a] basic element of pre-flight preparation requires the use of current navigational charts on which pilots can mentally review their intended route of flight. They may or may not wish to draw a line on the chart representing the true course."[248]

This advice is in line with Chicago Convention's Annex 6:

> An aeroplane shall carry:
>
> ...
>
> c) current and suitable charts to cover the route of the proposed flight and any route along which it is reasonable to expect that the flight may be diverted.[249]

In the USA, the legal obligation to carry charts on board is placed on the pilots of the following categories of aircraft:

- *Large and turbojet powered aircraft*

> The pilot in command of an airplane shall ensure that the following equipment and aeronautical charts and data, in current and appropriate form, are accessible for each flight at the pilot station of the airplane:

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[248] Federal Aviation Administration, *Advisory Circular 61-84B: Role of Preflight Preparation* (Washington, D.C.: FAA, 1985) at 4 (a)(1).

[249] ICAO, *Annex 6 to the Convention on International Civil Aviation – Operation of Aircraft*, 8th ed. (Montréal: ICAO, 2001) sec. 6.2.3.

> ...
>
> (3) Pertinent aeronautical charts
>
> (4) For IFR, VFR over-the-top, or night operations, each pertinent navigational en route, terminal area and approach and letdown chart.[250]

- *Air carriers – Smaller aircraft*

> The operator of an aircraft must provide the following materials, in current and appropriate form, accessible to the pilot at the pilot station, and the pilot shall use them:
>
> ...
>
> (3) Pertinent aeronautical charts
>
> (4) For IFR operations, each pertinent navigational en route, terminal area, and approach and letdown chart.[251]

- *Air carriers – Larger aircraft*

> The pilot in command shall ensure that appropriate aeronautical charts containing adequate information concerning navigation aids and instrument approach procedures are aboard the aircraft for each flight.[252]

In the United Kingdom, the Rules of the Air Navigation Regulations provide that any aircraft registered in the UK shall carry adequate equipment, among which the following is to be found:

> Maps, charts, codes and other documents and navigational equipment necessary ... for the intended flight of the aircraft including any diversion which may reasonably be expected.[253]

Finally, the Canadian Aviation Regulations state that no person shall conduct a take-off in a power-driven aircraft, other than an ultra-light aeroplane, unless are carried on board "where the aircraft is operated in VFR OTT, night VFR flight or IFR flight, all of the necessary current aeronautical charts and publications covering the route of the proposed flight and any probable diversionary route."[254]

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[250] *Federal Aviation Regulations*, 14 C.F.R. § 91.503 (a).

[251] *Federal Aviation Regulations*, 14 C.F.R. § 135.83 (a).

[252] *Federal Aviation Regulations*, 14 C.F.R. § 121.549 (a).

[253] *The Air Navigation (No. 2) Order 1995*, S.I. 1995/1970, sec. 14(2) and Schedule 4.

[254] *Canadian Aviation Regulations*, S.O.R./1996-433, sec. 602.60 (1)(b).

None of these various national regulations specifically require that the documents which are to be carried on board be in paper form (although a mention like "they may wish to draw a line on the chart" obviously takes for granted that they are!) One can nevertheless assume that the paper format is the format contemplated by such rules, for two reasons: the first being that such rules were drafted at a not-so-distant time when no other format was widely available, hence the drafters not having seen the necessity to explicitly state so.

The second reason is semantic: a chart is a tangible object *per se*. What is called an 'electronic chart' is not a chart, properly speaking; it is merely the reproduction on a CRT or LCD screen of digital information stored in electronic form.

The advent of e-AI and electronic charts challenges the relevance of the current regulatory framework: is the latter keeping with the times? In truth it is not, and this, under a number of possible scenarios.

If the air regulations are understood as **mandating that pilots bring paper charts on board**, then we find both inefficiency and a safety decrease. Pilots and operators would have to bear the economic inefficiency of paying for both top of the shelf EACDs, and expensive (but in these circumstances, practically useless) paper charts.

A clear example of this is the case of Air New Zealand, a reputable commercial aircraft operator which contracted with Boeing Commercial Aviation Services to have the Boeing Electronic Flight Bag (EFB) installed on some aircraft of its fleet.[255] According to its manufacturer, "the EFB contains all documentation and forms that pilots carry – aeronautical maps and charts, manuals or fault reporting and operations, minimum equipment lists and logbooks – in digital format, and puts them at the crew's fingertips."[256] At the same time, New Zealand's Civil Aviation Rules force Air New Zealand pilots to bring appropriate aeronautical charts on board with them,[257] thereby rendering the 'paperless' purpose of the EFB somewhat moot.

Alternatively, an operator who has gone through the expense of installing an EACD may decide, instead of procuring pricey conventional charts, to make 'house-made' printouts of the contents of the database as a means to fulfill his legal obligation to carry charts on board. This constitutes a potential hazard, for – as seen earlier – such charts do not present the same degree of precision, readability and

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255 Boeing Commercial Aviation Services, Press Release, "Air New Zealand Orders Boeing Electronic Flight Bag for new 777s, 787s" (22 March 2005).

256 *Ibid.*

257 *Civil Aviation Rules* (N.Z.) 1953/108, s. 91.221 (a)(2).

granularity than professionally-printed charts, and may thus be an ineffective substitute in case of failure of the electronic database system.

On the other hand, if the air regulations are understood as **allowing pilots to rely solely on EACDs**, then we find in the case of many States, a regulatory vacuum. Indeed it is in the interest of safety that the design and use of such equipment be strictly regulated, even more thoroughly than the aeronautical charts currently are. The nefarious consequences that could arise out of the dysfunction, in mid-flight, of the onboard EACD, where such device has entirely substituted itself to hard copy charts, are too great to be ignored.

Annex 4's standards in this respect are rather loosely drafted:

> To ensure safe navigation in case of a failure of the [EACD], the provision of adequate back-up arrangements shall include:
> a) facilities enabling a safe takeover of display functions in order to ensure that a failure does not result in a critical situation; and
> b) a back-up arrangement facilitating the means for safe navigation of the remaining part of the flight.
> *Note. – A suitable back-up system may include the carriage of paper charts.*

This loose drafting possibly ensues from the view of the 1998 AIS/MAP Meeting that "in order not to inhibit technological advances, new SARPs should not be directed at the technical methods by which these displays are achieved, nor should specifications be overly comprehensive and rigid."[258]

EACD and databases manufacturers' warranties (in the unlikely event that any would be granted) are simply insufficient; aircraft operators must be able to rest on the confidence that such devices have been thoroughly tested and certified by an independent regulatory authority.

A delay on the part of national civil aviation authorities in promulgating appropriate regulatory frameworks in this respect would quickly develop into an unacceptable technological and safety gap between the world's various aviation markets and countries.

In this regard, the aeronautical community should consider walking in the footsteps of its sister, the shipping community. Indeed, the *International Convention for the Safety of Life at Sea* (ratified by 141 countries) requires the carriage of adequate and up to date paper nautical charts on all ships.[259] But

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[258] *AIS/MAP Meeting*, *supra* note 206, at 2.1-1.

[259] *International Convention for the Safety of Life at Sea*, 1 November 1974, Regulations V/19 and V/27.

Regulation V/19.2.1.4 gives contracting States the authority to accept the use of an electronic chart display and information system (ECDIS) instead of paper-based nautical charts. As early as 1995, the International Maritime Organisation[260] adopted performance standards for electronic charts. It is hoped that ICAO will choose to follow a similar path.

A corollary issue should also be addressed: the functional and hierarchical relations between the two formats of AI, paper and electronic. The 1995 crash in the Andes of a Boeing 757-200 highlighted the tragic consequences that may result from the confusion brought about by the existence of the same data under two different formats. The following is excerpted from the accident report:

> Aeronautica Civil believes that the discrepancy between the approach chart and [Flight Management System (FMS)] presentation of data for the same approach can hinder the ability of pilots to execute an instrument approach, especially since flight crews are expected to rely on both the FMS-generated display and the approach chart for information regarding the conduct of the approach. When two methods of presenting approach information depict important information differently or one readily show it at all, the information can be counterproductive to flight crew performance in general, and their ability to prepare an approach in particular. The lack of coordinated standards for the development and portrayal of aeronautical charts and FMS databases and displays has led to a situation in which, not only are the charts and displays different in appearance, but the basic data are different.
>
> ...
>
> Numerous important differences existed between the display of identical navigation data on approach charts and on FMS-generated displays, despite the fact that the same supplier provided American Airlines with the navigational data.[261]

In light of these clear conclusions, and of the ever-increasing use of e-AI in cockpits, rules must be established as to 'how' and 'when' one AI format should officially predominate over the other.

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[260] International Maritime Organization, *Resolution A.817 on performance standards for electronic chart display and information systems (ECDIS)*, 19th session (1995).

[261] Aeronautica Civil of the Republic of Colombia, *Report – Controlled Flight Into Terrain, American Airlines Flight 965, Boeing 757-223, N651AA, Near Cali, Colombia, December 20, 1995* (Santafe de Bogota, 1996) at 43, 55-57.

F) Evidentiary value and electronic signature

Eurocontrol's Aeronautical Information Services Team touched upon an important legal aspect of the advent of e-AI, when it felt (as previously quoted) that "the issue of the legal value of an electronic AIP would become relevant in the case of dispute resolution, in particular before a court of law."

The admissibility of electronic data in evidence is closely linked to the concept of electronic signature. As early as 1985, the United Nations Commission on International Trade Law (UNCITRAL) recommended that governments review the legal provisions affecting "the use of computer records as evidence in litigation in order to eliminate unnecessary obstacles to their admission ... and to provide appropriate means for a court to evaluate the credibility of the data contained in those records."[262]

This was followed in 1996 by the first UNCITRAL Model Law on Electronic Commerce, the Article 9 of which stated:

> (1) In any legal proceedings, nothing in the application of the rules of evidence shall apply so as to deny the admissibility of a data message in evidence:
> (a) on the sole ground that it is a data message;
> ...
> (2) Information in the form of a data message shall be given due evidential weight. In assessing the evidential weight of a data message, regard shall be had to the reliability of the manner in which the data message was generated, stored or communicated, to the reliability of the manner in which the integrity of the information was maintained, to the manner in which its originator was identified, and to any other relevant factor.[263]

And in 2001, UNCITRAL adopted its Model Law on Electronic Signatures, defining an 'electronic signature' as "data in electronic form in, affixed to or logically associated with, a data message, which may be used to identify the signatory in relation to the data message and to indicate the signatory's approval of the information contained in the data message."[264]

Of course the manner in which the judiciary is to consider the evidence presented before it is a matter for national legislators to determine. But the legal movement imprinted at the international level by these UNCITRAL milestones is a powerful one, and reflects the even more powerful presence of paperless

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[262] UNCITRAL, *Recommendation on the Legal Value of Computer Records*, 40th session, Supplement No. 17, UN Doc. A/40/17 (1985) at par. 360.

[263] UNCITRAL, *Model Law on Electronic Commerce with Guide to Enactment* (1996) art. 9.

[264] UNCITRAL, *Model Law on Electronic Signatures with Guide to Enactment* (2001) art. 2 (a).

documentation in today's society. There is thus little doubt that, if an e-AI exhibit ever encountered judicial resistance as to its admissibility a few years ago, such reticence is bound to be soon brought down by the sheer flow of electronic format documents.

The European Community had already acknowledged this reality in 1999, when it adopted a "Community framework for electronic signatures", which mandated States to ensure "that an electronic signature is not denied legal effectiveness and admissibility as evidence in legal proceedings solely on the ground that it is in electronic form ..."[265]

If the national legislations of two major EU member States are to give any indication, e-AI documents appear well positioned with respect to their admissibility and authentication in the course of the judicial process.

Indeed, the UK's *Electronic Communications Act 2000* provides that:

> In any legal proceedings, an electronic signature incorporated into or logically associated with a particular electronic communication or particular electronic data ... shall ... be admissible in evidence in relation to any question as to the authenticity of the communication or data or as to the integrity of the communication or data.[266]

As well, France's Civil Code states that "a writing under electronic format is admitted in evidence to the same extent than a writing under paper format, on the condition that the person from whom it originates may be duly identified and that it be established and kept in conditions such as to guarantee its integrity."[267] Once this condition is established, "[a] writing under electronic format holds the same evidentiary value than a writing under paper format."[268]

Although these national legislations, among others, recognize the value of electronic data as a valuable element of evidence that can assist a court in conducting its fact finding task, the standards they lay down, in terms of reliability of the evidence offered, are imprecise and rely mostly on judicial discretion. This may impact a plaintiff's ability to demonstrate his case. By way of example, if an aircraft operator attempts to invoke an e-AI provider's liability, he will most probably need to offer the defective database (or a reproduction of its output) in evidence. From this point on, this plaintiff cannot predict in which way

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[265] EC, *Council Directive 1999/93/EC of 13 December 1999 on a Community framework for electronic signatures* [1999] O.J. L. 13/12.

[266] *Electronic Communications Act 2000* (U.K.), 2000, c. 7, sec. 7 (1).

[267] Art. 1316-1 C. civ. [author's translation].

[268] Art. 1316-3 C. civ. [author's translation].

the court will proceed to assess such evidence's reliability; will the court require an electronic signature or marker attesting that such data was effectively issued by a given provider? Will it require conclusive evidence that such data was not tampered with since it was released from the provider's control (an "electronic chain of possession" of sorts)? As Eurocontrol's Legal Service puts it:

> The crucial question is in how far reliance can be placed on electronic documents as opposed to paper copies. In fact, it is the ease of alteration, unintentional or intentional, of electronic documents, that reduces its value as evidence. From looking at a printout it is difficult to determine whether the information in the document is the same information that was originally entered into the system.
> Therefore, controls and technical tools have to be in place in order to ensure the reliability and integrity of both paper and electronic documents.[269]

The increasing reliance of tribunals in industrialized countries on electronic evidence entail these and countless other legal questions, but this is beyond the scope of this thesis. Suffice it to say that this constitutes but one of the many legal challenges brought about by e-AI.

It is highly unlikely that ICAO would ever consider enacting standards, or even recommendations, regarding the evidentiary value of AI, as such rules are concerned with the unfettered judicial discretion and thus falls entirely within the province of State sovereignty.

This being said, this particular issue does not relieve ICAO of its general ongoing duty of addressing the regulation of more 'technical' aspects of e-AI, such as storing, accessing, transferring and archiving of e-AI, which remain largely unregulated.

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[269] Eurocontrol, Legal Service, *Flimsy: Legal aspects of electronic Aeronautical Information Publications* (Brussels, 2-3 March 2004) at 3.

Conclusion

This thesis has attempted to put in perspective the dramatic evolution of AI within the last century, and the equally significant evolution of its corollary normative and legal framework. The latter bears much resemblance to the aeronautical information that it is meant to both regulate and foster: it is fragmented, and in constant evolution.

It is fragmented in the sense that AI is a quite diverse ensemble of different kinds of information, offered in different formats, gathered under a common denomination by reason not of their common nature, but of their common purpose. And it is the essential nature of that purpose – to provide the information necessary to safe and efficient air navigation – that makes the legal framework described herein essential as well.

The AI legal framework is also in constant evolution because it does not exist in isolation from the rest of the law. As new legal concepts emerge and as the law shifts, AI law evolves and adapts itself. This is evidenced by the profound impact product liability law has had on the liability schemes applicable to AI. Thus, by way of example, the nature of aeronautical charts may have remained almost unchanged in the past fifty years, but the liability implications for the publishers of such charts have been significantly altered by progressive judicial and legislative innovations designed to enhance the consumers' interests.

As well, the movement towards streamlining and decentralizing governmental functions of the past fifteen years has undoubtedly fuelled the rapid pace of ANS corporatisation, thereby entailing considerable rethinking of the hitherto immutable notion of State responsibility in this field.

The legal AI framework is not only altered, but also enriched by the trends of legal thinking. Hence the many challenges brought about by e-AI do, and will continue to, find their solutions (or at least the inspiration necessary to reach tailor-made solutions) in the legal initiatives concerning the internet, privacy and security of digital data. The law specifically applicable to e-AI will thus evolve at the same pace than our 'digital society' as a whole.

Fragmented and in constant evolution: these two dominant characteristics of AI law are bound to hinder (if not make impossible altogether) attempts to reach greater measures of uniformity on an international level.

To begin with, the sheer number and variety of national laws makes it an almost impossible task to tackle. Moreover, the potential impact of such attempts at uniformity on matters of sovereignty and judicial process is likely to meet strongly resisted.

Another reason lies in the technology-heavy and fast-paced nature of AI. The very real (and unfortunately increasing) technological gaps between the countries of the world translates into a legal gap, as some States do not perceive the same need to regulate and to invest in enforcement of such regulation to the same extent than industrialized States – which invest heavily in technological R&D – do. The effect of this dichotomy is increased by the consensual nature of decision-making within ICAO and other international aviation bodies.

It is therefore through the proverbial 'small steps' that aeronautical information shall strive to find its own coherent, comprehensive, legal regime.

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