CONTAMINATION OF EARTH'S ECOSYSTEM BY EXTRATERRESTRIAL MATTER: UNITED STATES AUTHORITY TO PROMULGATE AND ENFORCE QUARANTINE REGULATIONS

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Short Title

EARTH EXPOSURE TO ALIEN MATTER: QUARANTINE LAW

By

ROBINSON

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ABSTRACT

This interdisciplinary study records the scientific, legal and administrative history of the first steps taken by the United States National Aeronautics and Space Administration (NASA) to protect Earth from harmful extraterrestrial contaminants. The study undertakes critical analyses, within the context of both the United States and international legal regimes, of the first "back contamination" standards and attendant quarantine regulations known to be implemented.

Upon the premise that the regulations lack sufficient implementing authority, various legal approaches are explored - including possible injunctions against United States missions contributing to the threat of back contamination - which would force judicial review of those regulations and the promulgating procedures adopted. Proposed legislation is submitted which would provide necessary quarantine authority for NASA and other Executive agencies. Accommodation in the legislation is made for a politically realistic and effective form of international participation in United States procedures for promulgating future back contamination standards and quarantine regulations.

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PROLOGUE

This dissertation provides the first comprehensive accounting and evaluation of a largely undocumented, but legally and politically critical, situation pertaining to potentially adverse consequences of space exploration carried out by the government of the United States. The situation involves the contamination of Earth and its immediate ecosystem by extraterrestrial matter returned by astronauts and certain recoverable, unmanned space missions.

At the outset, it should be noted that the developmental history of protective measures against Earth-exposure to extraterrestrial contaminants is integral to the ultimate legal evaluation of such measures and attendant problems and issues. For this reason, the description of the science, technology and mechanics involved to date in protecting Earth's ecosystem from potentially adverse consequences of extraterrestrial contamination has not been placed in the appendices. It is not simply an interesting historical anecdote with only tangential pertinence to the principal legal analysis. Since recordation of the historical evolution of the problem is, in its own right, a contribution of this dissertation, and since it is integral to the legal analysis, the subject has been placed appropriately at the beginning of the dissertation.

For facility of reference, Chapters I through III deal principally with the history and mechanics of extraterrestrial contamination control. Chapters IV through IX encompass the legal and political analyses of the contamination control standards and procedures adopted by the United States, as well as this writer's proposals for necessary corrective actions.

A final caveat to the reader is that several of the footnotes deal with information and matters which not only are references in support of textual material, but which also offer discussions and data that are substantive in nature and normally would appear in the text. However, for practical reasons, it was determined that such information, data and discussions occasionally should be included as footnotes. Consequently, many of the footnotes should be considered as though they were integral aspects of the discussions and evaluation.

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[Statement of Contribution to original Knowledge and Acknowledgments]

The issues of extraterrestrial contamination control which are investigated for the first time in this dissertation are (1) the adequacy of established quarantine procedures as a response to the threat of extraterrestrial contaminants and (2) the effectiveness and legal propriety of such procedures and quarantine regulations promulgated by the United States Government. As previously noted, an historical

documentation of what has been done to date to protect Earth's ecosystem from alien contaminants is an integral aspect of the total evaluation, which also (1) illuminates the inherent faults of the quarantine regulations, and (2) exposes the consequent political and scientific weaknesses in the worldwide application of the presently-established quarantine procedures. After exposing the weaknesses in the procedures and regulations, the dissertation provides constructive suggestions for (1) public action (i.e., injunctive relief and standing to sue in view of recent U.S. court decisions) to avoid potentially harmful effects of recoverable space missions for which there is inadequate official preparation; and (2) proposed legislation which could serve as the framework not only for necessary quarantine authority, but also as the instrument for facilitating, realistically, international participation in what is truly a transnational problem.

The dissertation deals not only with the sui generis issue of Earth-exposure to unknown extraterrestrial contaminants, but also with the very sensitive and increasingly widespread issues involved in the application of advanced technology and the consequent level of acceptable scientific risk which is thrust upon the public without thorough and effective, domestic and international participation. For these reasons, the dissertation occasionally is marked with observations and conclusions that are intended to show applicability to related social issues, despite principal concentration upon the narrower issues

attendant to Earth contamination through extraterrestrial exposure.

Acknowledgment is given gratefully to four people who offered carefully considered advice and information during the preparation of this dissertation. First is Mr. Robert Wojtal, Office of the General Counsel, National Aeronautics and Space Administration, who was instrumental in drafting the quarantine regulations ultimately published and who continues his professional concern with the importance and efficacy of the regulations. Second is Dr. Lawrence B. Hall, Planetary Quarantine Officer, National Aeronautics and Space Administration, who provided invaluable information to fill the broad gaps where no documentation exists, and who continues his deep concern for protecting the public health from adverse changes in Earth's ecosystem caused by extraterrestrial contaminants. Third is Dr. R. Peter Suttmeier, international relations specialist with NASA and assistant professor of political science at Hamilton College in New York, who helped in keeping the political evaluations in proper perspective. Fourth is Dr. Sherrod V. Anderson, Office of the Federal Air Surgeon, Federal Aviation Administration, whose expertise in aerospace medicine and concern with the bureaucratic handling of the extraterrestrial quarantine procedures provided constant encouragement that the present dissertation is timely and essential.

CONTAMINATION OF EARTH'S ECOSYSTEM BY EXTRATERRESTRIAL MATTER: UNITED STATES AUTHORITY TO PROMULGATE AND ENFORCE QUARANTINE REGULATIONS

[Short Title - Earth Exposure to Alien Matter: Quarantine Law]

I. INTRODUCTION

> In the exploration and use of outer space, including the moon and other celestial bodies, States... shall ...conduct exploration of them so as to avoid their harmful contamination and also adverse changes in the environment of the Earth resulting from the introduction of extraterrestrial matter and, where necessary shall adopt appropriate measures for this purpose. 1/

A. PURPOSE AND SCOPE

The ensuing observations and discussions are interdisciplinary in scope and are premised upon the quarantine procedures and regulations promulgated by the United States National Aeronautics and Space Administration. The purpose is to evaluate a unique situation which not only precipitates equally as unique health and administrative problems, but exemplifies as well the broad political and legal problems resulting from rapid progress in sophisticated technology and the increasing disparity in the number of user and non-user nations.

The framework of the discussions includes a brief historical view of the evaluation of official interest in, and concern with, the

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1/ Treaty on Principles Governing the Activities of States in Exploration and Use of Outer Space Including the Moon and Other Celestial Bodies, Art. IX, UN Doc. A/RES/2222(XXI) 25 January 1967; TIAS No. 6347 [January 27, 1967], hereinafter referred to as the Outer Space Treaty.

means of ensuring against contamination of Earth's biosphere (and immediate ecosystem) by extraterrestrial matter returned through space research and activities. Also included is a reference to standards developed in international, as well as domestic, fora to ensure protection of other celestial bodies from adverse contamination by microorganisms and other matter indigenous to Earth's ecosystem. The relationships of this "outbound" contamination control to the "back contamination" control for Earth's biosphere also is evaluated in context with the unilateral quarantine procedures adopted for Apollo 11 and certain of the other subsequent manned missions.

Having reviewed the history of the politics and mechanics involved in developing the back contamination control standards, and their specific application to at least one manned mission, a study is made of the promulgation of standards, procedures and regulations with a view to determining (1) whether they met either the minimum standards of domestic administrative law during their respective gestation periods, or the provisions undertaken in pertinent international agreements to which the United States is a party; (2) whether they were, and are, the proper subject for the invoking of restraining orders and injunctions; (3) whether they are applicable beyond domestic jurisdiction; (4) whether applicable Treaties give extraterritorial substance to the criminal provision of the regulations; (5) whether adequate quarantine authority exists in the United States; and (6) whether, in fact, the quarantine regulations

are of questionable validity in the context of the United States Constitution. Finally, proposed legislation for the United States Congress is submitted which would ensure (1) that sufficient extraterrestrial quarantine authority exists, and (2) that international expertise in extraterrestrial biology, public health problems, quarantine procedures, etc., is made directly available to United States officials responsible for protecting Earth from adverse affects of extraterrestrial matter returned by U.S. space missions.

Insofar as adverse effects of lunar contaminants are concerned, the question may or may not be academic at this point. However, the element of scientific risk and speculation involved is basic to the following study since the questions raised are not so much answered by scientific measurability as they are by the amount of public scrutiny that will be required for future scientific research and attendant experimentation, particularly where an international res communis environment is involved.

1. "Ecosystem" - Limited Definition

Both in the title and consistently throughout the text, herein, frequent use is made of the term "ecosystem" as it relates to Earth. In view of the integral role it assumes in the present study, it is helpful to establish at the outset a simple, but functional, understanding of that term.

Essentially, ecology is the natural discipline which emphasizes the study of relationships between living organisms and their respective

environments. The relationships in an environment of a given organism, or group of organisms, constitutes a framework of existence referred to as the ecosystem of that organism or group. The basic components of a given ecosystem are:

a. Abiotic - non-living relevant and influential factors on organisms (pure elements, mineral complexes, water, air content, etc.); and

b. Biotic - living organic elements influential in a given ecosystem.

An ecosystem includes the interrelationships of all biotic and abiotic components of a particular environment, often referred to as the "biosphere" when emphasis is on the living component. In a strict sense, the entire universe may be considered a gigantic ecosystem. However, the scope of ecological study may be restricted to an area which can be managed reasonably. Within the discipline of ecology, one who confines his scope of study to a single biotic species, and the reciprocal cause/effect relationships among both the biotic and abiotic components of its ecosystem, is referred to as an autecologist. 2/ For purposes of evaluating extraterrestrial contamination of Earth, the principal species of concern is Homo sapiens and the effective ecosystem may be said to extend to the outer limits of the ionosphere (Earth's

2/ Opposed to autecology is synecology, which is an approach emphasizing not just one species, but the total biotic and abiotic community relationships in a given ecosystem.

"immediate" ecosystem); as long as it is understood that Earth's characteristics at any given time are influenced to varying degrees by all the factors comprising Earth's Solar system, galaxy, etc., ad infinitum. As a control standard for present purposes, the normal ecosystem for Earth may be considered that state of existence in which extraterrestrial matter is not an adverse factor.

B. SPACE ACTIVITIES AND THE REALITY OF EARTH CONTAMINATION

Perhaps the most expensive and intricate measures in preventive medicine were conducted prior to, during and after the United States Apollo 11 mission to the lunar surface. Official concern, both domestic and international, over what has been termed back contamination [3/]

3/ No specific instrument, pronouncement, or decree ordered the use of "back contamination" as official terminology and as the designation for the Interagency Committee on Back Contamination ultimately established to consider the problem. In contradistinction to "outbound contamination", interested members of the scientific community have used "inbound contamination" interchangeably with "back contamination". Contamination means to "...infect by contact or association...[and] implies intrusion of or contact with an outside source as the cause...." Webster's Seventh New Collegiate Dictionary (1965), under contaminate, p. 180. Within the context of quarantine regulations issued by NASA [34 Fed. Reg. 11975, No. 135 (July 16, 1969)], back contamination relates to the object of the regulations, i.e., those who, or that which, is "extraterrestrially exposed." The latter is defined in the regulations as "...the state or condition of any person, property, animal or other form of life or matter whatever, who or which has: (1) Touched directly or come within the atmospheric envelope of any other celestial body; or (2) touched directly or been in close proximity to (or been exposed indirectly to) any person, property, animal or other form of life or matter who or which has been extraterrestrially exposed by virtue of subparagraph (1) of this paragraph."

from re-entry vehicles, astronauts, associated equipment and non-crew personnel was not a last-minute issue of scientific interest [4] or concern over a possible reaction by an aroused international public [5] regarding the possibility of "Earth invasion" by alien micro-organisms from the lunar surface. [6] The official concern, although not completely revealed to the public, was timely and, in itself, precipitated partially adequate and timely preparations through the coordinated efforts of several Government agencies and elements of private industry. [7]

4/ Past mission analyses of certain U.S. manned spacecraft already have included procedures for observing any foreign organic molecular complexes in or on the re-entry craft. However, from an operational view, the real concern arises in the Apollo program where mission objectives include contact with the lunar surface as well as its atmosphere, such as it is.

5/ Just prior to the Apollo 11 mission, dramatic headlines appeared in newspapers and magazines throughout the world describing generally the precautions being taken by NASA to prevent Earth contamination by potential microorganisms from the lunar surface and space. See, therefore, "Hitchhikers from the Moon: 'Invasion' - Let it Come," Jeff. Nesmith column, The Atlanta Constitution, Fri., June 6, 1969. In this context, as will be seen at a later point in the discussion, several scientists assisted in stimulating the drama by expressing genuine concern to members of the Congress about back contamination of the Earth's biosphere by extraterrestrial microorganisms.

6/ Because of the proximity of the Apollo 10 Lunar Excursion Module to the lunar surface (9.5 mile "flyby" in an essentially non-existent lunar atmosphere), the Apollo 10 command module was subjected to limited bio-analyses and quarantine procedures. In this respect, see NASA - Medical Requirements, Apollo Mission F (10), Manned Spacecraft Center (April 1969).

7/ Until viewed to the contrary, herein, the timeliness of the preparations for back contamination has never really been questioned. However, the adequacy of attendant quarantine procedures and authority has been the subject of sharp dispute. See fnt. 94, infra.

1. Initial Concern Over Extraterrestrial Contamination By Earth Organisms

Certain precautions have been taken over the years to sterilize space hardware designed to leave Earth's atmosphere, to enter alien atmospheres, or to impact upon the surfaces of other celestial bodies. The principal purpose was, and is, to minimize the probability of contaminating outer space and other planets with Earth organisms, 8/ not only to avoid frustration of scientific investigations aimed at acquiring knowledge about life-forms and life-related molecules on other planets, but also to avoid the possibility of identifying, in a quarantine situation, organisms indigenous to Earth as space alien. 9/

With the imminence of manned missions and recoverable unmanned missions, the concern focused principally on the prevention of possible Earth contamination. 10/ Over a period of time, the National Aeronautics

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8/ Op. cit., supra note 1, wherein Art. IX provides for the exploration and use of outer space and celestial bodies in such a way "as to avoid their harmful contamination" (emphasis added). The Outer Space Treaty recognizes, by use of the word "harmful", that not only is 100% sterilization of spacecraft, equipment, delivery vehicles and personnel impossible, but also that within certain contexts the word "contamination" is legitimately argumentative.

9/ Effective control of "outbound contamination" is an integral facet of back contamination quarantine procedures since, among other factors, the duration of quarantine may depend upon the facility with which organisms are identified as indigenous to Earth and not extraterrestrially derived.

10/ As indicated in fnt. 8, supra, "contamination" is subjective in nature. Within the framework of space activities, and specifically back contamination of Earth's ecosystem, the word is intended to describe, essentially, an inclusive, but passive, situation, i.e., contact with extraterrestrial matter without necessarily involving infection or tainting of Earth's ecosystem. As will be seen in subsequent discussions of quarantine authority, the reason for such a passive definition is the large element of ignorance regarding the physical and potential etiologic properties of extraterrestrial matter.

and Space Administration has been developing a back contamination program designed principally for the Apollo manned missions and consisting of very complex equipment and extensively intricate operational procedures. The program is far in advance of generally practiced microbiological laboratory techniques and offers unprecedented laboratory capabilities.

Essentially, the back contamination program for Apollo missions can be divided into three phases: (1) procedures for the crew "while in-flight to reduce and, if possible, eliminate the return of uncontrolled lunar surface contaminants in the command module;" 11/ (2) procedures involving the spacecraft recovery and transport-isolation of the crew, lunar samples, and spacecraft and associated mission equipment to the site of protracted quarantine; 12/ and (3) procedures accompanying quarantine operations and initial lunar sample analyses at the Lunar Receiving Laboratory (LRL). 13/ Detailed discussions of these phases,

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11/ Although descriptive primarily of the Apollo 11 mission, a brief, but excellent, account of the Contamination Control Program can be seen in Nat'l. Aeronautics & Space Admin., Press Kit for the Apollo 11 Lunar Landing Mission, Release No.: 69-83K, pp. 181-191, released Sunday, July 6, 1969.

12/ Although controlled quarantine, albeit remote, actually begins with final ingress to the lunar ascent stage of the lunar module, the site where controlled quarantine testing begins in earnest is the Lunar Receiving Laboratory (LRL) in Houston, Texas.

13/ Obviously, decontamination and quarantine control procedures for unmanned spacecraft on sample-collecting missions would commence, effectively, with the recovery operations. Since the first step is eliminated, the second and third phases are proportionately more important, although risk of exposure in the second phase is minimized by absence of crew transfer.

in context with quarantine requirements, follow under subheading III - CONTAMINATION CONTROL AND QUARANTINE PROCEDURES FOR APOLLO 11 - THE BASIC PROTOTYPE, infra.

C. UNITED STATES AS THE INITIATE

Many factors have interacted to require the United States to be the first nation to promulgate and effectively implement rules regarding the safeguarding of Earth's ecosystem from extraterrestrial contamination. Principal among the influential factors was President John F. Kennedy's commitment of the United States to land a man on the moon by 1970. 14/ The fulfilling of this commitment necessitated the formulation of back contamination standards and quarantine procedures by July 1969.

To the extent that unmanned recoverable satellites may present possibilities of back contamination - as well as outbound contamination - it may well be said that the U. S. S. R. had the first opportunity to set the precedence for regulating the threat of contamination of Earth's ecosystem by virtue of having launched the world's first artificial satellite. 15/ However, because of the absence of effective reporting by the Soviets, it is difficult, at best, to determine whether they were mindful at that time of back contamination control - other than, perhaps

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14/ Speech delivered by President John F. Kennedy at Rice University, Houston, Texas on Sept. 12, 1962.

15/ Sputnik I was launched October 4, 1957 and was quickly followed on November 3, 1957 by Sputnik II.

within a strictly scientific framework as opposed to public health considerations. To the extent the U. S. S. R. presently is developing back contamination controls, the subject is discussed in further detail under subheading II. D., infra, which deals with terrestrial contamination of outer space.

As seen at a later point, herein, the fact that the United States was put in the position of promulgating back contamination regulations of the first instance does not necessarily imply that those regulations are precedence for subsequent manned and unmanned flights conducted by other countries. Indeed, every indication is that, effectively, they are constrained to domestic jurisdiction with only questionable efficacy as they relate to pertinent activities in international waters, international airspace, and perhaps even the res communis of outer space and other celestial bodies as envisioned by the United Nations. Functionally, however, operational application of the regulations has a direct effect on the rights of other nations in the preservation of their domestic and international health and security.

D. CONCLUSIONS

From the above, it is seen that several factors were influential in forcing the United States into becoming the first country to formulate standards and regulations for protection of Earth's immediate ecosystem from extraterrestrial contaminants returned by space missions; e.g., impetus of the first Soviet Sputnik, President Kennedy's commitment

speech of 1962 at Rice University, genuine concern in the science community and the general political pressure brought to bear by Article IX of the Outer Space Treaty. While the U.S. back contamination control scheme may be elaborate, an aspect of incompleteness is built into the controlling regulations, accompanied by an indication that public scrutiny and evaluation of the back contamination standards and quarantine regulations may have been studiously obscured by the cloak of "agency expertise." Reasons for the evolutionary obscurity of the standards and regulations, both domestically and internationally, are exposed in ensuing discussions.

II. PRESENT STATE-OF-THE-ART AND ITS INFLUENCE ON CONTAMINATION CONTROL

In terms of the form and substance of back contamination standards adopted, and attendant quarantine regulations promulgated, it should be understood that the contemporary levels of space-flight technology are always the controlling factors. A related, integral facet is the level of biomedical technology available for ensuring an acceptable degree of contamination control.

It is quite impossible to speculate effectively upon every eventuality within any given scheme for contamination-control quarantine, let alone prepare contingency plans designed to accommodate unforeseen eventualities. However, quarantine schemes are, for the most part, formulated within the framework of satellite and launch vehicle operational characteristics, as well as biomedical capabilities, particularly within the parameters of specific mission objectives. 16/ The close interdependence of satellite and launch vehicle technology with the quarantine methodology pursued may well be a substantial part of the reasons why quarantine standards and procedures for back contamination have not been considered substantially in a multilateral international forum.

16/ See, generally, Interagency Committee on Back Contamination, Quarantine Schemes for Manned Lunar Missions, published by the National Aeronautics and Space Administration.

A. MANNED SPACECRAFT

Primary concentration in the United States on back contamination control standards and appropriate quarantine procedures has been with an eye to the manned lunar missions; specifically, the lunar orbital and lunar landing phases of the Apollo program. 17/ Consequently, keeping in mind the biomedical analyses and microbial count at the beginning of a mission, concern with back contamination begins with the command service module (CSM) and the lunar exploration module (LEM). The CSM potentially is contaminated by close lunar orbital characteristics 18/

17/ Ibid., p. 1, wherein it is stated that the quarantine schemes provide "substantive methods for satisfying the quarantine requirements of the Regulatory Agencies." The regulatory agencies referred to in the document are the U.S. Department of Health, Education and Welfare, the U.S. Department of Agriculture, and the U.S. Department of the Interior. Since the procedural and substantive propriety of the delineated quarantine requirements are questioned at a later point in this paper, it is submitted here that the real motivation for the form of the schemes was the lack of exact scientific knowledge regarding the physical and potential biotic nature of the Moon and near lunar environment. The extent of ignorance is important since it has a direct bearing on later discussions dealing with risk and reasonableness within the parameters of the Administrative Procedure Act, 5 U.S.C. 1001-1011 (60 Stat. 237). See, also, note 102, infra. It appears, also, that time objectives for successful manned lunar missions were essential factors in denying consideration of the U.S. back contamination program to a formal, international forum - be it ad hoc or under the aegis of the United Nations.

18/ The lunar atmosphere is estimated to consist of only 10-100 tons of gases, micro-particles, etc. In this context, see Summary Record of CETEX Meeting, Paleis Noordeinde - The Hague, 12-13 May 1958. For purposes of potential CSM contamination by near-lunar contact, it has been determined for the present that sterilization of the outer skin by re-entry heat of Earth's atmosphere is an adequate back contamination standard. This would not hold true, of course, for a CSM from which extra-vehicular activity took place in a near-lunar orbit.

and extravehicular activities (EVA) of the crew on the lunar surface. 19/ The LEM is contaminated by extraterrestrial matter, specifically because of its mission objective of landing on the lunar surface. The descent stage presents a problem to back contamination control only to the extent it contaminates lunar soil and environment with terrestrial matter that could frustrate subsequent selenochemical investigations of samples by astronauts on the surface, or by scientists on Earth. Since the descent stage remains on the lunar surface, it does not serve as a vehicle for back contamination by lunar matter.

The ascent stage of the LEM serves as a vehicle for contamination by virtue of exposure of its interior to the immediate lunar environment and the re-entry of astronauts after EVA duties. Subsequent docking with the CSM and transfer of astronauts provides additional opportunity for contamination transmission to the CSM interior. After docking and astronaut transfer is completed, the ascent stage of the LEM is separated and left in lunar orbit until eventual orbital decay, unless it is used for lunar impact studies, as in the case of the Apollo 12 mission. At this point, the CSM, its occupants and lunar-contaminated equipment become the principal objects of back contamination procedures and Earth-oriented quarantine requirements.

19/ Although the CSM remains in orbit, crew transfer from the ascent stage of the LEM contaminates the CSM.

1. Experience and Quarantine Flexibility

Even within the Apollo program there exists technological flexibility which could change the characteristics of back contamination requirements and subsequent quarantine parameters. Technological improvements and mission variations could dictate new contamination standards and quarantine procedures. Information derived from successive investigations during periods of quarantine may dictate changes in spacecraft technology and mission characteristics. Unanticipated changes in re-entry characteristics easily could dictate alterations in contamination control standards, as were experienced in the recent, abortive Apollo 13 mission. In short, any back contamination program must, of necessity, rely on the level of spacecraft technology and, hence, must be a program which is capable of response to change in the state-of-the-art and identification of previously unknown influences. 20/

20/ Op. cit., supra note 16, wherein the ICBC observes that "[i]t is, of course, impossible in any set of quarantine plans to anticipate every eventuality. Therefore, it is necessary that the schemes include a contingency provision that gives the Interagency Committee and the Regulatory Agencies adequate opportunity to provide requirements and suggestions for situations not covered in the formal plans" (emphasis added). But see, contra, E. Brooks, Legal Aspects of the Lunar Landings, 4 The Int'l Lawyer, No. 3, p. 415 (April 1970), wherein it is observed at p. 423 that "[l]ogic indicates that if the danger of Earth contamination, however small, was sufficiently real to call for the extreme of a rigid quarantine, then all avenues of contact between the transported lunar material and Earth should have been closed without exception."

B. UNMANNED SPACECRAFT

Effectively, for purposes of contamination control, there are two types of unmanned spacecraft: (1) those which are recoverable and (2) those which are expendable. The former generally require a greater degree of control because of their designed re-entry into Earth's biosphere, while the latter are subject exclusively to outbound-contamination sterilization procedures.

1. Expendable Spacecraft

Spacecraft, such as pure science satellites, [21] applications technology satellites, [22] and mixed technology-science satellites, [23] are designed for telemetry data readouts at Earth receiving stations

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21/ It should be noted, here, that certain satellites with pure science missions are designated as recoverable, even though they are not manned craft in the strict sense. These are referred to as biosatellites; e.g., Biosatellite 111 (BIOS-D), launched 29 June 1969 and returned 7 July 1969 - monkey used to determine physiological effects of prolonged weightlessness, etc.

22/ The applications technology satellites (ATS) are used for the investigation of space technology common to a number of satellite applications. Spin and gravity gradient stabilization techniques, as well as SHF, VHF communication, meteorological data and microthrusters, are included.

23/ Depending upon the physical characteristics of a satellite, the primary mission objectives and the type of launch vehicle used, an effort is made to include carefully selected scientific experiments of merit either on the spacecraft, itself, on the launch vehicle, or both. Consequently, applications satellites and applications technology satellites often are accompanied by scientific experiments. This is true of ATS satellites I-V.

and not for direct examination involving recovery operations. These satellites ultimately are destroyed after Earth-orbital decay [24] when they re-enter the atmosphere, or they are left to drift in space or impact on other celestial bodies without adequate atmospheres. [25] In the latter instance, concern principally is with acceptable standards and procedures necessary to minimize terrestrial contamination of outer space or alien planets and their potential biospheres. [26]

2. Recoverable Spacecraft

Spacecraft designed for experimentation and missions requiring direct examination and analysis are subject, in theory, to more extensive control procedures than expendable spacecraft. In practice, however, science has determined that minimal bio-chemical threat exists to Earth's ecosystem from re-entering, unmanned spacecraft. The principal factor behind this determination is that such spacecraft do not come in contact with alien planets and atmospheres sufficient

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24/ Orbital decay and atmospheric destruction will occur also on non-Earth planets, such as Mars, when orbiting probes are accomplished in the 1973 (now 1975) Viking series of missions.

25/ These include such probes as the Explorer series of satellites which are designed principally to investigate Earth's environment in terms of energetic particles and fields. From Explorer I, launched Feb. 1, 1958 for the ultimate detection and discovery of the Van Allen Radiation Belt, to Explorer XLI, launched June 21, 1969 to study the environment within and beyond the Earth's magnetosphere during periods of high solar activities, these satellites have probed many of the remote areas of Earth's astrophysical ecology.

26/ In this respect, see generally, Biology and the Exploration of Mars (Pittendrigh and Vishniac ed. 1966); C. Sagan and I. S. Shklovskii, Intelligent Life in the Universe (1966).

to contaminate the craft and, should contamination occur, the skin temperature during atmospheric re-entry is adequate to minimize potentially adverse contamination characteristics. 27/

However, this reasoning depends upon the integrity of the isolation mechanics of the spacecraft interior. Quite obviously, the imminent generation of recoverable space vehicles and satellites designed for exposure of the interior to extraterrestrial environments will necessitate more extensive contamination controls and quarantine procedures. These craft include the soft-landing type with remote-controlled, and robot implemented, experiments. 28/

27/ It was recommended by the Ad Hoc Committee on Contamination by Extra-terrestrial Exploration (CETEX), under the auspices of the International Council of Scientific Unions (ICSU), that "[t]he outside of space vehicles need not be sterilized since exposure to the unfiltered solar radiation (in high vacuo) during flight will destroy all microorganisms which have settled on the shell." See ICSU, Second Meeting of the Ad Hoc Committee on Contamination by Extra-terrestrial Exploration, Summary Recommendations 4, Paleis Noordeinde - The Hague (March 9 - 10, 1959). For a discussion of the inadequacy of re-entry skin temperature as a sterilization standard see note 59, infra. For observations denying the thoroughness of sterilization by deep space solar radiation, see contra, note 59, infra, Hatchin, Lorenz and Hemenway, Survival of Microorganisms in Space, and Halvorson and Srinivason, Can Spores Survive Space Travel. See, also, Portner, Spiner, Hoffman and Phillips, Effect of Ultrahigh Vacuum on Viability of Microorganisms, 134 Science 2047 (1961).

28/ Remotely controlled, robot-implemented extravehicular scientific experiments may include those possibly intended for Luna 15 by the Soviet Union. (Luna 15 was launched 13 July 1969 and landed on the lunar surface 21 July 1969.)

C. EXTRATERRESTRIAL CONTAMINATION - ALIEN LIFE FORMS AND INERT MATTER

Before reviewing the contamination control and quarantine procedures used for the Apollo 11 mission, it is helpful to note the potential extraterrestrial biotic and abiotic matter anticipated by scientists in order to recognize their influence on the quarantine procedures and regulations ultimately adopted.

1. Biotics

In 1958, Dr. Harlow Shapley, emeritus director of the Harvard College Observatory, published Of Stars and Men, in which he stated

> "our sampling of space shows that at least a billion galaxies are within four billion light years. If they are on the average only one-tenth as rich in stars as our own galaxy, there must be $10^9 \times 10^{10} = 10^{19}$ stars now within our present sampling. A reach to only ten times our present probe would run the number of stars to something like 10^{22}. And that extension of reach is not asking too much of the future." 29/

According to Dr. Shapley's computations, a minimum of one star in every million either supports, or is capable of supporting, some form of "high-level protoplasmic operation on one or more of its planets." 30/

29/ H. Shapley, Of Stars and Men 80 (1958).

30/ It should be emphasized that this statement was premised principally upon mathematical analyses and permutations. Shapley made no attempt to discuss the various theories regarding the actual creative forces of life - only the supportive elements necessary to permit these forces to structure living matter. See, generally, Huang, Occurrence of Life in the Universe, 47 Am. Sci. 397-402 (1959). For an excellent discussion of exobiology and its relevance to contamination control, see Young, Painter and Johnson, An Analysis of the Extraterrestrial Life Detection Problem, NASA, Scientific and Technical Publication Division, NASA SP-75 (1965).

Shapley carried his conclusion even farther by stating that a great many of these planets, but not necessarily all of them, in every likelihood have the "plant-animal inter-dependence in which we ourselves participate."

The significance of the Shapley observations to the present discussion lies chiefly in the time they were published, i.e., 1958. It was at this time that the National Aeronautics and Space Administration was established, 31/ and soon thereafter that policy considerations were given to contamination control. Admittedly, the level of space technology limited such considerations to a scope much less sweeping than that envisioned by Shapley's observation. However, the possibility of life forms in outer space and on the lunar surface was sufficient to turn official attention to consideration of back contamination safeguards; if not because of direct knowledge, certainly from the lack of it. 32/

For the purposes of meeting the obligation of safeguarding the Earth's biosphere, scientists could not preclude rationally the possibility

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31/ The civilian National Aeronautics and Space Administration was established by the National Aeronautics and Space Act of 1958 (Public Law 85-568, 72 Stat. 426), approved July 29, 1958.

32/ In this respect, see Levin, Significance and Status of Exobiology, 15 Bioscience 17-20 (Jan. 1965). See, also, Tasch, Life-Forms in Meteorites and the Problem of Terrestrial Contamination - A Study in Methodology, 105 N.Y. Acad. Sci. Ann. 927-950 (Sept. 9, 1964); Hayatsu, Orgueil Meteorite - Organic Nitrogen Contents, 146 Science 1291-1293 (Dec. 4, 1964); and for a generally related discussion, see Kuiper, The Environment of the Moon and Planets, in Physics and Medicine of the Atmosphere and Space 577-583 (Benson and Stronghold ed. 1960).

of the existence of life on the moon - specifically, forms with pathogenic characteristics. Certainly, it appears the probability, as opposed to possibility, of lunar life forms is minimal, but the participants in a 1965 Conference on Potential Hazards of Back Contamination from the Planets [33/] concluded that "extraterrestrial life and the concomitant possibility of back contamination must be presumed to exist."

In an article prepared by M. Alexander of the Cornell University Laboratory of Soil Microbiology, it was suggested that

> "[s]hould biochemical evolution on the Moon or Mars have followed a different course from that which resulted in terrestrial life, it is likely that lunar organisms thrust into the alien environment of the Earth would not replicate and would soon die." [34/]

Of direct relevance and importance to the NASA back contamination program was Alexander's observation that

> "[i]n the absence of experience with extraterrestrial life, however, it is not possible to provide unequivocal a priori arguments to show that an organism developing in one biosphere might not indeed become established and

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33/ Space Science Board of the Nat'l Acad. Sci., Conference on Potential Hazards of Back Contamination from the Planets, Nat'l Acad. Sci. - Nat'l Res. Coun., Wash., D.C. (1965).

34/ Alexander, Possible Contamination of Earth by Lunar or Martian Life, 222 Nature 1 (May 3, 1969).

use untapped environmental resources which it can utilize...more efficiently than any terrestrial species." 35/

Concisely, organisms indigenous to the harsh extremities of lunar-type environments may not only have physiological properties permitting adaptability to Earth's biosphere, but also may well have a broad spectrum of organic tolerance sufficient to include Earth's ecosystem.

a. Early concern with "spores"

Essentially, spores are described as primitive, often unicellular, bodies produced by plants and a few invertebrates. A spore has the capacity to develop a new morphology totally distinct from the parent, either directly (asexual) or after fusion with another spore (sexual). Two of the principal, and pertinent, characteristics of spores are (1) their microscopic size, permitting movement by infinitisimal forces of wind, potentially to the upper reaches of the ionosphere, and perhaps in space by solar energy, and (2) their resistance to a broad range of extreme environmental conditions. However, it is apparent that at a fairly early point in the U. S. manned space program, it was determined that a threat of alien spores was either nonexistent or acceptably

35/ Ibid. For a demonstration of this point by characteristics of certain halophiles, barophiles and acid tolerant heterotrophs, see H. Larsen, Halophism, in 4 The Bacteria 297-342 (Gunsalus and Sanier ed. 1962); Painter, Factors Affecting the Growth of Some Fungi Associated with Sewage Purification, 10 J. Gen. Microbiol. No. 1 (London) 177-190 (Feb. 1954); and ZoBell and Morita, Barophilic Bacteria in Some Deep Sea Sediments, 73 J. Bacteriol. 563-568 (1957).

nominal to conduct the Mercury and Gemini programs and permit extravehicular activity without contamination controls and quarantine procedures. 36/

b. The Problem of Recognizing Alien Life Forms

One of the principal difficulties in establishing back contamination procedures and promulgating responsive quarantine regulations is not simply the absence of knowledge about potential exobiology, but total ignorance of relevant life characteristics. Specifically, unless extra-terrestrial life forms are within a fairly close range of characteristics similar to biotic and abiotic components of Earth's ecology, it is doubtful whether such life forms could be recognized, isolated and identified consistently with the knowledge and technology presently available. 37/

36/ Regarding the issue of the possible existence of interstellar matter, which should be considered in the establishment of quarantine procedures and which is not covered by existing quarantine regulations, it was reported in the December 11, 1969 issue of the Baltimore Sun that "[a]stronomers are finding far more formaldehyde in interstellar space than expected...." Formaldehyde is believed to play a key role in life processes and indicates the presence of methane in space, as well as ammonia and ether - all of which are essential for life as we know it. The article reported that "[a]monia and water were discovered to exist in space only months before the formaldehyde discovery," the details of which were reported at the 131st meeting of the American Astronomical Society. David Buhl, of the National Radio-Astronomy Observatory at Green Bank, West Va., observed in an interview at the meeting that "it now appears possible that the more complex molecules existed first in space - that biological evolution began there and not on earth...."

37/ See, therefore, Fox, The Development of Rigorous Tests for Extra-terrestrial Life, in Biology and the Exploration of Mars (Pittendrigh and Vishniac ed. 1966); and Lederberg, Signs of Life, in Biology and the Exploration of Mars 127-140 (1966). See, generally, Miller and

It is now known, for example, that certain terrestrial saprophytes are capable of metabolically producing a variety of organic complexes not recognized as occurring in any known protoplasmic variations indigenous to Earth evolution. 38/ Further, certain microorganisms of Earth's biosphere have been observed only recently for the first time. 39/

According to Alexander, since all too few terrestrial species can be propagated in vitro by biologists, it is not unreasonable to assume they may well be unable to recognize at least certain extraterrestrial life forms, particularly in a relatively short period of quarantine. To substantiate this proposition, he refers to the widely-recognized "[p]redisposition of plants or animals to one microbial agent by a

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37/ (continued) Urey, Organic Compound Synthesis on the Primitive Earth, 130 Science 245 (1959); Abelson, Extraterrestrial Life, Proc. Nat'l Acad. Sci. 47, 575 (1961); Briggs, The Distribution of Life in the Solar System: An Evaluation of the Present Evidence, 18 J. Brit. Interplanetary Soc. 431 (1962); and P. Moore and F. Jackson, Life in The Universe, London (1962).

38/ Alexander, Biodegradation: Problems of Molecular Recalcitrance and Microbial Fallibility, 7 Adv. Appl. Microbiol. 35-80 (1965).

39/ See, generally, Safferman and Morris, Algal Virus Isolation, 140 Science 679-680 (May 10, 1963); Banks, Buck, Chain, Himmelweit, Marks, Tyler, Hollings, Last and Stone, Viruses in Fungi and Interferon Stimulation, 218 Nature 542-545 (1968); Hollings, Gandy and Last, A Virus Disease of a Fungus: Die-Back of Cultivated Mushroom, 22 Endeavor 112-117 (Sept. 1963); Cassida, Abundant Microorganisms in Soil, 13 Appl. Microbiol. 327-334 (May 1965); Orenski, Bystricky and Maramorosch, Polyspheroids from American Soils, Nature 210 (5032); 221 (April 9, 1966); Staley, Prosthecomicrobium and Anacalomicrobium: New Prosthecate Freshwater Bacteria, 95 J. Bacteriol. No. 5, pp. 1921-1942 (1968).

second...." [40/] Alexander also emphasizes the difficulty in determining alien life forms by pointing out that some pathogens are known to reside with the host for long periods of time without any demonstrable symptoms until a stress situation occurs; or that the etiology of certain pathogens vary in the extreme from host to host, thereby vitiating the efficacy of biological quarantine tests on a limited number of personnel.

In any event, the rather high level of speculation by scientists in this matter, as well as available positive knowledge, [41/] undoubtedly

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40/ Op. cit., supra note 38, at p. 42. In this respect, see, also, Christensen and DeVay, Adaptation of Plant Pathology to Host, 6 Ann. Rev. Plant Physiol. 367-392 (1965); Yarwood, Predisposition, in 1 Plant Pathology 521-562 (Horsfall and Dimond ed. 1959); Macleod, The Pneumococci, in Bacterial and Mycotic Infections of Man 391-411 (Dubos and Hirsch 4th ed. 1965); and Linderman and Toussoun, Breakdown in Thielaviopsis Basicola Root Rot Resistance in Cotton by Hydrocinnamic (3-phenylpropionic) Acid, 58 Phytopathology No. 10, pp. 1431-1432 (Oct. 1968).

41/ See, therefore, Botan, An Instrumented Search for Extraterrestrial Life, 3 Space Sci. Rev. 715-723 (Dec. 1964); Hayatsu, Orgueil Meteorite - Organic Nitrogen Contents, 146 Science 1291-1293 (1964); Gaskell, Do Meteorites Reveal Life on Other Worlds? New Scientist 458-460 (Dec. 4, 1964); and Levin, Significance and Status of Exobiology, 15 Bioscience 17-20 (Jan. 1965). See, also, note 36 supra. Within a more immediate and practical framework, the biotic quarantine tests, initially conducted for the Apollo 11 lunar material at the Lunar Receiving Laboratory in Houston, included observation for microorganisms, virology tests, bacteriology tests, invertebrates and lunar vertebrates, mammals, and botany. [(See NASA Press Release No. 69-83K, p. 191 (July 6, 1969)]. For descriptions of the environmental procedures required for LRL biological quarantine testing, see NASA Doc. MSC 00003, Integrated Quarantine Operations Plan - Revision B 15-23 (Nov. 6, 1969, superseding Revision A - June 27, 1969). [Note: After conclusion of testing of Apollo 11 lunar samples in quarantine, a significant period of time lapsed between the detection of traces of organic complexes on the samples, and the determination that the complexes were human in origin - despite the elaborate sterile and clean room procedures and facilities used from the moment of sample selections on the lunar surface to their release to Principal Investigators (PI's).]

provided the impetus for NASA to determine that back contamination procedures were required for manned lunar missions along with attendant quarantine testing and regulations. Collectively, domestic and international scientific opinions were influential, and the United States was obligated in a general way by treaty to avoid "adverse changes in the environment of the Earth resulting from the introduction of extraterrestrial matter...." 42/ Certainly, no specific document can be illuminated which unequivocably serves as the source for developing intricate biological back contamination procedures. In short, ignorance in a virgin discipline seems to have been the prime motivator, with minimal influence ascribed to what may be termed legitimate interest of the domestic and international lay public.

Practically, organic lunar life appears to be non-existent - at least to the extent the presently accomplished Apollo missions have provided lunar material for analyses, i.e., Apollo 11 - 12 (the Apollo 13 mission, of course, aborted before a lunar landing was accomplished). This does not mean, obviously, that additional Earth-based analyses of lunar samples will not continue for a long time in an attempt to recognize and isolate an active or, more likely, dormant extraterrestrial

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42/ Op. cit., supra note 1. The Outer Space Treaty was signed in Washington, D.C., London and Moscow January 27, 1967; it entered into force for the United States October 10, 1967.

microbe. 43/ However, many scientists feel that principal planets with significant atmospheres are the most likely sources of exobiology in our solar system and that

> "NASA's quarantine procedures for the astronauts after their moon walk are merely a rehearsal for the more stringent requirements that will follow a landing on Mars. Nevertheless, there is no debate over that (sic) fact that the moon quarantine procedures would not be enough for Mars, where the probability of some form of life existing is greater." 44/

3. Abiotics

The abiotic, or physical chemistry, properties of extraterrestrial matter are significant to the back contamination control program insofar as such matter may have pathogenic characteristics, or even react adversely when exposed to terrestrial atmospheric conditions. For example, unknown chemical characteristics may result in violent combustibility when exposed to normal or occurring Earth conditions; although abiotic in nature, extraterrestrial matter may be the precipitant of extremely adverse conditions and diseases in terrestrial organisms. Early reports from Principal Investigators of Apollo 11 Lunar Samples

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43/ See, generally, The Sunday Star, Washington, D. C., August 10, 1969, in which columnist John Lannan, based in part on an interview with Dr. Norman H. Horowitz of the California Institute of Technology and the Jet Propulsion Laboratory, remarked that "... studies on lunar samples will continue for a long time in an effort to awaken any dormant creatures that might have been left over from a more lively era."

44/ The Washington Post - Outlook Section, Sunday, August 10, 1969, Stuart Auerbach column - "Mars Beckons Earthlings." This report was based on interviews with several exobiologists located at the Jet Propulsion Laboratory.

indicate that lunar "soil" has an acute growth stimulating effect on certain Earth-indigenous plants. Further, preliminary indications have arisen that control microbes deposited on the lunar surface at the outset of lunar activities are completely broken down chemically when analyzed at the LRL - a phenomenon not at all expected by the bio-scientists (see note 94, infra). In anticipation of these possibilities and eventualities, NASA provided for appropriate abiotic testing of lunar material in the Lunar Receiving Laboratory. Among the physical sciences tests initially undertaken at the LRL were

a. visual and microscopic examination;

b. petrographic and mineralogic;

c. x-ray diffraction and fluorescence;

d. physical properties;

e. chemical properties;

f. inorganic gas analysis;

g. organic gas analysis;

h. radioactivity;

i. magnetic properties;

j. magnetic monopoles; and

k. spectroscopic. 45/

45/ Op. cit., supra note 41, NASA Doc. MSC 00003, p. 20. See, also in the same source, "Lunar sample biological test protocols," p. 27. Tests f through k are conducted in whole or in part by Principal Investigators during the period of quarantine.

Additional detailed examinations of this nature were undertaken by Principal Investigators who were assigned lunar samples once they had been released from LRL quarantine. 46/

D. TERRESTRIAL CONTAMINATION OF OUTER SPACE

The subject of terrestrial contamination of outer space, or outbound contamination appears on the surface to provide the antithetical complement of back contamination. However, outbound contamination control procedures are an integral aspect of back contamination control and, indeed, are extremely influential in the formulation of quarantine requirements.

Specifically, microbial life indigenous to Earth which finds its way to alien celestial bodies and atmospheres through manned and unmanned missions must be "identified, quantified and, insofar as possible, located" in order that life on the returning spacecraft and collected extraterrestrial material "may be more easily identified as to terrestrial origin" if such is the case. Toward this end, a series of NASA policy directives were issued which provide, basically, that

> "[o]ut bound automated spacecraft and planetary exploration programs shall not, within probabilities established...transport terrestrial life to the planets until it is determined that life does or does not exist on the planet and the character of existing life is explored, including potential hazards to Earth of future returning missions." 47/

46/ See NASA Press Release No. 69-130, Moon Surface Samples Distributed (Sept. 12, 1969).

47/ NASA Policy Directive NPD 8020.7, Outbound Spacecraft: Basic Policy Relating to Lunar and Planetary Contamination Control (Sept. 6, 1967).

Within the organizational structure of NASA, the Associate Administrator for Space Science and Applications is responsible for the overall administration of NASA requirements regarding biological loading on lunar and planetary-bound spacecraft, wherein the missions may "affect the biological status of the planets and their natural satellites." In developing the basic policy for each specific mission, he must give attention to the probability of contamination by landers, flybys and orbiters. Finally, the NASA Office of Space Science and Applications is responsible for preparing

> "[s]pecial, periodic, and final reports covering the decontamination and sterilization of outbound spacecraft... Copies of such reports will be furnished to NASA management and the scientific and technical community as a whole." 48/ (Emphasis added.)

1. Development of Planetary Quarantine Standards

Before discussing present NASA standards for outbound contamination control, it is helpful to first develop an appreciation of the way in which the art of spacecraft sterilization evolved and influenced the policy approach pursued by NASA. Sterilization techniques have progressed in a very technologically complex manner since 1957 when the germ-free status of spacecraft was recognized as an integral facet of planetary exploration. As noted by Lawrence B. Hall, NASA Planetary Quarantine Officer,

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48/ Ibid., p. 2.

> "...we have come to realize how different spacecraft sterilization is from other sterilization processes - that the problem is more than just a matter of sterilizing the landing capsule, and furthermore that the total planetary quarantine effort pervades and interacts extensively with the scientific and engineering aspects of planetary exploration programs." 49/

a. COSPAR Resolution of 1964

Much of the original work was premised, in large part, on speculation. Techniques used consisted of variations on those sterilization procedures employed by the surgical, pharmaceutical and canning industries. It was not until 1964 that hard figures for sterilization standards evolved from an international forum, i.e., when the United Nations Committee for Space Research (COSPAR) began publishing resolutions of its committees in which agreement was reflected on the means of preventing contamination arising from extraterrestrial exploration. 50/

According to Hall, the COSPAR Resolution of 1964 established a structural framework consisting of three elements representing

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49/ Hall, L.B., Recent Developments in Planetary Quarantine, 9 Develop. in Indust. Microbio. 19 (1968). This article, prepared by the Planetary Quarantine Officer, National Aeronautics and Space Administration, offers an excellent, concise summary of the history of spacecraft quarantine and contamination control procedures, as well as the applicable criteria and standards found acceptable by U.S. scientists.

50/ See, therefore, U.N. Committee on Space Research, 20 COSPAR Information Bulletin 25-26 (Nov. 1964); Fifth International Space Science Symposium, Florence, Italy.

quarantine standards first recognized internationally. These elements consisted of

> "(1) a model of the principal parameters and their interrelations, (2) agreements as to which parameters should serve as basic standards, and (3) the selection of quantitative values for the chosen parameters." 51/

To Hall's mind, the framework should consist of a "common language" to provide a clear definition of the details envisioned for planetary quarantine; "fair warning" when quarantine objectives can interfere unnecessarily with mission definition and requirements; 52/ and a "method of demonstration" to show coherence by a launching nation to internationally agreed planetary quarantine objectives. 53*/ As recognized in the equations set forth in footnote 52, supra, the greatest difficulty in formulating quarantine standards lies in the fact that a considerable amount of what Hall politely refers to as "educated guessing" is required; however, "[t]he proportion of factual information to speculation has been changing as results of research and flight data produce more factual information." 54*/

51/ Op. cit., supra note 49, at p. 20.

52/ See, therefore, ibid., Figure 1, p. 20, wherein the first two elements of the framework are reduced to fairly uncomplicated formulae as follow:

* Footnotes 53 and 54 on following page.

There are many recognized areas of quantitative values - for setting quarantine standards - which are established principally by

52/ (Continued)

(1) $Pc = n_L \cdot P + n_U \cdot P'$

- P' — probability of contamination due to a non-lander
- n_U — number of non-lander vehicles
- P — probability of contamination due to lander
- n_L — number of landers
- Pc — probability that planet will be contaminated

(2) $P = P_N \cdot P_R \cdot P_G$

- P_G — probability of growth and spreading
- P_R — probability of release
- P_N — probability of one viable organism

(3) $P' = \sum_i (P'r)_i (P'_R)_i (P'_G)_i$

- $(P'_G)_i$ — probability of growth and spreading
- $(P'_R)_i$ — probability of release
- $(P'r)_i$ — probability of transferring viable organisms to planet

i = distinct, independent sources of contamination

(4) $P_C = n_L \cdot P_N \cdot P_R \cdot P_G + mv \sum_i (P'r)_i \cdot (P'_R)_i \cdot (P'_G)_i$

53/ As of this writing, the U. S. S. R. has refused to accede to international standards and the recognized method of demonstration.

54/ This observation, while logical, is limited in scientific efficacy by the number of planets being studied in depth. Consequently, although one might see changes in quarantine format as spacecraft missions continue to vitiate old fantasies and create new ones, the scientific objectives of back contamination control will remain the same.

sophisticated guess-work; 55/ e.g., microorganism growth and spreading probability; likelihood of encounter between microenvironments capable of supporting life forms indigenous to Earth 56/ and such microorganisms derived from a random lunar landing location; 57/ the probability that the microorganisms will survive the hostile environments of translunar movement; and the probability that, if such organisms survive on the lunar surface, they will proliferate to the unacceptable degree of seriously compromising biological exploration objectives of scientists, "either through interference with the planetary ecology or by confusing landed experiments." It can be seen,

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55/ In this respect, see Craven, McDade and Light, Sterilization and Quarantine Parameters for Consideration During the Design of Planetary Vehicles, in Spacecraft Sterilization Technology 43-50 (1966), wherein at least 14 methods were identified by which contamination might occur. For a discussion of the progress in establishing a comprehensive methodology for determining and evaluating all likely sources of contamination, see the section by Graven and Wolfson in COSPAR Symp. Steril. Tech. Instr. Materials Appl. Space Res. (July 1967).

56/ For a related discussion of a simulated Martian environment and its effects upon certain microorganisms indigenous to Earth's biosphere (spec., Staphylococcus aureus), see Scher, Packer and Sagan, Biological Contamination of Mars. 1. Survival of Terrestrial Microorganisms in Simulated Martian Environments, in II Life Sciences and Space Research 352-356 (1964)

57/ The principal problem area of contamination control appears to be in accidental impacts by non-landing spacecraft. See Haynes, Supporting Document for Planetary Quarantine, Calif. Inst. Tech. - Pasadena (March 7, 1967).

therefore, that the relative accuracy of guess-work directly influences the characteristics and constraints of Earth-oriented back contamination standards, quarantine procedures and ultimate regulations. Again, as observed by Hall, the

> "educated guessing...may seem unscientific, but it is well to remember that the setting of quarantine standards is an operational tool for a scientific purpose - it is not science in itself." 58/

In any event, Hall notes that the bio-assay and bio-control techniques responsive to spacecraft missions have progressed in the United States to the point where recent launches have had a total microbial contamination of as low as 3.5×10^3 with bio-clean techniques alone, and without having to apply sterilization procedures. 59/

58/ Op. cit., supra note 49, at p. 22. For an indication of the flexibility of this "operational tool" proportionate to incremental improvements in the state-of-the-art, see the NASA manual entitled Standard Procedures for Microbiological Examination of Space Hardware (1966), wherein frequent revisions to the manual are seen to be necessary. For a general coverage of the sterilization tools available, see Committee on Space Research, Sterilization Techniques for Instruments and Materials as Applied to Space Research (P. H. A. Sneath ed. - COSPAR 1968).

59/ Bio-clean techniques do not incorporate the common, but erroneous, belief that exposure to a deep space environment serves as an additional sterilization technique for all of the spacecraft surface so exposed. It has been shown by both the United States and Soviet Union that extended survival was common of most microbial species tested on their respective orbiting spacecraft. The problems thus created in terms of back contamination are readily apparent when slow spacecraft re-entry techniques are perfected and extreme heat temperatures cannot be relied on to destroy potential "hitch-hiking" extraterrestrial microorganisms. See, therefore, Hatchin, Lorenz and Hemenway,

2. NASA Policy for Outbound "Lunar" Biological Contamination Control

Although the basic policy of NASA Directive 8020.7 does encompass lunar missions, as well as non-terrestrial planets, natural satellites and atmospheres, a specific directive spells out the policy and responsibility for biological contamination control of all outbound missions which are intended to encounter the Moon. 60/ This policy arose from NASA's experience with contamination minimization during the early stages of lunar exploration, i.e., the Ranger probes, wherein every effort was made to avoid the depositing of terrestrial organisms on the Moon. However, experience showed that the prime objective of complete sterility was not practicable within the present state-of-the-art; each probe that impacted on the lunar surface transferred a certain amount of terrestrial microorganisms.

59/ (Continued) Survival of Microorganisms in Space, 206 Nature 442-445 (May 1965); Halvorson and Srinivason, Can Spores Survive Space Travel? in Proc. Atmospheric Biol. Conf. - Univ. Minn. 179-183 (April 1964); and Zhukova and Kozlova, Resistance of Certain Strains of Microorganisms to Ultraviolet Rays, 35 Mikrobalogiya No. 2, at pp. 306-320 (1967). On May 23, 1970, it was reported in The Washington Post, p. A3, Col. 1, that colonies of Streptococcus mitis, a common and benign bacteria, were found to exist in parts of the unmanned Surveyor spacecraft returned by the Apollo 12 astronauts. The bacteria had not only survived after 2-1/2 years of exposure to the lunar surface, they also had proliferated. These bacteria accentuated the ultimate problems of quarantine since, although common to man in an Earth environment, they very likely may have mutated into a different strain due to intense solar and cosmic radiation in the absence of an atmosphere. In short, they may not be the same strain now that left Earth 2-1/2 years ago.

60/ NASA Policy Directive NPD 8020.8, Outbound Lunar Biological Contamination Control: Policy and Responsibility (Sept. 6, 1967).

After reviewing the results of NASA's three years of practical experience in lunar probe contamination control, the National Academy of Sciences, through its Space Science Board, presented three basic recommendations regarding spacecraft designed to impact on the lunar surface:

(1) Minimize contamination to the extent technically feasible. By appropriate selection of components (favoring those which are inherently sterile internally) and the use of surface sterilants, it should be possible to achieve a cleanliness level to approximate that which prevails in most hospital surgery rooms.

(2) Inventory all organic chemical constituents. This will permit the interpretation of analytical results from future collections of lunar material.

(3) Undertake the development of the sterile drilling system to accompany an early Apollo mission to return an uncontaminated sample of the lunar subsoil. 61/ Samples aseptically collected from this subsoil will be of both biological and geochemical interest. Should life exist on the Moon, it might be expected at some depth below the surface where temperatures never exceed 100° C and below the zone of ultraviolet radiation. Every effort should be made to keep this level free of contaminants until it can be sampled by drilling. 62/ (Emphasis added.)

61/ Apollo missions 11 and 12 included experiments designed to accomplish this facet of the recommendation. However, the minimal depth of the core samples obtained gave significance principally to the selenochemical investigations as opposed to any indirect evidence for the exobiological investigations. See NASA Press Kit - Apollo 12, at p. 39, Release No: 69-148; Nov. 5, 1969. Core Samples from the Apollo 13 mission were programmed for greater depth.

62/ See, therefore, NASA Policy Directive NPD 8020.8, pp. 1-2. Subsequent investigations of lunar samples returned to Earth from the Apollo 11 mission indicated transfer of human organic contaminants despite the elaborate precautions undertaken to ensure non-contamination of the samples.

These recommendations, then, formed the basis for ultimate NASA policy that (1) manned lunar landers will be held to the minimum practical contamination level consistent with the primary mission objectives,[63/] (2) "contamination. . .of automated landers and orbiters will be kept below a level such that, if contamination is confined to an area of 2.59 square kilometers around the. . .impact point, there will not be more than one viable organism per square meter," and (3) an inventory of contamination levels at each Apollo and automated lander site will be obtained for future quarantine and investigation reference in the event sites are revisited.

This outbound contamination policy has guided NASA through the first phases of lunar exploration. It can be seen, therefore, that procedures for outbound contamination control are an integral facet in lunar mission back contamination control of exobiology simply because of the necessity of being able to account for the origin of all life forms; specifically, those indigenous to Earth's biosphere.

3. Outbound Contamination Control for "Planetary" Missions

With a view to long-range mission planning, NASA has devised a basic policy for minimizing the probability of contaminating other

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63/ To ensure satisfaction of the contamination level, this policy was constrained by the directive that "[u]nless otherwise authorized... all manned landings will be confined to the Apollo Landing Zone." This Zone is defined as "...that portion of the Moon located between 5° south latitude, and between 45° east longitude and 45° west longitude." NASA Policy Directive NPD 8020.8, pp. 1-2.

planets with Earth organisms. 64/ Although the most apparent reason for contamination control of outbound planetary missions is to eliminate or reduce the frustration to scientific investigations aimed at determining the existence of life on alien planets, it still is important in terms of Earth-oriented contamination standards and quarantine parameters.

Toward achieving the general objective of conclusively investigating the possibility of life and life-related molecules on other planets, NASA has established a "...basic probability of one in one thousand (1×10^{-3}) that the planets of interest will be contaminated...as the guiding criterion during the period of biological exploration of Mars, Venus, Mercury, Jupiter and other planets or their satellites that are deemed important for the exploration of life, life precursors, or remnants thereof." 65/ The criterion, of course, is not arbitrary and fits well within the limits set by experts in various international fora.

64/ The 1964 and the 1969 Mariner Mars probes were not covered by this policy since they were not designed to impact upon the Martian surface or come into immediate contact with its atmosphere. However, until flight reliability is of such a consistency as to ensure nominal probability of contact between the spacecraft and Martian atmosphere, this potential source of contamination will continue to raise problems for exobiologists. In terms of quarantine regulations already promulgated by NASA, this possibility may defeat some of the definitions inherent in those regulations.

65/ NASA Policy Directive NPD 8020.10, Outbound Planetary Biological Contamination Control (Sept. 6, 1967). See, also, NASA Doc. NHB 8020.12, Planetary Quarantine Provisions for Unmanned Planetary Missions (April 1969 ed.).

4. International Criteria for Control of Outbound Contamination

In late 1957 the U.S. National Academy of Sciences recognized the potential for biological research afforded by developing space activities and recommended establishment of a "Satellite - Life Science Symposium." The symposium was held in Washington, D.C., May 14-17, 1958 under the auspices of the Academy, the American Institute of Biological Sciences and the National Science Foundation. During the Symposium, Dr. Joshua Lederberg discussed the dangers of human contamination in a manner detailing his thoughts on the subject as expressed in a memorandum read by the scientific community in January 1958.

The Bureau of the International Council of Scientific Unions (ICSU), on the basis of resolutions of the U.S. National Academy of Sciences, formed the ad hoc Committee on Contamination by Extraterrestrial Exploration (CETEX). The first meeting of this Committee took place on May 12-13, 1958 and recommended adoption of a code of conduct "aimed at achieving a compromise between an all-out program of lunar and planetary exploration on the one hand and the desire to provide absolute protection of these objects for future research on the other."

The Space Science Board (of the U.S. National Academy of Sciences) strongly endorsed the recommendations appearing in the first Report

issued by CETEX on the subject in July 1958 - the endorsement being premised upon the cooperation and support of U.S. authorities responsible for space launchings. This support and the Board's recommendations formed the foundation for the U.S. response to the ICSU through CETEX. During March 9-10, 1959, CETEX held its second meeting 66/ and formulated the parameters of the "code of conduct;" it was also determined at the meeting that the contamination problem was an integral part of the duties of COSPAR. Subsequently, based upon ICSU instructions, COSPAR assumed the responsibilities of CETEX and has provided the principal international forum for outbound contamination control standards. To the extent back contamination standards have been debated and formulated in any detail by an international group, COSPAR also has served as the principal forum.

In 1962, COSPAR organized the Consultative Group on Potentially Harmful Effects of Space Experiments. Once more, the matter of planetary quarantine arose in the 1963 COSPAR meeting at Warsaw and in the 1964 Florence meeting. In the latter event, COSPAR Resolution 26.5 evolved which recommended interim objectives of contamination probabilities less than 1×10^{-4} by a spacecraft lander and 3×10^{-5} by an unsterilized fly-by orbiter. These probability objectives were based on a model which proposed 1×10^{-3} as the most reasonable contamination probability level during the entire biological exploratory program.

66/ See Appendix A, infra, for summary records of the first and second CETEX meetings.

Ultimately, at the 1966 COSPAR meeting, the Panel on Standards of Space Probe Sterilization recommended that COSPAR undertake an annual review of the sterilization values and rationale. Consequently, the Ad Hoc Committee for Annual Review of COSPAR Sterilization Objectives, under the aegis of the Space Science Board, was established to study and recommend "standard mathematical models, techniques, and nomenclature suitable for use in connection with space probe sterilization. 67/

This, then, is the history in brief of outbound contamination standards deriving from the international science community. The extent of influence brought to bear on the U. S. National Aeronautics and Space Administration in its own sterilization standards and procedures is reflected both in the extent of U. S. participation in this area of COSPAR responsibility and the fact that NASA's own contamination probability standard is 1×10^{-3}.

The effect on back contamination standards by outbound sterilization has been outlined already. The discussion immediately following traces the minimal involvement of the international science community with back contamination and reflects the direct influence, if any, on U. S. back contamination standards and ultimate quarantine procedures.

67/ For the recommendations of this Committee formulated at the May 1967 meeting, see Appendix B, infra.

5. International Consultation in the Promulgation of U. S. Back Contamination Quarantine Procedures and Regulations

Although comparatively significant, if only unilaterally effective, work has been accomplished in the international scientific community on outbound contamination, distressingly little cooperation has occurred in this forum involving protection of Earth's biosphere from back contamination. The response of Col. John Pickering, NASA's former Director of Lunar Receiving Operations, to a reporter's question at the Apollo 11 briefing for the news media represents a fairly realistic summary of the extent of international consultation on back contamination:

> QUESTION: What sort of international consultation -- This is a contamination question. What sort of international consultation was there, or was this all done unilaterally by the United States?
> PICKERING: I can't answer as to the international consultation in that sense, but in the treaty which is signed by many nations, it was agreed by the signatories that every attempt would be made to minimize the contamination on the surface of the moon, and to protect within technical feasibility, the Earth's biosphere.
>
> There occurred in Prague about a month ago an international meeting, COSPAR. The Committee on Space Research -- The exact acronym I am not certain. They made available to the totality of that international body a series of recommendations. Those recommendations were made available to us on the 5th of June at our meeting, and the recommendations are essentially... as I have described it. [Presumably, Pickering meant the recommendations essentially were those adopted by NASA and which were incorporated into the quarantine standards and regulations for publication in the Federal Register less than a month later.]
>
> We are making those attempts to protect the Earth's biosphere and to minimize the contamination on the surface of the moon.

> I would hasten to add COSPAR's recommendations, if any of you have read them, and I have not in their totality, refer more specifically to the planets than they do the moon, but the moon is mentioned in two paragraphs. 68/ (Emphasis added.)

The most distressing fact, then, is that absolutely minimal international consultation has occurred in the area of back contamination; all the more irreconcilable in view of the fact that the initial critical geographic locations involved in protection of Earth's biosphere are found in international airspace and on the high seas. 69/

E. CONCLUSION

In the foregoing discussions it was pointed out that the acceptable level of risk in formulating both outbound and inbound contamination control standards is dependent upon (1) mission objectives, i.e., the time schedule for lunar landings, based in large part initially on the dictates of international politics as constrained only by the technology available that would permit a U.S. manned lunar landing by 1970, (2) satellite and vehicle technology, (3) domestic and international politics, (4) state-of-the-art for bio-clean technology, and (5) level of awareness

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68/ See Apollo 11 - Mission Director's Briefing for News Media, 51, Wash., D.C., June 16, 1969. Col. Pickering's slight familiarity with the substance of the COSPAR recommendations, as well as the availability of those recommendations only one month prior to the Apollo 11 launching, indicates the absence of influence of formal international consultations and recommendations on the formulation of U.S. back contamination procedures.

69/ The "splashdown" coordinates for Apollo 11 and 12 were, respectively, 10.6° N., 172.4° W. and 16° S., 165° W.

of exobiology. It also was seen that the lack of knowledge about extra-terrestrial life, or debilitating characteristics of given extraterrestrial matter, provided the basis for the concomitant obligatory presumption that such life or matter does exist; and this, in turn, was the precipitant of the back contamination standards and ultimate quarantine regulations.

The form and substance of the back contamination standards was seen to be affected substantially by outbound quarantine requirements which are well within the constraints set by the international scientific community. However, despite the concern and considerations behind such a potentially explosive issue - politically and scientifically - the fact remains that no official overtures were made to the international, or even domestic, public to participate through consultation, or other forms of meaningful interaction, in the establishment of NASA's back contamination standards and quarantine regulations.

III. CONTAMINATION CONTROL AND QUARANTINE PROCEDURES FOR APOLLO 11 - THE PROTOTYPE FOR FUTURE MANNED PLANETARY MISSIONS

The first regulations promulgated by the United States responding to back contamination standards and quarantine containment requirements [70] were those issued by NASA. Their publication and date of effectiveness was precipitated in large part - if not solely - by the imminence of the Apollo 11 mission. [71] Since the contamination control procedures formulated for the first manned lunar landing mission had a direct bearing on the scope and form of the quarantine regulations, it is extremely helpful to trace briefly those control procedures in order to understand the evaluation, set forth at a later point in the discussion, dealing with the domestic and international applicability of the regulations.

A. BACK CONTAMINATION CONTROL PROGRAM FOR APOLLO MISSIONS

In the latter part of 1958, some members of the scientific community voiced concern with the unknown effects of extraterrestrial matter on Earth's biosphere should such matter be returned by spacecraft. In 1960, the late Dr. Hugh Dryden informed the directors of NASA's field

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70/ See NASA Doc. NMI 1052.90 which sets forth policy for the Interagency Committee on Back Contamination. This document incorporates the Interagency Agreement into NASA management policy.

71/ 14 CFR §1204.509, §1211. It should be recalled that the quarantine regulations based on extraterrestrial exposure appeared in the Federal Register, Vol. 34, No. 135, pp. 11974 - 11976, on Wednesday, July 16, 1969 - the same day as the Apollo 11 launching.

centers that consideration should be given to the possible pathogenicity of lunar materials which might affect Earth's biosphere.

Between 1960 and 1964 a series of informal committees considered the problem. In 1965, the Space Science Board of the National Academy of Sciences, made a series of recommendations to NASA emphasizing the need to (1) quarantine astronauts, lunar-exposed equipment and lunar samples; (2) maintain a quarantine site with a biological barrier system; (3) designate the period of quarantine as from the "time of ascent from the moon, or that period which the astronauts could have last contact with lunar materials." 72/ Also, the Space Science Board recommended laboratory facilities at the site of prolonged quarantine in order not to lose scientific data dependant upon time-critical studies; e.g., "low-level background for short-lived radio-isotopes which would be produced by bombardment on the surface of the moon; volatility or gas analysis studies, etc...." Based on these recommendations, coupled with its own functional concerns, NASA began to formulate the Interagency Committee on Back Contamination.

For the purpose of providing assistance to NASA in formulating a program to prevent adverse contamination of Earth's biosphere by lunar matter returned from manned explorations, the Interagency Committee

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72/ Op. cit., supra note 68, at p. 28.

on Back Contamination (ICBC) was established in 1966. 73/ In the preamble to the Interagency Agreement, it is observed that

> "[i]n developing the Apollo Lunar Program, the National Aeronautics and Space Administration recognizes that it must draw upon the specialized knowledge and experience of certain other agencies [presumably restricted to Federal agencies or instruments of the Federal Government] in order to protect the public's health, agriculture, and other living resources against the possibility of contamination resulting from returning lunar astronauts or lunar exposed material...." (Emphasis and insert added.)

The principal agencies represented on the ICBC are NASA, The Department of Agriculture, the Department of Health, Education and Welfare, the Department of the Interior, and the National Academy of Sciences. The primary mission of the ICBC was, and continues to be, the provision of assistance to NASA in developing a lunar-Earth contamination preventive system. Specifically, the ICBC Interagency Agreement provides for the authority to evaluate and approve procedures to prevent back

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73/ The Interagency Agreement, establishing the Interagency Committee on Back Contamination, came into effect August 24, 1967. The Committee is charged with the protection of Earth's biosphere from lunar sources of contamination. The discrepancy in dates of establishment of the Committee (1966 in text; 1967 this fnt.) arises from the fact that the Agreement confirmed "previous arrangements made by the heads of the interested agencies...." (Item 4.a. of the Agreement.)

contamination. 74/ Towards accomplishing this objective, the ICBC approved the requirements for manned lunar missions as set forth in the cited NASA Management Issuances and detailed Manned Spacecraft Center Documents MSC 00001-00004.

From the pertinent NASA policy directives and deliberations of the ICBC evolved the Apollo Back Contamination Program which can be divided, very generally, into three phases: (1) procedures to be followed by the crew "while in flight to reduce and, if possible, eliminate the return of lunar surface contaminants in the command module;" 75/ (2) procedures involving the spacecraft recovery and isolated transport of the crew, lunar samples, and spacecraft and associated mission

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74/ According to Item 5.b. of the ICBC Agreement, "[t]he Administrator of NASA, or NASA's designated representative, shall consult with the head or designated representative of each other interested agency prior to NASA's taking of any of the following actions, unless such action is in accordance with the unanimous recommendation of the regulatory agency and National Academy of Sciences members of the Interagency Committee on Back Contamination...." The actions specified cover (1) changing of procedures regarding isolation and containment of astronauts and lunar samples; (2) changes in procedures, standards, etc., of containment testing at the LRL; (3) changing of procedures, standards, etc., for astronaut testing and lunar-exposed material; and (4) the release of astronauts and lunar-exposed materials.

75/ For a brief, but good, working description of the contamination control program see Nat'l Aeronautics and Space Admin., Press Kit for the Apollo 11 Lunar Landing Mission 181-191, Release No. 69-83K, released Sunday, July 6, 1969, by the National Aeronautics and Space Administration. See, also, NASA - Report on the Status Of the Apollo Back Contamination Program, Manned Spacecraft Center (April 28, 1969).

equipment to the site of protracted confinement (quarantine); [76] (3) procedures accompanying quarantine operations and initial lunar sample analyses at the Lunar Receiving Laboratory. [77]

1. In-Flight Procedures

a. Lunar module/command module operations

Keeping in mind the necessary flexibility of the Apollo Back Contamination Program to respond to new discoveries, conditions and unanticipated situations, one can view the following procedures used for the Apollo 11 mission as essentially basic. Briefly, back contamination procedures are commenced by the astronauts immediately prior to re-entering the lunar module after the conclusion of final surface activity. [78] The procedures consist of a careful brushing of lunar dust and dirt from space suits, including the scraping of overboots on the

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76/ Although controlled quarantine officially begins with lunar departure in the ascent stage of the Lunar Module, the site where quarantine testing begins in earnest is the LRL in Houston. Op.cit., supra note 12.

77/ Actually, as discussed above, the preconditioning to this program involves the first step of outbound contamination control, i.e., Earth-oriented micro-organism control prior to launching. At the point of initial contact between the Lunar Module's interior and the lunar surface there is minimal contamination of the latter by the former. The Lunar Module is designed and fabricated with a bacterial filter system to permit only negligible contamination of the lunar surface when the cabin atmosphere is released at the start of lunar exploration. Op. cit. supra note 75, Release No. 69-83K, at p. 181.

78/ It has been observed previously that, insofar as outbound contamination control is concerned, back contamination standards and procedures are directly influenced thereby. Of course, pre-mission sterilization of hardware and biological count play an important part. Since in all likelihood what is sent up will be returned in recoverable spacecraft, microbiological studies have been done on the astronauts in all of the manned missions of the Apollo series.

footpad of the module. Equipment, which is bagged and jettisoned onto the lunar surface to reduce likelihood of uncontrolled contamination, include the overshoes, portable life-support system, camera, lunar tool tether and the spacesuit connector cover. After the lunar module rendezvous with the command module, additional lunar surface exposed equipment is left in the former which remains in lunar orbit after transfer of the crew. 79/

Prior to transfer of the crew, the lunar module atmosphere is circulated through lithium hydroxide cannisters to filter particles in the atmosphere and reduce original airborne contamination by about 10-15%. During this time, lunar particles are partially prevented from transfer to the command module by a constant flow of 0.8 lbs/hr. of oxygen from the command module to the lunar module. All the equipment transferred to the command module is placed in storage bags except for the space suits and flight logs.

b. Command module operations

During the trans-Earth portion of the mission, and prior to re-entering the Earth's atmosphere, various housekeeping procedures in the command module are conducted by the crew to reduce "lunar surface and/or other

79/ For an excellent graphic depiction of the disposition of each item of equipment exposed to lunar matter (Apollo 11), see op. cit., supra note 75, p. 184, Table 1. Note: The Apollo 12 lunar module was returned to the lunar surface, after crew transfer, for impact in furtherance of monitored experimentation.

particulate contamination." These procedures include removal of visible liquids by the liquid dump system, use of towels to wipe surfaces clean of liquids and solid particles, etc. The atmosphere is continuously filtered through lithium hydroxide cannisters in the environmental control system which essentially removes all airborne dust particles. 80/

2. Spacecraft and Crew Recovery Operations

Following the landing of the spacecraft in open waters 81/ a swimmer in a biological isolation garment (BIG) opens the spacecraft hatch and passes three BIGs to the crew and immediately shuts the hatch. After each member of the crew dons a BIG, he leaves the command module for a liferaft containing a decontaminant solution. 82/ The spacecraft hatch

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80/ After approximately sixty-three hours of this operation, essentially none (10^{-90}) of the original contaminants will remain (op. cit., supra note 75, Release No. 69-83K, at p. 187).

81/ The Apollo missions are, of course, programmed for soft landings in international waters. The back contamination problems attendant to emergency recovery in situations involving landings in non-U. S. territory will be dealt with at a later point in context with discussion of U. S. quarantine jurisdiction.

82/ The biological isolation garment is, perhaps, the first step in controlled quarantine incarceration in Earth's biosphere. Although mobile in their BIGs, the astronauts transit from their spacecraft to the mobile quarantine facility within the parameters of a stringent regime of procedures. For a good description of the BIG isolation and contamination control design, see op. cit., supra note 75, Apollo 11 Press Kit No. 69-83K, at p. 188. See, also, NASA Press Release No. 69-148A, Apollo 12 Quarantine Procedures (October 31, 1969), wherein it is stated that the ICBC, based upon conclusions reached from the Apollo 11 mission, recommended that "if the Apollo 12 crew condition is normal at Earth landing, fresh flight suits and oral-nasal masks will be used instead of the integral Biological Isolation Garments...as on Apollo 11. BIGs will be available for use as a contingency in case of unexplained crew illness."

remains open only for a few minutes and both it and the crew are decontaminated by the swimmer using a liquid agent. From the life-raft, the crew is transferred to the recovery ship on which the Mobile Quarantine Facility (MQF) is located. The spacecraft is then retrieved for transfer to quarantine facilities in Houston, Texas.

The MQF is the second most important facet of back contamination control in the recovery phase since it is this mobile facility which transitions from the initial biological isolation garment to the permanent site of protracted quarantine and testing, i.e., the Lunar Receiving Laboratory in Houston. The MQF is designed and equipped to accommodate a total of six people for a period of up to ten days. 83/ The facility is capable of interfacing, through several systems, with various ships, aircraft and other transportation vehicles. 84/ The outer shell of the MQF is air/water tight and the principal means of assuring internal environmental quarantine is the filtration of effluent air, as well as maintenance of a negative pressure differential for microbiological containment in

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83/ For a detailed discussion of the Mobile Quarantine Facility and operational integration facets, see, NASA MSC 00025, Recovery Quarantine Equipment - Familiarization Manual, issued by Landing and Recovery Division - Flight Operations, Manned Spacecraft Center, Texas.

84/ It appears imperative that future mobile facilities should be designed with flexibility of interfacing characteristics in order to ensure compatability with transport capabilities of foreign countries in the event of landing errors, and in the event the international principle of the "safe return of the astronauts" needs to be invoked.

the event a leak occurs. Procedures for complete control over all bodily functions are established to ensure containment and laboratory measurability.

3. Quarantine at the Lunar Receiving Laboratory

In late 1966, Congress authorized construction of a Lunar Receiving Laboratory[85/] which would serve as a containment facility and also as a laboratory in which early, preliminary contamination tests would be carried out. Basically, the LRL is designed to accomplish three objectives:[86/]

(1) Quarantine and containment of the lunar mission crew, spacecraft, lunar and lunar-exposed materials,

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85/ See Public Law 89-528, 89th Cong., August 5, 1966, wherein $12,800,000 was appropriated for construction of facilities (including the LRL) at the Manned Spacecraft Center, Houston. See, also, House Conf. Rept. No. 1748, 89th Cong., 2d Sess., wherein appropriations for the LRL facility is defined on p. 9 as follows: "For the Manned Spacecraft Center, NASA requested $13,800,000 including $9,100,000 for a Lunar Receiving Laboratory. The House approved this amount for the Lunar Receiving Laboratory; the Senate reduced it by $1,000,000. The Managers on the part of the House acceded to the Senate figure, making the total authorization for the Manned Spacecraft Center $12,800,000."

86/ For detailed descriptions of the Lunar Receiving Laboratory, procedures and contingency procedures, see NASA Doc. MSC 00002, Lunar Receiving Laboratory Sample Flow Directive - Revision B, (Nov. 11, 1969); superseding Revision A - July 1, 1969) and NASA Doc. MSC 00004, Lunar Receiving Laboratory Contingency Plan - Revision B, (Nov. 5, 1969; superseding Revision A - June 26, 1969).

and to provide for the bio-physical testing for adverse effects of lunar material on terrestrial life; 87/

(2) protection and preservation of the integrity of the lunar samples; and

(3) initiation of time-critical investigations.

Quarantine procedures and confinement at the LRL represent the final stage of the back contamination program. The crew and spacecraft, as well as certain attending volunteer personnel, are confined "for a minimum of 21 days after lunar lift off and are released based upon completion of prescribed test requirements and results" (emphasis added). 88/ Lunar samples are quarantined from 50-80 days, depending

87/ Among those tests conducted in the biomedical laboratories of the LRL for the Apollo 11 mission were (1) exposure of germ-free mice to lunar material with continuous visual and pathological observation for 21 days for abnormal changes; (2) application of lunar material to 12 different culture media, maintained under several environmental conditions, with continuous observation for bacterial or fungal growth; (3) observation of human and other animal tissue cultures, as well as embryonated eggs, to determine viral presence through cellular changes; (4) exposure of thirty-three species of plants to lunar material with attendant use of histological, microbiological and biochemical techniques to determine the cause of any suspected abnormality; and (5) exposure of a number of lower animals to lunar material with subsequent tests to determine the transmissibility of a suspected abnormality from one group to another.

88/ "Twenty-one days" is the period selected since it is the most reasonable time for those Earth infections that are, or may be, of epidemic proportions to become manifest. See Nat'l Aeronautics and Space Admin., Apollo 11 - Mission Director's Briefing for News Media 42, June 16, 1969, Wash., D.C. Since there are certain Earth-indigenous organisms which become pathogenic only after satisfying the requirement of alternating hosts, or which manifest pathogenicity only after a long period from introduction to the host, the judgment basis was the

upon the results of biological testing. 89/

Although the Lunar Receiving Laboratory covers a total of 83,000 square feet of floor space, the crew reception area accounts for only a portion of that area. Other areas of non-crew personnel confinement are not specifically delineated, and are established fairly much

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88/ (Continued) period of incubation for terrestrial organisms that reach epidemic proportions. It should be noted, here, that the 21-day period of quarantine for the astronaut crew begins from the moment of lunar surface departure and not 3-4 days hence with crew entry into the MQF or the LRL. As observed by the Space Science Board of the National Academy of Sciences, "[s]ince the risk of introducing a pathogen for man is greatest at the time the astronaut leaves the lunar or planetary surface and decreases each day that he remains healthy, the quarantine for lunar missions should begin immediately upon take off from the moon. The long return time from Martian missions (minimum 150-200 days) itself constitutes an extended quarantine. However, further considerations apply in Martian missions. The fact that the astronauts were healthy at return would not assure that the Martian organisms were not pathogenic. It is possible that while immune themselves, the astronauts could act as carriers of disease. It is also possible that the organisms could be harmful to terrestrial plants and animals." See Space Science Board of the Nat'l Acad. of Sci., Conference on Potential Hazards of Back Contamination from the Planets 8-9, Nat'l Acad. Sci. - Nat'l Research Council (19 February 1965). The specific recommendation of the Conference was "[t]hat astronauts returning from lunar or planetary missions be placed in three weeks of strict quarantine upon return to earth; that in the case of lunar missions, the quarantine period should begin from the moment of take off from the moon" (p. 13). The period of incarceration for contingency confinees is flexible and dependent upon the circumstances and attendant influential factors precipitating the confinement.

89/ The actual date of initial release of lunar samples returned by Apollo 11 to Principal Investigators or their representatives was September 12, 1969, at the LRL in Houston. For the first preliminary report on NASA evaluation and testing of the lunar samples, see NASA Document entitled Lunar Sample Information Catalog - Apollo 11, Lunar Receiving Laboratory - Science and Applications Directorate; MSC, Houston, Texas (August 31, 1969).

on an ad hoc basis. 90/ In certain instances the size, design and facilities of personnel quarantine areas may have a direct bearing on the definition of incarceration as it relates to the efficacy of quarantine regulations promulgated by NASA. 91/

Finally, despite the elaborateness of back contamination standards and procedures, from before the mission to confinement in the Lunar Receiving Laboratory, there is still the strong possibility that potentially viable organisms or other pathogenic extraterrestrial matter may be introduced into the Earth's biosphere. In response to a question pursuing this line of reasoning, Col. John E. Pickering of NASA observed in the June 16, 1969 Apollo 11 Mission Director's briefing for news media that

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90/ For example, during the Apollo 11 quarantine period a "spill" occurred in which a female scientist in the LRL was determined to be "extraterrestrially exposed." She was placed immediately in quarantine, but was isolated from other personnel in quarantine only for purposes of sleep and defecation.

91/ See op. cit., supra note 86, NASA Doc. MSC 00004, for a description of the crew reception area in the LRL. Although this area represents restricted freedom, there is a certain amount of comfort and mobility available which may have a bearing on the definition of incarceration, both for project volunteers and those who are confined involuntarily. Interestingly, confinement is so complete as to include special building systems which maintain air flow into, among other areas, the crew reception area for sterilizing waste "and incinerating contaminated air from the primary containment systems."

"you have to look at it from one other point of view, too, and that is that quarantine unto itself is not infallible nor is it ever intended to be. Ideally, one would protect against (sic) immunization or vaccine if one knew what to immunize against, and when one doesn't, one goes to quarantine."

B. CONCLUSION

In the above discussions it was observed that the representative Apollo 11 back contamination control standards and quarantine procedures were fairly thorough, albeit premised upon absolute accuracy in the technological and navigational execution of the mission. In terms of back contamination control, it was seen that there was no room even for moderate contingencies, and the international facets were non-existent, minimally related Search and Rescue procedures and agreements notwithstanding. In short, the back contamination control program was significantly fallible where, in fact, it need not have been to the degree it was and continues to be at present.

IV. CONCERNED REACTION AND THE QUESTION OF RESTRAINING ORDERS AND INJUNCTIONS

From the preceding discussions it has been seen that space activities carry a threat of disrupting adversely Earth's immediate ecosystem through biosphere contamination; that both manned and unmanned spacecraft are potential sources of back contamination; that outbound contamination control has an immediate, as well as protracted, influence on present planetary quarantine criteria; that domestic and international quarantine and sterilization standards have been recognized; and that insofar as the United States is concerned, steps have been taken, reflecting the current state-of-the-art consistent with mission objectives, to ensure protection of Earth's biosphere from extraterrestrial contamination through manned lunar landings.

This is the background in which two basic, and very practical, issues of a legal complexion have arisen within the United States prior to, and after, the successful technological conclusion of the Apollo 11 and 12 missions. These issues are (1) whether the National Aeronautics and Space Administration can be enjoined or restrained from conducting manned lunar and other planetary missions, and (2) whether the quarantine regulations promulgated by NASA pursuant to the U. S. back contamination program are of questionable legal efficacy both domestically and internationally.

A. PUBLIC OPPOSITION TO THE THREAT OF CONTAMINATION

The acceptance of NASA's expertise and that of the ICBC in the protection of Earth's biosphere has not been total. As indicated previously, the news media tended to incite what may have been undue public concern with very misleading headlines and incomplete reporting - particularly as the Apollo 11 launch date drew close. Most of the intensity of public concern was dissipated in the absence of complete knowledge and effective direction; witness the lack of pre-mission public concern with back contamination during preparation for Apollo 12 and 13. Lunar sample analyses from the Apollo 11 mission had not even been completed by the successful conclusion of the Apollo 12 mission. However, a few biologists concerning themselves with the issue of extraterrestrial back contamination took the most readily available avenue of action, i.e., expression of their concerns to members of the Congress and other appropriate Government officials. 92/

92/ Copies of pertinent letters may be found in the files of NASA's Planetary Quarantine Office, Washington, D.C. In this respect, also, see The New York Times, May 18, 1969, p. 27, Col. 1, wherein the issue of examining and discussing the change in the Apollo 11 quarantine procedures on a broader and more thorough basis was emphasized in the following manner: "The probability of lethal organisms being imported from the moon is small, but it is not zero. If there are lunar bacteria, fungi, viruses or the like different from anything known on earth, then the plant and animal life here - including human beings - have not been prepared in any way by previous evolutionary history to resist the depredations of such extraterrestrial pathogens. The result could be disaster. Fortunately, there is still time for the broader discussion and more careful examination that this problem deserves but has not received" (emphasis added).

1. The Congress, the ICBC and the Dissenters

a. Confusion between scientific opinion and Constitutional procedure

Senator Clinton P. Anderson, Chairman of the Senate Aeronautical and Space Sciences Committee, has taken a rather emphatic position regarding dissenting views of members of the science community who are not associated officially with the NASA back contamination program. In this respect, he has observed that

> "[o]f course, in this area, as in virtually all scientific disciplines, it is difficult if not impossible to get 100-percent agreement from everybody... some biologists, who apparently were not completely informed regarding the details, have raised a raucous voice against the new procedure." 93/

The new procedure referred to by Senator Anderson involved a change in the method of transferring Apollo 11 astronauts from their spacecraft to the waiting aircraft carrier during recovery operations. 94/ He

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93/ 115 Cong. Rec. 8127 (daily ed. July 15, 1969), "Back Contamination Proceedings."

94/ The original plan considered was to have the Apollo 11 astronauts "remain inside the Command Module while it was hoisted onto the recovery ship." The procedure finally adopted involved "... egressing them from the spacecraft into a raft and transferring them by helicopter to the recovery ship" where they entered the MQF. See Cong. Rec., ibid., letter from Homer E. Newell, Acting Administrator of NASA at that time, to Senator Anderson. See, also, note 82, supra, wherein pertinent procedures followed for Apollo 12, and planned for Apollo 13, indicate the policy of diminishing the stringency of quarantine procedures as experience dictates. In this context, it is important to note that on 14 January 1970, the ICBC recommended to the NASA Administrator that the quarantine procedures be dropped for subsequent Apollo missions since evidence had demonstrated "a. The incompatibility of geochemical findings with the existence of conventional life forms

continued his observations on public dissent in the matter by stating that

> "...certain of the press has seen fit to print the position of the dissenters while ignoring the preponderance of qualified opinion...[i]n the last few days, allegations have been raised that certain members of the ICBC had resigned under protest and that other members were coerced into giving their approval to the new procedure." (Emphasis added.) 95/

Senator Anderson concluded his remarks by stating that the charge was sufficiently serious for him to raise the matter with members of the ICBC. Response from the members were in the way of letters detailing the recovery procedures for Apollo 11, which also were incorporated into the Congressional Record for July 15, 1969. Concerning these responses to his questions, Senator Anderson observed that

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94/ (Continued) on the moon, b. the complete absence of evidence or hint of hazard to animal or plant life in the biotests conducted on samples from Apollo 11 and 12, and c. that the samples were representative of the various types of terrain, both surface and subsurface, mare and highland." On January 21-22, 1970, a meeting was held in San Francisco by the NASA Planetary Biology Subcommittee of the Space Science Application Steering Committee. At the meeting it was reported that not one Earth microorganism was found at the lunar landing sites, where large numbers were anticipated. The preliminary conclusion was that lunar material either was inhibiting the microorganisms, or was killing them. In view of this, and in view of the unknown causes for rapid plant growth in lunar soil, it is submitted that an adverse biological effect by lunar matter should be determined to exist and the quarantine procedures should be retained until these unknowns are analyzed, evaluated, and put in correct perspective vis-a-vis the quarantine procedures and regulations.

95/ Op. cit., supra note 93.

> "[T]he conclusions to be drawn are as follows: First, the ICBC has a well-established operating procedure which allows for dissent and for the filing of minority reports. No such dissent nor minority report was filed. Second, no member of the ICBC has resigned. Third, no member of the ICBC has been coerced. Fourth, no member has changed his view since the original approval was given." 96/

Obviously, Senator Anderson's observations on the ICBC structure and operating procedures were not intended to be definitive and conclusive, but his statements do, of themselves, raise questions having consequent legal significance. For example, why were certain biologists "...not completely informed regarding the details..." of the procedural changes in the recovery operations? Was it because of a personal deficiency, or were adequate participatory and informational

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96/ In this context, Col. Pickering responded to a reporter's question, regarding unanimity of the ICBC on the use of BIGs by astronauts for transfer from the command module to the MQF, in the following manner: "The Committee was in unanimous agreement. The way in which we have operated, it would be misleading, I suppose, to say it was unanimous or non-unanimous agreement. The way our agreement is written, we don't vote. Individuals may write a minority report if they disagree." (Apollo 11-Mission Director's Briefing for News Media, p. 58, June 16, 1969 - NASA, Wash., D. C.) Obviously, in the absence of a vote, a course of action effectively is prejudged without the benefit of a member knowing the extent of his colleague's conviction on an issue. When it is clear that the ICBC will approve one particular course of action over another, it is highly questionable whether the filing of a minority report is tantamount to an opportunity for persuading the so-called "majority" members to the contrary - particularly in view of the fact that most ICBC decisions to date appear to have been premised on time-critical situations wherein minority reports could barely be submitted, let alone provide the minority authors adequate time to persuade the majority. It is difficult for this writer to understand how a report can be classified as "minority" before the "majority" position has been defined in a reasonably recognizable manner - such as a vote.

fora unavailable to the public? Is there, in fact, an ICBC mechanism providing for public comment and active participation in promulgation of back contamination standards and quarantine regulations? If so, was the mechanism effectively implemented for the Apollo 11 mission? Will it be so implemented for other appropriate manned and unmanned missions? Is such a mechanism required, assured, or permitted by public law? Does the Administrative Procedure Act apply? Could private citizens obtain a restraining order and/or injunction against the launching of Apollo 11, or similar mission involving a potentially high level of scientific risk? Can they obtain such order or injunction with respect to future manned and unmanned missions and attendant scientific risk?

2. Restraining Orders and Injunctions

> Does or should the administrative agency have the exclusive power to determine whether, when, or where the statutory policy shall be enforced? If the policy is a "public" policy, is the agency, then, its sole guardian and promoter? These questions are complicated by the fact that all areas of administration have limits. Some aspects of a transaction may be within an agency's power and some not. Each aspect may raise questions for adjudication and may involve common questions of fact. Thus, there may be a conflict of original jurisdiction between court and agency and its solution will affect the control of the administrative agency over the area committed to it. 97/

It can be seen from the Jaffe and Nathanson observation, above, that once a determination has been made to challenge the substantive

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97/ L. Jaffe and N. Nathanson, Administrative Law - Cases and Materials 637 (3d ed. 1968).

and/or procedural rule-making of a Federal agency, a very un-neat confrontation will likely arise between public and private interests. It will involve questioning the very juridical tenets of public responsibility. Equity often will be determined or frustrated by the challenging procedures used - whether immediate judicial review is selected, or preliminary injunctive relief. In the latter situation, although frequently used as a synonym of injunction, a restraining order is properly distinguishable in that it

> "...is intended only as a restraint upon the defendant until the propriety of granting an injunction, temporary or perpetual, can be determined, and it does no more than restrain the proceedings until such determination." 98/

For purposes of the present discussion, in terms of the time interval between public knowledge and the commencement of a given space mission involving the possibility of terrestrial contamination by returned extraterrestrial contaminants, the injunction/restraining order distinction is very important.

98/ Black's Law Dictionary 1247 (4th ed. 1951), under order. Accord, Wetzstein v. Boston, etc., Min. Co., 25 Mont. 135, 63 P. 1043 (S. Ct. Mont., 1901); Mason v. Milligan, 185 Ind. 319, 114 N.E. 3 (S. Ct. Ind., 1916); Labbitt v. Bunston, 80 Mont. 293, 260 P. 727, 730 (S. Ct. Mont., 1927). For a good example of distinguishing between power to grant a preliminary injunction and authority to grant a restraining order, see United States v. Ohio Railroad Co., 225 U.S. 306 (S. Ct., 1912).

a. Injunctions against government-sponsored activities

An injunctive or prohibitive writ is issued by a court of equity, not only for the prohibition of certain conduct or acts which are injurious to a plaintiff and for which there is no adequate redress by an action at law, but also for the prohibition or restraint of the continuance of such acts by a defendant and his servants or agents. 99/ An injunction pendente lite, or a preliminary injunction, is one which is granted at the initial proceedings of a suit

> "to restrain the defendant from doing or continuing some act, the right to which is in dispute, and which may either be discharged or made perpetual, according to the result of the controversy, as soon as the rights of the parties are determined." 100/

Essentially, the principal function of an injunction pendente lite is preservation of the status quo until the merits are considered judicially. 101/ The importance of a preliminary injunction within the framework of ICBC back contamination procedures lies in the fact that,

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99/ Ibid., Black's 923, under injunction. See Dupre v. Anderson, 45 La. Ann. 1134, 13 So. 743 (S. Ct. La., 1893); City of Alma v. Loehr, 42 Kan. 368, 22 P. 424 (S. Ct. Kan., 1889).

100/ Ibid., Black's 923, under injunction pendente lite. See Darlington Oil Co. v. Pee Dee Oil Co., 62 S.C. 196, 40 S.E. 169 (S. Ct. S.C., 1901). See, also, Fredericks v. Huber, 180 Pa. 572, 37 A. 90 (S. Ct. Pa., 1897).

101/ Ibid., Fredericks v. Huber.

if jurisdiction is proper, the plaintiff need not always prove he is suffering, or will suffer, irreparable damage at the hands of the defendant or his agents. Although many factors are considered in determining the appropriateness of a preliminary injunction, in the present situation it should be recalled that it is the lack of certainty on both sides of the issue (i.e., whether extraterrestrial life exists and whether it, or extraterrestrial matter generally, will adversely effect Earth's biosphere or immediate ecosystem) which gives rise to the issue, itself, within a juridical context.

i. temporary relief and the question of irreparable damages

Two major sources of authority exist for seeking temporary relief from governmental agency action: (1) The Administrative Procedure Act 102/ and (2) 28 U.S.C. 2282, wherein provision is made for the enjoining of the enforcement of a Federal statute. In the first instance, under Chapter 7 of Title 5 U.S.C., Supp. IV, section 705 provides for temporary restraint of an agency action pending judicial review, subject to whatever conditions "...may be required and to the extent necessary to prevent irreparable injury..." (emphasis added). In the second instance, subsection 2284(3) of Title 28 U.S.C., provides, in part, that "...the district judge to whom the application is made may,

102/ The Administrative Procedure Act, 60 Stat. 237 (1946), as amended by Pub. L. 89-487 (1966), and Pub. L. 89-554 (1966), 5 U.S.C. Supp. IV, §§551-559, 701-706, 3105, 3344, 5362, 7521 (Supp. IV, 1967).

at any time, grant a temporary restraining order to prevent irreparable damage" (emphasis added).

For the most part, stress is placed upon the extent and conclusiveness of the damage which would occur in the absence of a restraining order or temporary injunction, i.e., just how irreparable the damage would be. However, it must be assumed that use of the word "prevent" was consciously made, and that it applies at least before the fact, i.e., the grant of a restraining order is not designed as a post facto corrective measure. Other related factors which might be taken into consideration in determining whether to grant a temporary injunction are (1) the extent of the injury or damage, as well as the issue of how irreparable the damage (the problem in the instant situation being, of course, the absence of knowledge whether alien life forms exist, what form they might take, and the type of damage they might cause), (2) degree of inconvenience to the defendant; (3) the effect upon the public interest; 103/ and (4) even the probability of success by the plaintiff in a court review

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103/ This issue would involve the question of standing to sue, i.e., whether an action could properly be brought on behalf of a reasonably definable segment of a community or class of people. See fnts. 106-110, infra, as well as subsection IV. A.2.a.ii., infra, standing to petition for injunction, for a more detailed discussion of standing to sue and the public interest.

is taken into consideration. 104/ Within the context of whether adequate protection exists of Earth's biosphere from extraterrestrial back contamination, it is submitted that the element of unknown, regarding irreparableness of damage, is sufficiently substantial to permit the shift of emphasis to the need of preventing what could very well be irreparable damage, rather than stopping the continuation of damage which, by its nature, must occur before it can be recognized; that a temporary injunction or restraining order should look for justification to the degree of risk and the possible extent of damage if the threat comes to fruition - not to the extent of damage, based upon experience and consequent standards of judgment, which could not really be compensated for in any event. In this respect, a plaintiff seeking to delay a manned, or recoverable unmanned, mission based upon existing back contamination standards and quarantine regulations, probably would seek a restraining order since the criteria, as seen above, are prerequisites to, and not as stringent as those required for, a temporary

104/ See, therefore, Hamlin Testing Laboratories, Inc. v. AEC, 337 F. 2d 221 (6th Cir., 1964); Baines v. City of Danville, 321 F. 2d 643 (4th Cir., 1963); Associated Securities Corp. v. SEC, 283 F. 2d 773 (1960); and Erie-Lackawanna R.R. Co. v. United States, 259 F. Supp. 964, 971 (S.D. N.Y., 1966). For a discussion of the necessity of considering all of these relevant factors, see Embassy Dairy, Inc. v. Camalier, 4 Ad. L. 2d 90, 211 F. 2d 41 (U.S. App. D.C. 1954); and Consolidated Edison Company of New York, Inc., 17 Ad. L. 2d 355 (FPC, 1965).

injunction. As discussed above, a temporary injunction will be cancelled or made permanent pending judgment of the merits of the case, while a restraining order is issued pending the determination of the propriety of an injunction. The importance of a restraining order, of course, lies in the restraint of a particular flight or mission, thereby providing sufficient time to determine the propriety of a preliminary injunction with an ultimate hearing on the merits.

It may appear, at a quick glance, that the probability of a plaintiff suffering injury from back contamination is too remote to justify a restraining order or a temporary injunction. However, the possibility of severe disruption of portions of Earth's biosphere (or even its inclusive, immediate ecosystem) might well diminish the importance of immediacy, or probability of injury, and increase the importance of the possibilities of back contamination, particularly within the context of the speculative adequacy of protective back contamination standards. Flowing from this, it might well be argued that the inconvenience of a restraining order or injunction to NASA in executing its statutory responsibilities is of proportionately less influence. Further, the relative remoteness of injury to a plaintiff would not be unduly significant since a petition for an injunction pendente lite undoubtedly would be to the adequacy of protection against the remoteness of the contamination possibility and the extent of consequent

damage - not to any actual damage which the plaintiff could identify based on prior knowledge. In any event the standards, regulations and the circumstances surrounding their establishment would at least be open to public scrutiny for the first time.

Finally, it would be an erroneous assumption to state categorically that, based on the merits, the plaintiff has slight likelihood of success when confronted with the public interest in manned or unmanned missions to the moon and other celestial bodies. 105/ It may be said

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105/ For an excellent reference representing a cross-section of the controversy on the priority issue, of whether manned or unmanned space research should be pursued after Apollo 11, see the Congressional Records for July 31, 1969, setting forth results of a poll administered by Rep. John R. Dellenback to his constituents in which they were asked to rank 20 issues in terms of priority - the Vietnam war and crime ranked at the top and space exploration ranked 19th; September 19, 1969, in which the transcript of a TV news interview with Senator Mike J. Mansfield was inserted giving the Senator's view that the space program should be cut back and that "we ought to pay more attention to the difficulties, the ills and the evils on earth rather than the projections which we have towards the moon and other planets." Within the context of space exploration, Earth-bound priorities also are discussed by, among many others, Rep. James W. Symington, Rep. James H. Schever and Rep. William F. Ryan, and Rep. Richard L. Ottinger in, respectively, the 9 Sept. 1969, 21 July 1969 and 23 July 1969 issues of the Congressional Record. Finally, Rep. John C. Culver of Iowa inserted in the Congressional Record, Dec. 22 and 23, 1969 issue, the results of a questionnaire administered to his constituents in which they were asked to state their priorities for Federal budget cuts. Out of 12 items listed, the first two were Defense - 55.1%, Space - 47.3%. The indication from discussions such as these is that, although launching of Apollo 11 on schedule, and in pursuance of President Kennedy's commitment, may have been in the public interest, subsequent manned missions have not enjoyed the same refuge of urgency in terms of denying the public effective access to the quarantine rule-making processes. See,

that space activities of necessity entail risk to both the crew and Earth's biosphere, but that the risk is abolutely nominal in view of NASA's back contamination preparations based on ICBC recommendations and approval of NASA's program. However, since legitimate scientific difference of opinion is common, particularly in disciplines where measurable facts are minimal, the recognized expertise of a plaintiff microbiologist, ecologist, etc., may completely destroy the

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105/ (Continued) also, Matheson Radio Co., Inc. (WHDH), 8 FCC 430, 3A Ad. L. 48 h. 2-1 (1941), wherein the reviewability of a denial was considered and it was determined an order will not be stayed pending judicial review...where the public interest would be served by carrying out the administrative order unless irremedial injury can be shown. In the present context, this principle would reflect the necessity of proof by NASA that pertinent space missions which are challenged do, in fact, serve the public interest. Prior to recent awareness of acute problems of environmental degradation, it may well have been considered an improper line of inquiry for a court to attempt establishing public interest by balancing specific Federal legislation against results of public polls. However, in view of present inclinations of both the Congress and the courts to hold the Government accountable for its own activities which pollute the environment or deny the rights of individuals and classes of individuals to a "safe, healthful and pleasant environment," the public polls may well become a legitimate source for determining evolving public values and standards as to what is an acceptable quality of environment and what level of scientific risk may be undertaken as such risk may affect the environment. See, therefore, H.R. 15780, a bill "To amend the National Environmental Policy Act of 1969 to confer standing on private persons to sue for relief from pollution." [Proposed legislation submitted Feb. 9, 1970, in the House of Representatives by Mr. Hanna.]

reliable authoritativeness of the ICBC in judicial determination of an injunction proceeding.

ii. standing to petition for injunction against agency action

Essentially, the right of an individual to obtain a temporary injunction against a Government agency is restricted by the constraints on his right to obtain judicial review of an agency action. In these situations, judicial review is limited to

> "[a] person suffering legal wrong because of agency action, or adversely affected or aggrieved by agency action within the meaning of a relevant statute...." 106/

It appears that by using the phrase "within the meaning of a relevant statute" the term "legal wrong" requires a specifically defined invasion of a legal right before a plaintiff has proper standing to sue. 107/ However, as provided by the long-standing rule enunciated in Perkins v. Lukens Steel Co.,

> "[i]t is by now clear that neither damage nor loss of income in consequence of the action of the Government, which is not an invasion of recognized legal rights, is in itself a source of

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106/ 5 U.S.C. 702.

107/ Braude v. Wirtz, 350 F. 2d 702, 707 (9th Cir., 1965). It should be noted here that a "legal wrong" cannot be identified, specifically, except to the extent that if a certain situation exists, (pathogenicity of extraterrestrial life which finds its way into or on a recoverable spacecraft), an identifiable type of damage will occur.

legal rights in the absence of constitutional legislation recognizing it as such." 108/ (Emphasis added.)

108/ Perkins v. Lukens Steel Co., 310 U.S. 113, 125 (1940). See, also, Pauling v. McNamara, 331 F. 2d 796 (D.C. Cir., 1963), cert. den. 377 U.S. 933 (1964), and Pauling v. McElroy, 278 F. 2d 252 (D.C. Cir., 1960), cert. den. 364 U.S. 835 (1960), wherein complaints were dismissed on grounds the allegation, that possible injury to plaintiffs and others would result if they were exposed to a world-wide increase in the radiation level, did not provide standing to sue and it did not state a justifiable controversy. Additionally, the Circuit Court affirmed both decisions on grounds that the power to conduct nuclear tests was plainly authorized by law and the Constitution. Compare, Flast et al v. Cohen, Secretary of Health, Education and Welfare, et al., 392 U.S. 83, 102 (1968), wherein the "standing" and "justiciability" decisions of the Pauling cases have been unsettled by specific, but more flexible, criteria. The present writer considers the Flast v. Cohen case as a definite indication of a judicial trend toward a wider recognition of individual interests affected by Governmental action and strict accountability of regulatory agencies to Constitutional requirements (specifically, Article III). Further, it is submitted that, as exemplified by H. R. 15780 (supra, fnt. 105), that the Congress also is inclined toward easing restrictions on standing to sue. Finally, in Crowther v. Seaborg, in a decision from the United States District Court for Colorado which was published as recently as March 16, 1970, the court held that the "allegations of threat to health, welfare, and safety through addition of radioactive particles [by the Atomic Energy Commission] to the atmosphere...constitute the substantial assertion of a personal stake in the controversy, regardless of the fact that no economic detriment is urged...The APA gives a right of review to any person suffering legal wrong because of agency action. The Atomic Energy Act does not expressly supersede the APA, but rather makes it expressly applicable to AEC agency actions." In dictum, the court stated that both Flast v. Cohen and the APA confer standing for "Colorado homeowners apprehensive about the exotic activities of their neighbor [AEC]...." See 38 U.S. Law Week, No. 38, at pp. 2512-2513 (March 31, 1970).

Taken a step farther, it was determined in Norwalk CORE v. Norwalk Redevelopment Agency 109/ that the existence of a statute for the protection of the public interest in relocating displaced persons was a sufficient "legal right" to warrant standing to petition for injunction. At the same time, however, the court observed that the outcome would be entirely different if no statute or common law principle existed for plaintiff's protection. Although the National Aeronautics and Space Act does not provide specifically for such protection, judicial trends have been observed to indicate a legal 'interest', as opposed to 'right', may exist sufficient to provide an individual with standing to petition for enjoinment of certain tangentially adverse agency actions. 110/ On the other hand, insofar as the Administrative Procedure Act is concerned, the provision for ensuring public safety in the execution of

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109/ 395 F. 2d 920 (2d Cir., 1968). Compare, In the Matter of Northwest Marine Terminal Association, Docket No. GS 1-938-P (OPA 1942), wherein it was argued successfully that an association was not a proper party to represent an individual's interests, although an individual could, in certain circumstances, represent the interests of a group. For an excellent discussion of how "public interest" was argued successfully in obtaining a preliminary injunction against agency action, see Central Louisiana Electric Co., Inc. v. Rural Electrification Administration, 16 Ad. L. 2d 595 (W.D. La., 1964).

110/ See, L. Jaffe and N. Nathanson, Administrative law - cases and material 3rd ed. 1968, wherein the authors observe at p. 254 that "...normally the courts will require the relator in a prerogative writ proceeding to have a special 'interest'. But this interest may be something less precise than a 'right,' e.g., the interests of adjacent landowners in the enforcement of zoning law...."

the vast majority of Governmental agency responsibilities is found in sections 3 and 4 of that Act, wherein agencies are required to keep the public currently informed of their organization, procedures and rules, and provide for public participation in the rule-making process, respectively. In this context, the principal issue involved herein may be said to be whether the Government may cloak questionable judgment and activity, regarding a very sensitive area of public safety, in legal immunity; e.g., waiving the 30 days' notice of effect in rule-making procedures. The consequent overriding issue is whether this type of administrative procedure sets a dangerous precedent.

iii. proper parties defendant

In the event an appropriate plaintiff seeks to enjoin either a specific mission or the enforcement of the consequent quarantine regulations by the National Aeronautics and Space Administration, the proper party would be the United States in one instance, and designated officials in another. Basically, the judiciary has recognized three exceptions to immunity of agency personnel from personal liability and specific relief. In Larson v. Domestic & Foreign Commerce Corporation [111/] these exceptions are stated as follows:

> An action against an officer of the United States for specific relief does not also constitute a "suit against the United

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111/ 69 S. Ct. 1457, 337 U.S. 682 (1949).

> States" where the officer purports to act as an individual and not as an official, as where he acts beyond the statutory limitations upon his powers, or is not doing business which the Government has empowered him to do, or is doing it in a way which the Government has forbidden, and where the statute or order conferring power upon the officer in the name of the United States is claimed to be unconstitutional.

As stated by Mr. Justice Hughes, the rule is that

> "...in case of an injury threatened by his illegal action, the officer cannot claim immunity from injunction process. The principle has frequently been applied with respect to state officers seeking to enforce unconstitutional enactments. And it is equally applicable to a Federal officer acting in excess of his authority or under an authority not validly conferred." 112/

In the context of judicial reviewability necessary for a perpetual injunction, it is the application of quarantine regulations by personnel in situations where the necessary authority to act is not validly conferred, or the substance of the regulations themselves are of questionable Constitutionality, which is at issue. The first aspect is examined in following discussions in terms of the Administrative Procedure Act, and the second aspect is analyzed in terms of legislative authority and possible unconstitutionality under Subheading VII, infra. Both of these areas are included in the exceptions to actions against officers of the

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112/ Ibid., p. 1462. Compare, North Carolina v. Temple, 10 S. Ct. 509 (1890) wherein it is recognized that a suit may fail "...if the relief requested cannot be granted by merely ordering the cessation of the conduct complained of but will require affirmative action by the sovereign or the disposition of unquestionable sovereign property." See fnt. 11 in Larson, supra note 111, at p. 1462.

United States Government, [113] and it is submitted here that both of these exceptions offer possibilities for legitimate pursuit of injunctive relief from given space missions and the consequent implementation of back contamination quarantine regulations.

iv. judicial review of agency action - prerequisite to injunction

Subsection 10(c) of the Administrative Procedure Act (APA) provides, in part, that

> "[e]very agency action made reviewable by statute and every final agency action for which there is no other adequate remedy in any court shall be subject to judicial review." [114]

In this context, agency action is defined as including "the whole or part of every agency rule, order, license, sanction, relief...or failure to act." [115] The agency action must be final before judicial review may be had. At that point, according to the second sentence of subsection 10(c) of the APA,

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113/ See, therefore, Hawaii v. Gordon, 373 U.S. 57 (1963), and Dugan v. Rank, 372 U.S. 609 (1963). For recent appeal cases indicating no additional exceptions to the cloak of Federal immunity, see Simons v. Vinson, 394 F. 2d 732 (5th Cir., 1968), cert. den. 393 U.S. 968 (1968); Delaware Valley Conservation Ass'n v. Resor, 392 F. 2d 331 (3d Cir., 1968) cert. den. 393 U.S. 915 (1968); Gardner v. Harris, 391 F. 2d 885 (5th Cir., 1968).

114/ 5 U.S.C. 704. Hereinafter, for facility of reference, provisions in the APA will be referred to by sectional numbering, i.e., sections 1 through 12, as in the original Public Law 404 - 79th Congress; Chapter 324 - 2d Session.

115/ 5 U.S.C., Supp. IV, §551(13). For the legislative history of the definition of "agency action," see Administrative Procedure Act - Legislative History, Sen. Doc. No. 284, 79th Cong., 2nd sess., at pp. 197 and 225.

> "[a]ny preliminary, procedural, or intermediate agency action or ruling not directly reviewable shall be subject to review upon the review of the final agency action." 116/

It should be noted, again, that in the case of the initial quarantine regulations the effective date was July 16, 1969, with the same date showing for publication, i.e., the substantive rules were effective immediately upon publication and the 30 days' minimum notice was not available to the public. 117/ Further, the definitive NASA policy directive 118/ establishing NASA responsibility and procedures for guarding "the Earth against any harmful contamination or adverse changes in its environment resulting from" back contamination was signed by the Administrator and became effective only on July 14, 1969 - two days before the launching of Apollo 11; hardly sufficient time to seek an administrative hearing, and injunction, or simply to prepare oneself for potential consequences.

The only significant difference between the directive and the regulations which appeared in the Federal Register was the format.

116/ 5 U.S.C. 704. This is cited usually in enforcement actions or declaratory judgment proceedings; see, therefore, Declaratory Judgment Act, 28 U.S.C. 400.

117/ Subsection 4(c) of the Administrative Procedure Act [5 U.S.C. 553(d)], provides that "[t]he required publication or service of a substantive rule (other than one granting or recognizing exemption or relieving restriction or interpretative rules and statements of policy) shall be made not less than thirty days prior to the effective date thereof except as otherwise provided by the agency upon good cause found and published with the rule."

118/ NASA Doc. NPD 8020.14.

Effectively, the directive substantially was the same as the regulations and the time of publication is sufficiently suspicious to justify questioning whether (1) the directive provisions, for purposes of petitioning for a restraining order or temporary injunction, were in fact the regulations, and (2) whether the waiver of 30 days' public notice was proper.

First, subsection 4(d) of the APA [5 U.S.C. 553(e)], provides that "[e]very agency shall give an interested person the right to petition for the issuance, amendment, or repeal of a rule." This section does not apply simply to substantive rules. It applies to interpretive regulations and statements of general policy, as well as to organization and procedural rules. 119/ For this reason, petition to "amend or repeal" the policy directive was an appropriate avenue for an "interested person," and a preliminary injunction by the reviewing court 120/ would have been proper if irreparable damage could have been prevented. Although a successful petition would have vitiated the published regulations, it is extremely doubtful whether two days' notice would have provided sufficient time to initiate proceedings and conclude them successfully.

119/ For a helpful discussion of this subsection, see U.S. Dept. of Justice, Attorney General's Manual on the Administrative Procedure Act 38-39 (1947).

120/ Section 10 of the Administrative Procedure Act [5 U.S.C. 702] deals with judicial review of agency actions. See pp. 94-110 of the Attorney General's Manual, ibid, for a good discussion of the applicability of this Section to situations such as those being considered, herein.

The introductory clause of section 4 of the APA [5 U.S.C. 553(a)] exempts from the requirements of that provision "(1) military, naval, or foreign affairs functions or (2) matters relating to agency management or personnel...." The regulations, of course, do not pertain only to agency personnel and management. 121/ However, publication of the rules on the same day they are to be effective, i.e., the launching of Apollo 11, provides a successful frustration of what otherwise might be a legitimate petition. Although the Apollo 11, 12 and 13 missions are faits accomplis, it is well to keep in mind that the back contamination standards very likely will change with experience gained from successive missions with appropriate modifications of the quarantine regulations. 122/ Consequently, it is helpful to make some evaluation of NASA's justification for rule making with immediate effect in view of possible last minute amendments to the quarantine regulations as applicable to succeeding missions. 123/

121/ The Regulations apply to the public in general, as well as to NASA personnel; see, particularly, Part 1211.104(b) of Chapter V, Title 14 of the Code of Federal Regulations.

122/ Of course, the possibility remains that there will be no change in the original regulations, either because the operational and scientific environment remains essentially the same, or because the initial obstacle of public pressure has been met, both of which appear to be true for the Apollo 12 and 13 missions. See fnt. 82 supra, for a change in Apollo 12 procedures. Agency expertise versus court jurisdiction is not an issue here since, by virtue of the ICBC existence, neither NASA nor any of the other component agencies or departments is, by itself, an expert agency.

123/ Reference the standards and quarantine procedures which were changed vis-a-vis use of the Biological Isolation Garments after the Apollo 11 mission, as well as the possible cancellation of all quarantine procedures and repeal of attendant regulations.

b. Federal rule making, public participation and the 30 days' notice-of-effective-date requirement

For the most part, the Administrative Procedure Act does not provide for uniformity in rule-making procedures. There are too many "exceptions" to permit predictability which normally flows from uniform applicability of procedures. Other than the minimum requirements to provide for the "...opportunity to participate in rule making through submission of written data, views, or arguments..." [4(b)] or to provide that

> "[s]o far as the orderly conduct of business permits, any interested person may appear before an agency or its responsible officers or employees for the presentation, adjustment, or determination of any issue, request, or controversy in any proceeding...or in connection with any function" [§6(a); 5 U.S.C. 555(b)],

no uniformity exists. For that matter, even these minimum requirements have exceptions, may be dispensed with, and often are when a given agency finds for good cause that the minimum standards are "impractical, unnecessary, or contrary to the public interest" [§4(a); 5 U.S.C. 553(b)(B)].

As observed by Kenneth Culp Davis, "[i]nformal written or oral consultation with affected parties or with advisory committees is the mainstay of rule-making procedure," 124/ particularly in view of the fact that public scrutiny can be avoided by the often-used facility of

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124/ K.C. Davis, 1 Administrative Law Treatise §6.02, at p. 363 (1958).

invoking "impractical, unnecessary, or contrary to the public interest." It should be noted, however, that under no circumstances can the ICBC be considered an advisory committee capable of substituting for public procedure. The ICBC and the promulgators are one and the same. 125/ Since neither the majority 126/ nor the minority 127/ of the Attorney General's Committee on Administrative Procedure advocated establishing a minimum requirement of hearings for rule making, and only provided for the public "opportunity to participate in the rule making through the submission of written data, etc.," it would appear that both agencies and courts of appeal would be meticulous in ensuring that any exceptions to this minimum proviso are completely justified. 128/

It is provided in subsection 4(c) [5 U.S.C. 553(d)(3)] of the APA that

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125/ For an interesting account of the very effective method of public procedure by which the New York Board of Standards and Appeals uses advisory committees, see Davis, ibid., p. 366.

126/ Rept. Att'y. Gen. Comm. Admin. Proc. 195 (1941).

127/ Ibid, pp. 224-232.

128/ For general interest, see Ohio R.C. 119.03 Code Ann. §154-64 (1946), wherein "[t]he effective date of a rule may not be earlier than the tenth day after the rule has been filed in its final form with the secretary of state. The principal exception to the procedural requirements is that the governor may issue a written order declaring an emergency, but even then a rule becomes invalid after sixty days unless the agency has by then followed the prescribed procedure." See K.C. Davis, op. cit, supra note 125, at p. 372.

> "the required publication or service of any substantive rule (other than one granting or recognizing exemption or relieving restriction or interpretive rules and statements of policy) shall be made not less than thirty days prior to the effective date thereof except as otherwise provided by the agency upon good cause found and published with the rule." 129/

The purpose of the time-lag required by this section is to "afford persons affected a reasonable time to prepare for the effective date of a rule...or to take any other action which the issuance of rules may prompt." 130/ The thirty days' lead time can be dispensed with, but only as provided for in subsection 4(c). Further, according to subsection 4(a)(3) of the APA [5 U.S.C. 553(b)(B)] notice of rule making, as well as the thirty days' lead time for the effective date, may be dispensed with in

> "any situation in which the agency for good cause finds (and incorporates the finding and a brief statement of the reasons therefor in rules issued) that notice and public procedure thereon are impracticable, unnecessary, or contrary to the public interest." (Emphasis added.)

129/ Although no notice is required for internal policy directives, interested persons are permitted to petition an agency for amending or repealing them. However, an agency denial of the petition is not subject to judicial review - and hence no preliminary injunction is available (see Sen. Doc. No. 284, 79th Cong., 2nd sess., p. 230). Also, it cannot be said that, since the regulations are essentially a verbatim iteration of internal policy directives, there is no requirement for notice. It will be seen at a later point that members of the public are very much affected by the regulations.

130/ Ibid., Sen. Doc. No. 284, pp. 201, 259.

Neither notice and public procedure nor thirty days between publication and effective date were adhered to in the NASA quarantine regulations. 131/ Despite the extensive lead time in the work of the ICBC and NASA's Quarantine Office, justification for waiving the requisite of thirty days between publication and effective date, as well as notice of proposed rule making and other attendant public procedures, was stated in the regulations to be the following:

> In light of the Apollo 11 space mission and the need to guard the Earth against extraterrestrial contamination, it is hereby determined that compliance with section 553 of Title 5 of the United States Code is impracticable and contrary to the public interest; therefore, the provisions of this Part 1211 are effective upon publication in the Federal Register.

It hardly can be said that this is an adequate statement of the reasons why NASA found that notice and public procedure were impracticable and contrary to the public interest. The Apollo 11 space mission was programmed sufficiently in advance to allow more than enough time for notice and public procedure; therefore, waiving this requirement

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131/ See last paragraph, F.R. Doc. 69-8473, 34 Fed. Reg. 11975, 11976, July 16, 1969. Regulations which are procedural or which are substantively "relaxatory" (i.e., less burdensome than the amended regulation) in nature, also may be exempted from the publication of notice requirement. See, therefore, Kessler v. FCC, 326 F. 2d 673 (U.S. App. D.C. 1963); Ranger v. FCC, 294 F. 2d 240 (U.S. App. D.C. 1961); and Air Line Pilots Ass'n. Int'l v. CAB, 215 F. 2d 122 (CA 2d 1954). Further, regulations which are strictly interpretative of a statutory provision do not necessitate notice of rule making; see, therefore, American President Lines, Ltd. v. F.M.C., 316 F. 2d 419 (U.S. App. D.C. 1963).

could not really be premised upon impracticability. Since several years have elapsed between the commencement of manned and recoverable unmanned space missions, both of which were recognized at an early date to require the need for guarding Earth against extraterrestrial contamination, the impelling need to establish appropriate quarantine regulations was not quite so great as to state that 30 days could not be spared between publication and the effective date, let alone provide notice of rule making with public participation. 132/ In short, Senator Anderson

132/ The type of time-critical situation envisioned by the drafters of Section 4 of the APA can be seen in Allegheny Airlines, Inc. v. Village of Cedarhurst, 132 F. Supp. 871 (E.D. N.Y. 1955), wherein the court determined that "notice of proposed adoption of a new aircraft flight pattern was properly dispensed with where the agency found that the amendment should be adopted without delay in the interests of safety and that compliance with Section 4...would be impracticable." See, also, Reallocation of Certain Frequency Bands, 8 Ad. L. 2d 385, 17 RR 1587 (FCC 1958), wherein it was determined that the "Federal Communications Commission was justified in acting without prior notice of...rule making and in making changes in rules effective without delay, where the changes involved a reallocation of frequencies from private to governmental use... and had been requested by another government agency in the interests of national defense, the government had a vital need for the frequencies, and the considerations in support of the request involved highly classified data which could not be made public." Finally, see St. Louis, Mo. - East St. Louis, Ill., Commercial Zone, 8 Ad. L. 2d 520, 76 MCC 418 (ICC 1958), wherein it was determined that the "definition of a commercial zone may be amended without prior notice and hearing proceedings where an extraordinary situation exists, in that a large number of motor carriers seek authority to serve the site of a new manufacturing plant, which appears clearly to be within the commercial community involved..." (emphasis added). An excellent example of a situation in which a court will not substitute its judgment for that of an administrative agency's expertise, but still recognizes as valid the motivation of agency judgment, is Air Line Pilots Ass'n, Int'l v. Quesada, 182 F. Supp. 595 (S.D. N.Y. 1960), wherein the court observed,

notwithstanding, NASA and other members of ICBC either could not agree on the adequacy of the back contamination standards and quarantine regulations, or the question of adequate legislative authority was not resolved. An appropriate launch "window", or astrophysical sequence, could not be relied on as a reason for avoiding public participation since, at a maximum, a "window" for Apollo 12 was available only 4 months later in November 1969. Under any circumstances, the suggestion is a serious abuse, whether intentional or inadvertent, of the Administrative Procedure Act - certainly a contravention of the spirit of the Act - with a likelihood of its continuation as quarantine requirements change or continue unchallenged. Since Apollo 11 justification (i.e., a successful manned lunar mission by 1970) no longer exists and the regulations are presumed to be valid and applicable for all recoverable missions, it is timely to move towards invoking judicial review of the regulations; particularly so, if there is an attempt to invoke the quarantine requirements in a manner which is anything less than completely public - internationally as well as domestically.

c. Agency Discretion and Judicial Review

Action or responsibility committed by statute to agency discretion is not subject to judicial review. 133/ Since most conduct, whether

132/ (Continued) regarding a mandatory retirement age of 60 set by the Civil Aeronautics Administration for airline pilots, that a staying action would not be considered when "[t]he public interest in air safety outweighs any monetary interests of the pilots."

133/ 5 U.S.C. 701(a)(2).

permissive or premised upon mandatory direction, involves varying degrees of discretion in the decision-making phases, the issue of whether discretion exists within the parameters of specific authorizing legislation may not be precisely clear. In Ferry v. Udall 134/ it was observed as dictum that although all agency action involves a specified degree of discretionary judgment it does not mean that all agency action is judicially unreviewable. In interpreting 5 U.S.C. 701(a)(2), the court reasoned that a necessary implication of the provision is that there can be no judicial review of discretionary decisions made in accordance with a permissive statute. 135/ Further, there can be a judicial review of agency action deriving authority from a mandatory statute, despite the possibility of some discretion being involved. 136/

In terms of authorization for NASA to execute its functions, the Space Act of 1958, as amended, 137/ sets forth relatively broad objectives, although mandatory, with equally as broad, but permissive, provisions for their implementation. Among the permissive provisions is Section 203(b)(1), which provides that "[i]n the performance of its functions the Administration is authorized -

134/ 336 F. 2d 706, 711 (9th Cir., 1964), cert. den. 381 U.S. 904 (1965).
135/ For an excellent discussion and citation of cases dealing with judicial review of action statutorily committed to agency discretion, see K.C. Davis, 4 Administrative Law Treatise, §28.16, pp. 80-87 (1958).
136/ Op. cit., supra note 134. See, therefore, Knight Newspapers, Inc. v. United States, 395 F. 2d 353 (6th Cir., 1968).
137/ P. L. 85-568, 72 Stat. 426.

> ...to make, promulgate, issue, rescind, and amend rules and regulations governing the manner of its operations and the exercise of the powers vested in it by law."

Of course, in this context the authority to regulate for prevention of back contamination appears permissive, as is true with all agencies directed to accomplish defined objectives with varying degrees of statutorily-defined methodology. Permissiveness to regulate, however, does not mean either permissiveness in carrying out the mandatory broad objectives, nor does it mean immunity from the dictates of the Administrative Procedure Act. Therefore, although a given regulation may not be judicially reviewable, the manner in which it was promulgated (if substantive in nature and damage will occur), is reviewable. Further, in the case of actual quarantine regulations, a successful petition for preliminary injunction very likely would be premised upon doubt as to the safety adequacy of the standards and procedures from which the regulations flow, rather than upon the need to stop a space mission based upon inconclusive evidence regarding extraterrestrial pathogens. In this situation, statutory permissiveness would not be an issue.

Finally, the fact that the quarantine regulations are applicable, in part, to activities conducted in international airspace and the high seas (with the possibility of involvement of foreign territories), indicates that NASA quarantine regulations respond to international commitments

in addition to whatever domestic authority exists. 138/ We have, therefore, the applicability of the Administrative Procedure Act, the mandatory objectives authorized in the Space Act of 1958, and the possibility of treaty authority as grounds for a legitimate argument for removal of the quarantine regulations from the judicial restraints of "agency discretion." Hence, it is submitted, the regulations may be judicially reviewable.

d. Agency Action, Injunctive Relief and the Question of Constitutionality

Injunctions obviating the enforcement of Federal legislation are authorized specifically by 28 U.S.C. 2282, which provides that the only grounds for "...restraining the enforcement, operation or execution of any Act of Congress..." is when the legislation is repugnant "...to the Constitution of the United States." 139/ A successful challenge to

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138/ The relationship of Article IX of the Outer Space Treaty to the quarantine regulations will be discussed at length at a later point in connection with the issue of jurisdictional scope and adequacy of authority for the regulations.

139/ Darlington, Inc. v. F.H.A., 134 F. Supp. 337 (D.S.C., 1955), rev. other gds., 352 U.S. 977 (1956). See, also, for a precise definition of "repugnance to the Constitution," Flast v. Cohen, 392 U.S. 83 (1968). This case involved an attempt to enjoin the use of Federal appropriations for the support of parochial schools. In distinguishing prior cases, wherein taxpayers interests were too remote to justify standing to sue, the Supreme Court held that Federal expenditures could not be enjoined unless it could be shown successfully that the legislative enactment for the expenditure "exceeds specific Constitutional limitations on the taxing power and spending power and not merely is generally beyond the powers delegated to Congress." (Flast, pp. 102-103.) See, also, 28 U.S.C. 2284, wherein the three judge district court and applicable procedures are prescribed.

enacted legislation must, among other factors, be based on the violations of[a] particular Constitutional guarantee[s].

There are no restrictions which would prohibit or deny Congress the authority to appropriate funds for expenditures on space activities. There is nothing in the Space Act of 1958, itself, which would violate Constitutional guarantees. The Constitution does not specifically prohibit such activities as space research and exploration and, it may be said, any threat to an individual or group which might derive from those activities for which NASA is responsible is too remote to present a possibility of deprivation of life or property without due process of law.

However, although the possibility of extraterrestrial pathogens being introduced into Earth's biosphere may be remote in terms of probable existence on the Moon, and in view of procedures adopted by NASA to ensure control of back contamination, the fact remains that no probability or possibility figure can be established for the extent of damage which could reasonably occur from uncontrolled, or inadequately controlled, contamination. Quarantine procedures may be acceptable for pathogenic characteristics with which we are familiar, but the threat lies in large part with those alien characteristics with which we are not familiar, or are unable to recognize as pathogenic. It is the threat which would appear to increase standing to seek appropriate injunctive relief. It is the risk of extent of potential damage

which is at issue, not remoteness of back contamination from extra-terrestrial microorganisms. It is this risk that the present writer submits is sufficiently at doubt as to at least raise the question of deprivation of life or property without due process of law. Under these circumstances, it is extremely important in a sui generis situation, such as the Apollo 11 mission, that the Administrative Procedure Act (due process) be followed closely in promulgating the regulations that implement the principal legislation. Regarding the existing back contamination quarantine regulations, it is doubtful that the substance of those regulations, which may deprive persons of liberty and property, as well as the defective promulgation procedure (the APA serves as a partial assurance of due process), satisfies Constitutional "due process."

B. CONCLUSION

The preceding discussions have involved two legal issues basic to the back contamination standards, the quarantine procedures and regulations, and the manner in which both were promulgated and implemented. The issues are (1) whether a Government agency can be enjoined, not from executing statutory responsibilities (albeit permissive and indirect), but rather from executing the responsibilities in a particular manner, and (2) whether NASA's quarantine regulations are internationally, as well as domestically, applicable in scope. (The latter issue is discussed in more detail under subheading V., infra.)

Precedence indicates minimal chances for success in the issuance of a permanent injunction against implementation of the contamination control standards adopted, and regulations promulgated. However, the foregoing discussions suggest a likelihood of success for a restraining order against such implementation of agency policy directives dealing with back contamination standards, and the enforceability of the quarantine regulations to which the policy directives have given rise. Both the absence of rigid requirements for a restraining order (as opposed to an injunction pendente lite) and the heavy reliance on scientific speculation, on each side of the issue makes a restraining order a reasonable candidate for success. 140/

Once a restraining order is in hand, a successful preliminary injunction, at least, appears possible, even though it would be more difficult to obtain in view of two essential points required for issuance: (1) likelihood that irreparable injury or damage will be incurred, and (2) the case must be judicially reviewable on the merits. In both instances, it is submitted that the element of speculation is too greatly relied upon in fact to determine out-of-hand that the anticipated damages are, or are not, irreparable, and that the case is properly eligible for

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140/ The fact that the Federal Government may, as in the case of Apollo 11, voluntarily delay publication of quarantine regulations until the mission itself has commenced, or that any delay would involve a disproportionate waste of committed public funds should not militate against a legitimate petition for injunction. It should be recalled that a mission involving the threat of extraterrestrial

judicial review. Concisely, a sui generis situation exists without guiding legislative or judicial authority. Consequently, those sources of indirect, but pertinent, guidance should be examined carefully; and this in turn invokes a liberal interpretation of the spirit and intent of the Administrative Procedure Act as it applies to the promulgation of the quarantine regulations, as well as a closely-guarded interpretation of the Federal Constitution as it applies to both the promulgation and the substance of the regulations. 141/ In subsequent discussions, it will be seen that treaty obligations regarding preservation of Earth's biosphere may confirm justification for injunctive measures.

Finally, the preceding observations suggest a good likelihood exists that promulgation of back contamination standards and quarantine regulations will occur in the future in public view with close adherence

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140/ (Continued) contamination of Earth's biosphere can be aborted for a period of several days after it has been commenced. Also, if the delay in publishing the regulations was legitimate in terms of Apollo 11, the chances that any delays will be legitimate in subsequent regulations until mission launching are very slim. Lead time for appropriate administrative procedures is now too great to rely on impracticability of notice of rule making and public procedure thereon - unless the change is precipitated by new evidence just made available.

141/ In terms of Constitutionality, it will be shown at a later point in the discussion that if, in fact, there is no legislative authority for quarantine incarceration involving extraterrestrial exposure, the question of enforcement of the regulations without "due process" becomes a serious candidate for litigation by anyone involuntarily exposed to extraterrestrial matter and who objects to quarantine confinement.

to the less restrictive provisions of the Administrative Procedure Act. In short, agency expertise in scientific research and experimentation will be confirmed by public scrutiny. It also is imperative, given the unique nature of the situation, that specific new legislation be considered authorizing the quarantine of extraterrestrial pathogenic microorganisms, and Earth-alien inorganic elements and complexes, as well as extraterrestrially-exposed personnel and equipment.

V. U.S. QUARANTINE REGULATIONS AND THE QUESTION OF INTERNATIONAL EFFICACY

As noted previously, the quarantine regulations on extra-terrestrial exposure, and the U.S. jurisdiction and enforcement authority under such circumstances, are justified, in part (if not solely), upon Article IX of the Outer Space Treaty. 142/ Since Article IX will be questioned rather seriously at a later point as the only possibly legitimate source of authority, both for U.S. domestic as well as international jurisdiction, and since even this possibility will

142/ 19 UST 2410, 2416, TIAS 6347 [Jan. 27, 1967] Article IX of the Outer Space Treaty provides, in pertinent part, as follows: "In the exploration and use of outer space... States Parties to the Treaty shall be guided by the principle of co-operation and mutual assistance and shall conduct all their activities in outer space...with due regard to the corresponding interests of all other States Parties to the Treaty. States... shall pursue studies of outer space...and conduct exploration...so as to avoid... harmful contamination and also adverse changes in the environment of the Earth resulting from the introduction of extra-terrestrial matter and, where necessary, shall adopt appropriate measures for this purpose" (emphasis added). One of the most important requisites of this provision is that cooperation and mutual assistance shall be the guiding principle. Concisely, Parties to the Treaty are bound to prevent harmful effects to Earth's biosphere through back contamination. Cooperation and mutual assistance presupposes, at a minimum, multilateral consultations regarding standards and procedures to be followed. Subsequent wording, requiring "States" to "adopt appropriate measures for this purpose," is sufficiently inclusive to be directed at several or all States Parties to the Treaty; or, in the absence of conclusions based on multilateral consultations, each launching or responsible State must take appropriate measures unilaterally.

be challenged, the ensuing discussion examines whether, in the absence of a specific agreement, the U.S. quarantine regulations may be recognized under international law as efficacious when applied to alien citizens on the high seas, in international airspace, or in foreign territory.

A. THE ANALOGY OF NUCLEAR TESTING

Nations have employed the high seas and superjacent airspace for a rapidly increasing variety of reasons, particularly in the past 10-15 years. Many of the uses are conflicting and attempts to resolve them are manifest in conventions and treaties. 143/ The physical continuum starting beneath the seas, to the surface of the seas, and then into international airspace has been the situs of rapidly accelerating military use for testing subsonic and supersonic aircraft, missiles and for such other use as nuclear weapons testing which, although

> "controverted and vigorously debated, has not created consequential international tension. There would appear, in short, a very wide-spread consensus, clearly in accord with the common interest, that access to the oceans is permissible for any peaceful purpose." 144/

143/ For a discussion of contemporary conflicting uses of the high seas and international airspace, see Robinson, Military Requirements for International Airspace: Evolving Claims to Exclusive Use and De Facto Control, J. Nat. Resources (July 1970). See also by Robinson The Regulatory Prohibition of International Supersonic Flights, 18 Brit. Int'l & Comp. Law Q., Part 4, pp. 833-846 (Oct. 1969), wherein the economic and legal problems attendant to conflicting uses of international airspace are discussed, in part, as they relate to innovative aviation technology.

144/ McDougal, M., and W. Burke, The Public Order of the Oceans 763 (1962).

Although ignorance and general apathy have precipitated little serious controversy to date over any particular type of non-belligerent use of the high seas, the situation is only recently changing with new evidence that certain human activities are causing serious disruptions of oceanic marine life, 145/ i.e., "disruption of the Earth's biosphere" by peaceful experimental activities initially thought to offer no harm to human ecology, or to provide an imbalance well within acceptable limits. 146/ For this reason, it is helpful to review some of the

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145/ An example of ecological disruption with severe consequences involves the explosive proliferation of the matured "crown of thorns" starfish (Acanthaster planci) which are destroying living coral reefs in the Pacific area at a startling rate. Theories accounting for the phenomenon are many and varied, ranging from "optimum nutritional" conditions for the starfish to drastic diminution in the population of the giant triton (Charonia tritonis), a known predator, caused by atomic weapons testing. For a good preliminary report on this situation, see Department of the Interior, News Release - Report on "Crown of Thorns" Starfish Indicates Danger to Pacific Ecology, Dec. 9, 1969. See, also, in files of the Department of the Interior, a report entitled Summary of "Crown of Thorns" Workshop Discussions, Oct. 9-10, 1969, Univ. of Cal., San Diego - Scripps Institution of Oceanography.

146/ The problems within the present context are very similar; e.g., it has been determined that if back contamination of Earth's biosphere occurs with the introduction of alien pathogenic microorganisms, the infection can be kept endemic by measures of isolating the source of infection. There are those, however, who feel that infections will run their courses regardless of immunization procedures and the only effective protection is to provide a barrier around the uninfected. Since this is the procedure presently adhered to by public health officials, insofar as known Earth indigenous pathogens are concerned, it appears that the back contamination procedures devised by NASA and approved by

principle arguments surrounding international legal efficacy of nuclear weapons testing on the high seas, 147/ as well as cases and opinions involving the issue of sovereign jurisdiction exercised without territorial limits, or in geographic locations not within sovereign limits. The principal issue raised by the following discussion involves the question of acceptable parameters of risk for scientific research and testing.

1. The Legal Arguments Surrounding Nuclear Testing on the High Seas

From the earliest naval armadas and commercial shipping fleets to the "quarantine" of Cuba in 1962 by the United States, 148/ freedom

146/ (Continued) the ICBC are within acceptable limits in terms of disruption of Earth's biosphere. However, in the absence of standards permitting of immediate and positive identification of the potential pathogens, and in the absence of immunization procedures and drugs known to be effective against a particular extraterrestrial pathogen, it is readily understandable that such back contamination (and the measures taken to prevent it) of Earth's biosphere would be totally unacceptable.

147/ It should be noted, here, that the problem of back contamination cannot be compared validly with the classic problems of international air and water pollution. In the former instance, the principal concern is with preventive methodology involving possible unknowns. In the latter instance, cases have been concerned principally with liability for recognizable damage. For a discussion of exemplary international cases involving water pollution, see M. Whiteman, 3 Digest of International Law §23, pp. 1040-1050 (1964).

148/ For a general discussion of military impositions on the use of international airspace, including the United States "quarantine" of Cuba in 1962, see F. Fidele, Peacetime Reconaissance from Airspace and Outer Space: A Study of Defensive Rights in Contemporary International Law, thesis submitted for LL.M. degree, McGill University, Montreal (1965).

of the high seas as a practical principle of law has withstood innumerable cases involving application of the principle, juridically considered in both domestic and international fora. 149/ The most authoritative, contemporary manifestation of the principle can be seen in Article 2 of the Geneva Convention on the High Seas of 1958, which provides that:

> The high seas being open to all nations, no State may validly purport to subject any part of them to its sovereignty. Freedom of the high seas is exercised under the conditions laid down by these articles and by the other rules of international law. It comprises, inter alia, both for coastal and non-coastal states:
>
> (1) Freedom of navigation;
> (2) Freedom of fishing;
> (3) Freedom to lay submarine cables and pipelines;
> (4) Freedom to fly over the high seas. 150/

149/ For a good discussion of cases pertaining to exercise of jurisdiction over the high seas, and uses thereof, by States, see M. Whiteman, 4 Digest of International Law 501-528 (1965).

150/ Part II, Article 26 of the 1956 Report of the International Law Commission on the Law of the Sea, sets forth, in part, the following definition of the high seas:
"1. The term 'high seas' means all parts of the sea that are not included in the territorial sea...or in the internal waters of a State.
"2. Waters within the baseline of the territorial sea are considered 'internal waters'."
Rept. Int'l Law Comm'n, 8th sess., 23 April - 4 July 1956; U.N. Gen. Ass. Off. Rec. 11th Sess., Supp. No. 9 (A/3159), at pp. 23-24, 2 Y.B. Int'l L. Comm'n 253, 277-278 (1956). See, also, Article 1 of the Convention on the High Seas concluded at Geneva in 1958, which states "[t]he term 'high seas' means all parts of the sea that are not included in the territorial sea or in the internal waters of a State;" II U.N. Conf. on the Law of the Sea, Plen. Mtgs. 135-136, U.N. Doc. A/CONF. 13/L. 53 (1958). See, also, Grotius, De Juri Belli ac Pacis 190-191 (1646 ed., Kelsey trans. 1925); Vattel, Law of Nations 106-110 (1758 ed., Fenwick trans. 1916).

An integral part of this Article is that present freedom of the high seas and international airspace, as defined, is a qualified right. For all practical purposes, once a right is qualified by recognized conditions, it becomes a privilege with reasonable restraints when exercised within the framework of those conditions. Insofar as the 1958 Convention relates to activities of a State on, beneath and above the surface, the right, or privilege, to conduct the activities is subject to observance of certain conditions designed to protect the corresponding rights, or privileges, of other States. In this respect, the important words of Article 2, as quoted above, are "...no State may validly purport to subject any part of...(the high seas and superjacent airspace) to its sovereignty." It also should be understood that the term "inter alia", as used in Article 2, was the mode selected to emphasize the fact that framers of the Convention did not consider the four freedoms itemized as excluding other freedoms. 151/

a. Reasonable Use - Distinction Between Unacceptable Interference and Unacceptable Use

The International Law Commission observed for the record that insofar as Article 2 of the Convention was concerned,

> "[t]he list of freedoms of the high seas...is not restrictive; the Commission has merely specified four of the main freedoms. It is aware that there are other freedoms, such as the freedom ...to engage in scientific research therein. 152/

151/ I Y.B. Int'l L. Comm'n 222, para. 30 (1955).
152/ Int'l L. Comm'n Rept. 3 (1955).

Officially, it was pointed out in 1956 by the Rapporteur that the International Law Commission had taken no formal position on the permissible uses of the high seas and had

> "expressed no opinion on the question whether the freedom of the seas includes the freedom of each State to engage in any form of scientific research it desires, even if, as a consequence thereof, larger sea areas used by others for purposes of navigation or fishing become closed to shipping." 153/

In this context, the Rapporteur recommended a statement of principle that would make scientific research and testing subject to reasonableness in preventing other States from enjoying their corresponding freedoms. 154/ Ultimately, the principle was incorporated in the commentary on draft Article 27, which provided that "States are bound to refrain from any acts which might adversely affect the use of the high seas by nationals of other States." 155/

The "statement of principle" ultimately incorporated did not, of course, resolve the issue of whether certain activities, such as atomic weapons testing on the high seas was by its nature inherently impermissible to civilized nations. A great deal of debate, much of it undoubtedly in the form of highly-charged emotions, was attendant to the evolution of Article 2 of the Convention regarding the type of use as opposed to the extent of interference. The simple fact of the matter, however, was

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153/ 2 Y.B. Int'l L. Comm'n 9-10, para. 50 (1956).
154/ Ibid, p. 10, para. 52.
155/ Int'l L. Comm'n Rept. 24 (1956).

that the International Law Commission and 1958 Geneva Conference avoided the issue of whether freedom of the seas included "harmful acts" such as the hydrogen bomb tests conducted by the United States. Apparently, the rationale was that criteria for determining harmful acts or uses of the high seas was too subjective for a meaningful provision. Further, the effects of the hydrogen bomb test involving the Marshall Islands had not indicated an unacceptable level of interference (subjective in itself); and at that time the affects appeared transitory in nature - as was the blocking off of certain areas of the Pacific Ocean for the duration of the test. In other words, the question of "permissibility of use" was decided essentially on the basis of the hydrogen bomb test and at a time when the long-range bio-ecological consequences were unknown. 156/ Even the principal academic advocates of the

156/ Even at the time of the first nuclear bomb tests conducted by the United States in 1954 the "enormous destructive power of the new weapon" had immediate adverse consequences. "Through a series of miscalculations, a number of Marshallese, Japanese, and Americans were injured by the [first] test...and the test series as a whole in some measure disrupted the activities of a segment of the Japanese fishing industry." McDougal and Schlei, Hydrogen Bomb Tests in Perspective: Lawful Measures for Security, 64 Yale L.J. 649 (1955). See fnt. 7 of McDougal and Schlei wherein the New York Times, Jan. 5, 1955, p. 6, col. 1, is cited as reporting a "$2,000,000 payment to Japan, 'without reference to the question of legal liability' was agreed upon January 4, 1955." In this respect, see Standing Committee on Petitions, U.N. Trusteeship Council, 87th Report 5 (Doc. No. T/L. 510 (1954). McDougal and Schlei notwithstanding, this type of conduct hardly could be considered a responsible answer to existing or potential contamination of Earth's biosphere by alien

permissibility to test atomic weapons on the high seas, i.e., McDougal and Schlei, restrict their advocacy to reasonableness in terms of geography, duration and immediate inconvenience to other users, viz.,

> "[f]air assessment of the relevant factors would indicate to the impartial observer that the exclusive use attendant upon weapons testing fully comports with the reasonableness criterion. For the United States, all such tests have been carried out in parts of the sea far removed from populations of any appreciable magnitude. The test areas selected have offered minimal interference with navigation and flight." 157/

156/ (Continued) matter - for which there is no drug to cure, nor adequacy of restitution by unlimited funds. See Laurents, Experiment in Annihilation, 5 Contemp. Issues 214 (1954). The newness of the problem of contamination characteristics from unknown organic and inorganic complexes makes an analysis and evaluation "of these problems on the basis of relevant rules of international law a difficult task. There are no general principles on all fours with the issue, nor are there treaty provisions setting forth such clear 'Thou shalt not's' as to leave no room for doubt with regard to conducting ... experiments" involving potential extraterrestrial contamination of Earth's biosphere. Margolis, The Hydrogen Bomb Experiments and International Law," 64 Yale L.J. 629, 640 (1955), wherein reference is to thermonuclear experimentation.

157/ McDougal and Lasswell, The Public Order of the Oceans 772 (1962). See, also, McDougal and Schlei for justification and use of the high seas for weapons testing based on self-defense and lack of significant public pressure to stop. This situation has been overtaken to a degree, of course, by the self-imposed series of moritoria on atomic weapons testing on the high seas by the United States, i.e., a new awareness of atmospheric pollution, etc., has brought a certain amount of public pressure to bear effectively. Where McDougal and Schlei would premise the acceptability, of atomic testing on the high seas, squarely upon existing law or law derived from public pressure, the present writer would premise acceptability upon scientific conclusions erring on the side of excessive caution to protect a required level of balance between ecological components and premise a juridical framework upon such conclusions. The same would hold true for space activities offering the threat of back contamination. In the instance of atomic weapons testing, it has been found that customary law arising from evolution and usage will not suffice; further, international consultations and appropriate codification is essential in the case of back contamination where no experience is available to determine a level of acceptable risk.

We see the argument for unrestricted use of the high seas for scientific research and testing, subject to the sole criterion of the "reasonableness of interference," carried farther by McDougal and Schlei. 158/ Absence of specific standards relating to reasonable interference to corresponding rights 159/ of other nations implies a necessary vagueness since each situation must be adjudged on an ad hoc basis. This does not mean, however, that judgment of the use must also be post facto. Because of the increasing uses to which international seas and airspace are being put, there appears to be a requirement for international consultations and evaluation of national uses within a general set of parameters prior to the actual use of such areas which might cause, from a protracted view, harmful effects of an unacceptable nature. The very same principle holds true for those situations in which no precedent and little firm knowledge is available for scientific research, the consequence of which may disrupt or taint those physical properties which are considered res communis to all nations. One may suspect that mandatory international consultations, leading to minimum back contamination standards and procedures to be implemented in the event of the

158/ Op. cit., supra note 156, McDougal and Schlei, at p. 648. For a totally inadequate, and perhaps impertinent assertion that the hydrogen bomb tests violated the law of the sea, see Margolis, op. cit., supra note 156, wherein most of his arguments are based upon "ethical" use.

159/ This point can be stretched quite easily to include a balanced ecology and absence of threat to the biosphere.

return of alien pathogens and other matter of harmful effect, was considered by COSPAR and possibly in other international fora, but the official records offer a dearth of information and reference. 160/

b. Customary law and the evaluation of events - no longer totally responsive to the preservation of minimum international rights

An excellent historical summary of international customary law and its very functional applicability to areas not subject to sovereign jurisdiction, is provided by McDougal and Schlei:

> "Throughout the centuries of its development, one may observe the regime of the high seas as, not a static body of absolute rules, but rather a living, growing customary law, grounded in the claims, practices, and sanctioning expectations of nation-states, and changing as the demands and expectations of decision-makers are changed by the exigencies of new social and economic interests, by the imperatives of an ever developing technology and by other continually evolving conditions in the world arena." 161/

This is the classic understanding of the law of the seas - a flexible policy of interests in accommodating and rejecting unilateral conduct and

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160/ See Preliminary Report of the COSPAR Twelfth Plenary Meeting and Tenth International Space Science Symposium May 11-24, 1969, Prague, Czechoslovakia, p. 103, wherein one of the points emphasized by the Consultative Group on Potentially Harmful Effects of Space Experiments was that the "...Group strongly supported the proposal of the Panel for a symposium jointly sponsored by COSPAR and WHO on 'Back Contamination' to be held during the 13th Plenary Meeting of COSPAR." This point did not appear in the final report. It reasonably may be anticipated that this type of COSPAR/WHO meeting will not take place as long as the Strategic Arms Limitations Talks (SALT), which involve the issue of atomic weapons testing, are progressing, and as long as such a meeting might derogate the political timing and success of any manned lunar mission.

161/ Op. cit., supra note 158, at pp. 655-656 (footnotes omitted).

claims by the community of nations. However, as the consequences of technological innovations have intensified proportionately to touch the interests of an ever-increasing number of the world's population, a post-facto reaction to unacceptable unilateral conduct becomes progressively less effective and satisfactory to the total community of nations. Even international consultations, from which minimum standards are developed to guide certain types of conduct affecting interests and rights of other States, is not a prophylactic guarantee against adverse consequences. However, it does serve to minimize the risk as well as the number of frivolous, unsubstantiated and self-serving claims.

In such geo-political circumstances of scientific experimentation, world leaders can no longer afford to react to unacceptable consequences, precisely because such consequences - or objectives - of the experimentation are a priori unknown and may be unacceptably detrimental. It is an infringement upon the rights of other nations [162/] and involves too

162/ Until fairly recently, the geo-physical regimes of the Earth were not really treated, or thought of, as constituting an interdependent continuum. Certainly, there is very slight juridical recognition of this fact. Concisely, one should always be aware of the unexpected consequences of certain conduct, whether internationally or territorially situated, upon seemingly remote interests of other nations; e.g., from the immediate effects of pollution to the long-range consequences of disrupting inter-biotic relationships in an ecosystem whereby, for example, extinction of a required food staple ultimately occurs. For a classic myopic juridical view, see Missouri v. Illinois, 200 U.S. 496 (1906), where the "Court refused to enjoin defendants from emptying sewage into [a] tributary of [the] Missouri River because it was not shown pollution was 'of serious magnitude.'"

much of a scientific as well as political burden for one State to evaluate and justify on such subjective grounds as "reasonable use," "in the interest of self-defense," etc. 163/ In the present context of back contamination from extraterrestrial matter the very existence of conflicting scientific opinion as to the most effective manner for protecting the public against edpidemics - i.e., either providing a barrier for a nation against an epidemic, or containing the pathogens at the source - dictates, at a minimum, international consultation and resolution. In any event, McDougal and Schlei notwithstanding, there is no reason why an

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162/ (Continued) For good discussions of the inter-dependent factors and continuum relationships in the human ecosystem, see C.B. Knight, Basic Concepts of Ecology (1965); J. H. Storer, The Web of Life (1954); J. Hillaby, Nature and Man (1960); R. Buchsbaum and M. Buchsbaum, Basic Ecology (1957); G. L. Clarke, Elements of Ecology (1954); and J. W. Bews, Human Ecology (1935).

163/ Almost the entire justification for use of the high seas and international airspace for atomic weapons testing is the right of a State to ensure its security and to invoke actions of self-defense. See generally, H. Lasswell and A. Kaplan, Power and Society (1952). Insofar as the National Aeronautics and Space Administration is concerned, scientific experimentation with little known - or unknown - risk cannot be justified directly in terms of security and self-defense with military overtones. Rather, the authorized objectives are civil in nature. See, therefore, Section 102(b) of the National Aeronautics and Space Act of 1958 (72 Stat. 426) wherein it is provided that "[t]he Congress declares that the general welfare and security of the United States require that adequate provision be made for...space activities...(and) that such activities shall be the responsibility of...a civilian agency..." (emphasis added).

international framework of procedures [164] for evaluating and monitoring unilateral scientific experimentation, i.e., unknown consequences of the use of the high seas and superjacent airspace, cannot be established without requiring the promulgation of a "static body of absolute rules." [165] Such procedures would not deny "an appropriate discrimination between remedy for damage and mutual tolerance for vital interests." They would, however, assist in defining acceptable levels of tolerance within the framework of technology and scientific methodology available to ensure maintenance of those levels; and also would influence the various parochial definitions of what constitutes "vital interests."

c. The lack of progress in involving the World Health Organization (WHO) in outbound sterilization practice and the problematic threat of back contamination

In July 1964, three delegates representing the United States, the U.S.S.R. and France met in Paris to consider the following issues:

164/ Such an international framework of procedures would not be a contradiction to, or substitute for, "a whole decision-making process" that constitutes the public order of the high seas and superjacent airspace. Quite simply, it would be only a component thereof to assist in certain areas of interest toward which the decision-making process is directed at any given time.

165/ McDougal and Schlei espouse, and correctly so, an approach to the use of the high seas which does not promote restrictiveness or negativism; rather it encourages the proper use of the high seas. This is not inconsistent with the present writer's views, but it does not cover a realistically complete approach, i.e., the juridical attitude of encouragement should be manifest in terms of maximum proper use within the framework of the entire ecosystem of Earth - not just the high seas. Op. cit., supra note 158, McDougal and Schlei, at p. 657.

(1) What benefits can be derived from the space programs... that would be of benefit to the WHO member nations....?

(2) What space-related program...particularly adapted to the needs, abilities, and constitution of WHO, could appropriately be undertaken?

(3) How can WHO best accomplish these objectives? 166/

In relevant part, the conclusion arising from this meeting was that the principal international expert organization, WHO, should (1) not concern itself with the matter of spacecraft sterilization, the first steps in effective control of back contamination, and (2) that "[s]ince action on this problem (of extraterrestrial contamination of Earth's biosphere) would be premature in the light of presently available knowledge, we recommend that WHO not concern itself with the matter until it is clearly evident that a hazard exists that can be met only through action by WHO" (emphasis added). The point of contention that was not resolved, however, is precisely what constitutes prematurity? Obviously, the delegates were thinking in terms of scientific verification of the existence of extraterrestrial pathogens, and not in terms of the legal structure necessary to facilitate adequate and timely response to the threat of back contamination. Equally as obvious is the probability that at least two of

166/ In July 1964 Lawrence B. Hall (USA), V. V. Parin (USSR), and F. Violette (France) met in Paris to discuss "WHO Consultation on Health Aspects" of the exploration and peaceful uses of outer space. See the report by Mr. Hall in the files of the Office of Planetary Quarantine, NASA, Washington, D. C.

the representatives had instructions to the effect that back contamination was a delicate international political issue at the time and, hence, not a desirable subject for WHO involvement.

The issue of effective WHO participation in international consultations on quarantine and back contamination matters was considered once more in a non-definitive way in May 1969. The Consultative Group on Potentially Harmful Effects of Space Experiments requested the President of COSPAR

> "to explore with WHO the possibilities and conditions under which WHO's representative to this Group would become an effective member and not an observer. A representative from the FAO [Food and Agricultural Organization]...would also be most desirable." 167/

As of this writing, no action has been taken on the recommendation. 168/

167/ Committee on Space Research, Report of the Consultative Group on Potentially Harmful Effects of Space Experiments, in Committee on Space Research (ICSU) - Report of the Twelfth COSPAR Meeting 147-148 (May 11-24, 1969); Report of Consultative Group submitted May 18, 1969.

168/ From the program posture of avoiding compromise in the timetable of the basic Apollo Program objective, i.e., land astronauts on the Moon and return them safely by 1970, it was wise not to involve too many people and institutions, domestic as well as international, in considering the best means of protecting Earth's biosphere from back contamination. Most certainly, this was in the mind of one Government official when he made the following observation at a monthly program meeting of NASA's Office of Space Science and Applications in March 1968: "...I feel somewhat concerned, and I think that I should call this to your attention in behalf of NASA's interests...[about] the problem of quarantine and of making sure that when NASA is ready to go to the moon, technically, we aren't in the position of having either the national or international body that says you can go, all right, but you can't come back, and then facing next year, maybe, this kind of

2. Extraterritorial Application of Criminal Provisions - An Acceptable Extension of "Reasonable Use?"

The authority upon which promulgation of the U.S. quarantine regulations is premised is:

(1) Sections 203 and 304 of the National Aeronautics and Space Act of 1958, as amended (40 U.S.C. 2473, 2455 and 2456);

(2) 18 U.S.C. 799;

(3) Article IX, Outer Space Treaty, TIAS 6347 (18 U.S.C. 2416);

(4) NASA Management Instructions 1052.90 and 8020.13.

Items (2) and (3) are the most pertinent in terms of jurisdictional applicability, or scope, of the criminal penalty provision of the quarantine regulations which states:

> "Whoever willfully violates, attempts to violate, or conspires to violate any provision of this part or any regulation or order issued under this part or who enters or departs from the limits of any quarantine station in disregard of the quarantine rules or regulations or without permission of the NASA quarantine officer shall be fined not more than $5,000 or imprisoned not more than 1 year, or both..." (Emphasis added.)

The provision derives its authority, as noted above, from 18 U.S.C. 799, dealing with violation of regulations of the National Aeronautics

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168/ (Continued) administrative dilemma that Mr. Webb [former NASA Administrator] has been warning us not to get ourselves trapped into, because we don't work that part of the problem as well as we work the programmatic and technical part." See Transcript of Proceedings, National Aeronautics and Space Administration, Office of Space Science and Applications, General Management, Monthly Program (Status Review) Meeting, Tape Recording No. 2, 8 March 1968, pp. 5-6.

and Space Administration. Applicability outside the territorial limits of the United States is, of course, limited to the usual in personam requirements of citizenship, and the in rem requirements of U.S. registration of ships and aircraft, physical possession, etc. The real test of the effectiveness of the regulations pivots upon the scope and effect of the sanctioning provision. Within the present context, the purpose of the quarantine confinement can be defeated if practical exceptions to such confinement and testing of people and articles are permitted; e.g., failure to apply the regulations to non-U.S. citizens who have been "extraterrestrially exposed" outside U.S. territorial jurisdiction and who are permitted to remain unquarantined. The logical question, of course, is whether the criminal provision is applicable to foreign citizens, ships and aircraft on the high seas and in international airspace who, or which, are part of a conspiracy, or attempt, to violate the quarantine regulations. Further, will the provisions be applicable to those who render assistance to astronauts landing by error in foreign countries? Also, if effective quarantine is accomplished, is this not in fact enforced incarceration which would make the criminal provision redundant or partially academic in some ways?

a. Extraterritorial Crime

Although the proper enforcement of most criminal statutes depends upon locus of the crime, applicability of the statute and consequent jurisdiction of the court, there are some criminal statutes the natures of

which do not rely upon the locality of the crime for jurisdiction. In the present context, where conspiracy to violate the quarantine regulations is recognized for sanctioning purposes, as much as the attempt or successful violation of such regulations, there is ample room to argue that the criminal provision of the regulations may apply to acts upon the high seas and in international airspace, 18 U.S.C. 799 notwithstanding.

For example, in United States v. Tello, et al., 169/ defendants were charged, in part, with conspiring to smuggle dutiable (prohibited merchandise) into the United States. Defendants claimed that the alleged offense did not take place within the territorial jurisdiction of the U.S. and, therefore, no offense had been committed against it. The court found that conspiring on the high seas to violate a criminal statute did not void proper jurisdiction. 170/ On the other hand, if a conspiracy to violate the quarantine regulations takes place outside the territorial jurisdiction of the United States, the question obviously will arise, "what effect has such a conspiracy on the territorial laws of the U.S. when, in fact, a subsequent violation of the regulations takes place on the high seas?" If, under the Sixth Amendment to the Federal Constitution, all criminal prosecution must be had in the "district wherein the crime

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169/ 6 F. (2d) 579 (D. Mass., 1925).
170/ See Ford et al. v. United States, 273 U.S. 593, 620 (1927).

shall have been committed," from what source does U.S. jurisdiction derive for prosecution of a violation of the quarantine regulations committed on the high seas or in international airspace - for that matter, within the territorial jurisdiction of another country?

In the first instance, by virtue of Article IX of the Outer Space Treaty, it may be said that since each ratifying State has agreed to protect Earth's biosphere from harmful back contamination through their respective space activities, as a means of safeguarding national as well as international physical well-being, a violation of measures taken in pursuance of that protection is a violation of prescribed national requirements no matter where the act occurs. In other words, intentional or willful exposure to extraterrestrial matter on the high seas may lead to epidemics, disruptions of specific ecosystems, etc., within the territorial limits of a country - an epidemic or disruption specifically anticipated by quarantine regulations. Also in this respect, the conspiracy and act of regulatory violation could be shown to have a direct effect on the security and well-being of the regulating country. 171/

171/ See United States v. Linton, et al., 223 Fed. 677 (W.D., Wash., 1915), wherein the court stated that "...[t]he unlawful conspiracy, being entered into in British Columbia to commit an offense against the United States, continued with the parties on entering the jurisdiction of this court, and the doing of the overt act in furtherance of this conspiracy, within this district, vitalizes the conspiracy in this jurisdiction as fully as though it had originally been entered into here." In the present instance of quarantine regulations, some attempt would have to be made to show constructive entry into the

Effective criminal jurisdiction need not pivot specifically upon whether Congress had provided in the controlling legislation that the criminal regulations were applicable to acts outside the United States. Some offenses can be committed only within the territorial jurisdiction of the regulating government because of the local acts required to constitute such offenses. Others are such that "to limit their locus to the strictly territorial jurisdiction would be greatly to curtail the scope and usefulness of the statute and leave open a large immunity...." 172/ Further, because of the right of a government to defend itself against obstruction in the execution of its sovereign responsibilities (which are found acceptable to all civilized nations), "Congress has not thought it necessary to make specific provision in the law that the locus shall include the high seas and foreign countries, but allows it to be inferred from the nature of the offense." 173/ In the present instance, from the nature of quarantine regulations applicable to people and material extra-terrestrially exposed, it could easily be inferred that willful violations might well take place on the high seas or in international airspace.

171/ (Continued) U.S. However, if Article IX of the Outer Space Treaty is an effective, albeit vague, source of authority, it may well be sufficient to give the U.S. (and other ratifying States) adequate jurisdiction to prosecute violation of the regulations on the high seas. One would suspect, however, that such an approach would best require international accord on quarantine standards, procedures and consequent regulations, as well as possible resolution of conflicts and disputes before the International Court of Justice.

172/ See, generally, Hackworth, II Digest of International Law, Chp. VI, p. 198 et. seq. (1941).

173/ Id.

Finally, although invoking the necessity of extradition treaties, police jurisdiction and the chance-element of an offender being found in a domestically cognizant jurisdiction, it is possible to obtain de facto - if not internationally de jure - jurisdiction over alleged offenses (and offenders) of the U.S. quarantine regulations which occur on the high seas, or simply outside the territory of the United States and its possessions. Section 41 of the Judicial Code 174/ provides the following:

> "...the trial of all offenses committed upon the high seas, or elsewhere out of the jurisdiction of any particular State or district, shall be in the district where the offender is found, or into which he is first brought." 175/

In any event, reliance upon Article IX of the Outer Space Treaty as authority for extraterritorial criminal jurisdiction may well be legitimate and internationally acceptable if (1) the U.S. or any other country wishes to so apply domestically-promulgated regulations to crimes committed without its territorial jurisdiction and (2) if, in fact, Article IX is self-executing and does not require additional implementing legislation to ensure Constitutionality of the regulations.

174/ 28 U.S.C. 41.

175/ See United States v. Bowman, 260 U.S. 94, 97-100, 102-103 (1922).

b. Agreement on the Safe Return of Astronauts - Its Affect Upon Quarantine Procedures Adopted By the U.S.

The Agreement on the Rescue and Return of Astronauts and the Return of Objects Launched into Outer Space 176/ was approved unanimously in 1967 by the General Assembly of the United Nations. It was a significant and speedy follow-up to the Outer Space Treaty of 1967. The Agreement details the rights and obligations of cont racting parties in terms of rescue, assistance and return of astronauts, as well as the return of artificial objects launched into space and surviving Earth's atmosphere after recapture by its gravity.

The importance of this Agreement to the present evaluation of U.S. quarantine regulations, as applied without the territorial jurisdiction of the U.S., is to determine (1) whether aliens assisting in the rescue of astronauts and equipment are subject to U.S. quarantine; (2) whether the Agreement does, in fact, recognize the legitimacy of applying quarantine procedures (including temporary incarceration),

176/ UN Doc. A/AC. 105 (1967), hereinafter referred to as the Agreement. For an interesting, but general,discussion of the subject, see Agreement on the Rescue of Astronauts, the Return of Objects Launched into Outer Space, Analysis and Background Data; staff report prepared for the use of the Committee on Aeronautical and Space Sciences, United States Senate, July 16, 1968. For a detailed discussion of the Agreement, but with no direct commentary on the problems of quarantine and back contamination programs for protecting Earth's biosphere, see Dembling and Arons, The Treaty on Rescue and Return of Astronauts and Space Objects, 9 William and Mary L. Rev., No. 3 (1968).

at least as between contracting parties, to aliens assisting astronauts in distress and, therefore, exposed to extraterrestrial matter; (3) whether international recognition of rights and obligations in the rescue and prompt return of astronauts, etc., does in fact recognize the necessity of applying extraterritorially, unilaterally-promulgated quarantine regulations in the absence of internationally-promulgated regulations; and (4) whether recognition of the need for regulations presupposes the necessity of sanctioning provisions as a means of enforcing the regulations, assuming domestic jurisdiction can be had over alleged offenders.

Several of the salient, and in the present context pertinent, provisions of the Agreement appear ambiguous and inconclusive. 177/ For example, it is not conclusively clear from the Agreement who must be rescued, assisted and returned; who must be returned promptly; what conditions justify delay in the return of astronauts; and in what manner the astronauts must be returned. Ambiguities can be seen in the fact

177/ But see, contra, R.C. Hall, Comments on Rescue and Return of Astronauts on Earth and in Outer Space, NASA A69-37115, wherein it is observed at p. 115 that "[t]he rights and duties of States with respect to rescue and return of astronauts who have crash-landed on Earth are carefully drawn, and it does not appear that there are any foreseeable circumstances of astronaut-emergency on earth not covered in these articles."

that both the Outer Space Treaty and the "title" of the Agreement refer specifically to astronauts, while the substantive provisions of the Agreement speak of spacecraft personnel. Obviously, in the latter instance the coverage regarding who must be returned promptly is much broader than implied simply by "astronaut". An astronaut may be defined generally as that member (or members) of a spacecraft crew authorized to navigate the craft. "Personnel" can include anyone else officially assigned to the spacecraft, such as scientists, physicians, mechanics, surface crew during errant recovery operations, etc. From another view, "personnel" would not cover unauthorized passengers and, in the near future, commercial passengers in the form of scientists traveling by space shuttle to an Earth orbiting space station.

Although not all the ambiguities in, and inconclusiveness of, some of the Agreement provisions are of practical importance, many are. For example, is a contracting State compelled to return a non-astronaut crew member promptly? Will this have an effect on quarantine procedures? If the contracting State is also a party to the Outer Space Treaty, is it not required by Article IX either to apply its own adequate quarantine procedures and regulations, or in the absence of such, to return the "personnel" promptly to ensure adequate application of quarantine procedures by the launching or responsible State?

A Contracting State is obligated to pursue all possible steps and render all necessary assistance only if a spacecraft landing occurs in territory under the sovereign jurisdiction of such State. 178/ Should there be any dispute as to what constitutes assistance that is necessary and steps that are possible, including measures to protect Earth's biosphere from harmful back contamination, it would appear that the State rendering assistance is the final arbiter as to what quarantine measures are satisfactory. Such a decision would be consistent with the requirements of Article IX of the Outer Space Treaty. In the absence of quarantine procedures and other measures for protecting against back contamination by the State rendering assistance, the minimum requirements would appear to be those of the launching State; or at least a prompt return of astronauts, personnel and space objects to the launching State for the earliest implementation of quarantine procedures possible.

Even if this obligation of a Contracting State is reasonably clear, situations may occur in which the prompt return may be either physically impossible or legitimately argumentative as to the procedures for

178/ Article 2 of the Agreement on Safe Return of Astronauts. Pursuant to Article 3 of the Agreement, the sole obligation of a Contracting State to spacecraft personnel located on the high seas or any other place not under the jurisdiction of another State, is to extend assistance if in a position to do so and if such assistance is necessary to ensure speedy recovery.

return in situations where, for example, the government rendering assistance is not recognized by the launching State. Concisely, political relationships, as well as more practical obstacles, can easily frustrate back contamination programs, especially where immediate notification and very prompt return of astronauts and space objects are deciding factors in the success of such programs. 179/

Dr. G. P. Zhukov of the Soviet Union has emphasized the fact that the Agreement is "in full conformity with the principles of the Space Treaty of...1967." For this reason, states Zhukov,

> "...the regulations of the Agreement on the rescue are closely tied up with the principles of the Space Treaty of ...1967, and should be regarded in the light of those principles." 180/

If states are bound to interpret, as Zhukov implies, the provisions of the Agreement within the dictates of the Treaty, it appears that Article IX of the Treaty would be one of the controlling provisions and that "all possible" steps and "all necessary" assistance would be rendered in a fashion to protect Earth's biosphere from harmful effects; e.g., the most effective back contamination program and

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179/ An example of issues raised within a political context is whether a Contracting State may grant political asylum to an alien astronaut, or whether the Agreement or Outer Space Treaty requires the astronaut's return if the launching State considers prompt return essential to its back contamination program.

180/ G. P. Zhukov, International Cooperation on the Rescue of Astronauts, Proceed. Int'l Astro. Fed., 11th Colloq. on the Law of Outer Space, Oct. 17-18, 1968 (ed. by Schwartz 1969).

quarantine regulations available would be accommodated by the State effecting assistance to spacecraft personnel in distress.

Zhukov enhances this possible interpretation of the Agreement by observing that

> "...one could not but take into account the fact that the technical facilities of different states are far from being the same and so not every state is capable of carrying out the necessary operations, ensuring a quick and effective rescue of the personnel of a spacecraft. It is possible that a spacecraft crew makes an emergency or unintended landing in territory of a state which will have the necessary technical facilities (for example helicopters) for the search and for the rescue, while the state, which launched the spacecraft, has skilled personnel and corresponding transportation, technical, and other conveniences for the rescue operations. The help of the state, which launched the spacecraft may...become necessary. The Agreement has provisions committing the state, which launched the spacecraft, to cooperate with the country, on whose territory the spacecraft crew landed, for the effective accomplishment of the search and rescue operations." 181/ (Emphasis added.)

The importance of this observation by Zhukov is threefold in nature. First, it recognizes that not all States have the technological capability and equipment to effect a rapid and efficient rescue and that some States (at least the launching State) do have the capability. Second, it recognizes

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181/ Ibid., p. 128. See, supra note 177, Hall at p. 119, wherein politics and the cost of assisting in rescue may be justifiable grounds for not honoring the Agreement, at least insofar as Earth-to-space rescue is involved. See, also, G. P. Zhukov, International Rescue Service for Space Travelers, Moscow News, No. 6, Feb. 18-25, p. 6, 1967, wherein an international organization for the rescue of astronauts in outer space is justified on the basis of overwhelming costs and the time-element of "emergency" in rescuing astronauts in distress. It should be noted also that while the Agreement does provide for the rescue and rendering

that more than simple recovery of astronauts is contemplated, i.e., sophisticated equipment that could very easily imply mobile-type quarantine facilities to implement the back contamination program in situations involving errant and emergency landing procedures. Third, Zhukov's statement is the closest to public recognition of the need to accommodate alien quarantine procedures, if not attendant sanctions for criminal violations. Certainly, no U.S. jurist or governmental official has publicly recognized this possible requirement. Confirmation of the groping directions, in the present context of back contamination programs, pursued by Zhukov can be seen in the following quotation describing his concern for the physical well-being of astronauts in distress:

> The personnel of a spacecraft should be under the Agreement on the rescue, safely and promptly returned to representatives of the state, which launched the spacecraft. But what is to be done if the health of one of the...crew does not permit him to be moved? It seems to us that in that case the state, on whose territory is the injured member of the crew, should provide the necessary care and give the government of his country the chance to send medical personnel and to render any other necessary help. The question of the procedure and the time of the return of such member of the crew home should be settled by the government of the country whose citizen he is. (Emphasis added.) 182/

181/ (Continued) of assistance to astronauts in distress in space and on celestial bodies, such provisions clearly are subordinate to those for the rescue and safe return of astronauts on the surface of Earth. They are inadequate and ambiguous, and not at all responsive to accommodating any quarantine requirements established in furtherance of Art. IX of the Outer Space Treaty.

182/ Ibid, p. 130.

From this, it would appear that at least one source recognizes the need for, if not efficacy of, international applicability of the quarantine regulations promulgated by the National Aeronautics and Space Administration. As observed previously, enforceability of such foreign regulations against the crew, and any other personnel falling within the definition of those exposed to extraterrestrial matter, or attempting or conspiring to violate the regulations, rests basically with the host country and/or the country whose regulations are violated and which has effective jurisdiction. 183/

B. CONCLUSION

Much of the scope of international applicability and enforceability of U.S. quarantine regulations rests upon the extent to which other

183/ It is interesting to note that R. C. Hall recognized precisely what was essential for ensuring adequate quarantine procedures in furtherance of an internationally contrived back contamination program. In making specific recommendations for the amendment of the Agreement, Hall suggested the "[e]xchange and standardization of certain essential technical data and equipment on manned spaceships and stations where necessary for rescue purposes to avoid undue hazards to those who answer a request for assistance and to facilitate a rescue, should be agreed upon; e.g., data on electrical and life support systems, provision of oxygen line couplings that mate properly, etc." Op. cit., supra note 177, at p. 122. Quarantine and back contamination may not have been foremost in the priorities of Hall - indeed, they may not even have been a part of his consideration. In point of fact, however, internationalization of the back contamination program and attendant quarantine regulations is what his proposed amendment would encourage and permit.

nations are willing to promote measures to protect Earth's ecosystem from the possibility of unknown adverse contaminants. Much of this depends upon the thoroughness with which nations understand the problems involved and upon corrective measures taken by the United States. Much of the applicability and enforceability depends upon the various interpretations of relevant provisions of the Outer Space Treaty and the Agreement on the Safe Return of Astronauts adopted by individual contracting States. In short, the scope of the quarantine procedures and regulations outside the jurisdiction of the U.S. depends, within a juridical framework, (1) upon the sufferance of other nations and the extent to which they recognize or agree with the necessity of particular precautions taken (criminal provisions notwithstanding), and (2) the level of risk understood by other nations to be involved in the scientific activity being conducted in international airspace and on the high seas, with a potential threat to other territories; e.g., the atomic weapons testing analogy. At present, sufferance is the source upon which the United States must rely since there was no international consultation on the back contamination standards and quarantine regulations finally adopted.

Although it appears that aliens assisting in the rescue of astronauts and space objects, determined by NASA to be exposed to extraterrestrial matter, may be subject to U.S. quarantine procedures and

regulations by virtue of the quasi-legal and moral suasion of Article IX of the Outer Space Treaty, and the implementing provisions of the Agreement on the Rescue and Return of Astronauts, the final resolution of applicability lies with (a) the host country providing assistance; (b) the launching country which may force quarantine procedures on the alien through the pressure of international public sentiment; and (c) the country having in personam jurisdiction over the alien. It is hoped that resolution of the problem would find itself in the uniformity and standardization of rescue and quarantine procedures established through international consultation and agreement - in the same, but more sophisticated, manner as that leading to search and rescue obligations and rights established by the International Civil Aviation Organization. 184/

At best, the Agreement imposes a certain measure of moral commitment upon a Contracting Party through Article IX of the Outer Space Treaty to permit, at a minimum, reasonable foreign quarantine procedures to be applied to its citizens and property which are exposed to extraterrestrial matter. Article IX of the Treaty is, itself, too ambiguous as a source of authority to serve as the basis of internationally applicable quarantine regulations - certainly not for attendant criminal

184/ See, therefore, Convention on International Civil Aviation, Annex 12, Search and Rescue, International Standards and Recommended Practices (fourth ed., May 1960).

provisions. Further, as discussed in the ensuing Chapter VI, if Article IX is not self-executing there is serious question whether the regulations are Constitutional for purposes even of domestic application. Since there is, in fact, no internationally promulgated procedures and regulations governing back contamination quarantine to protect Earth's biosphere from harmful effects, and since foreign assistance or accommodation in this respect is premised primarily on humanitarianism and the interest of national self-protection, unilateral quarantine regulations appear to have no legal efficacy in an international forum.

Finally, there is nothing in customary international law which sets precedence for the presupposition of one State applying criminal sanctions of another State. Jurisprudence is replete with authority and practical experience regarding this issue. If criminal provisions are to be invoked, they normally are the criminal provisions of a specific State having recognized jurisdiction over an alleged offender. 185/

185/ In this respect, see Article 12 of the Convention on International Civil Aviation, 61 Stat. 1180 (signed by the U.S. in Jan. 1945 and ratified in August 1946), which provides, in part, that "[o]ver the high seas, the rules in force [for civil aviation] shall be those established under this Convention. Each contracting State undertakes to insure the prosecution of all persons violating the regulations applicable" (emphasis added). It is quite likely that, insofar as back contamination control is concerned, a similar international arrangement could be worked out, whereby international standards and procedures for quarantine are established with each acceding State undertaking to "insure prosecution of all persons violating the regulations applicable." This would not only provide operational uniformity in back contamination control, it would avoid the necessity of invoking the protracted confusion always attendant to extraterritorial application of criminal provisions, the invoking of extradition machinery, etc. See, also, the 1958 Geneva Convention on the High Seas, 13 UST 2312, 2320, wherein the same type of national prosecution responsibility is provided in Art. 27.

VI. THE REGULATIONS ON EXTRATERRESTRIAL EXPOSURE - A SECTIONAL EVALUATION

A. QUARANTINE PROCEDURES AND THE SCOPE OF APPLICATION

> The provisions of this part apply to all NASA manned and unmanned space missions which land on or come within the atmospheric envelope of a celestial body and return to the Earth. (Emphasis added.) 186/

1. The Regulations

From the above, it can be seen that the NASA quarantine regulations apply to all types of NASA space missions. The constraints of principal importance are that the objects of quarantine must (a) land on or come within the atmospheric envelope of a celestial body, and (b) return to Earth. Obviously, matter existing in space, other than celestial bodies and that which is included in atmospheric envelopes, is not part of the extraterrestrial matter covered by the exposure and quarantine regulations. Apparently, the presumption is that the "other" matter in space is not considered to be contaminating in nature, or that the probability of pathogenic organic and inorganic complexes surviving or existing in outer space is too remote to consider, or that the probability of an encounter between space missions and such "free-floating" matter is too remote to be covered by the regulations. 187/ However, without

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186/ 14 CFR 1211.101. For the regulations in their entirety, see Appendix C, infra; published as 34 F.R. 11975 et. seq., July 16, 1969.

187/ It has been determined by the ICBC that should any microorganism in space strike a spacecraft, the force of impact (16,000 meters/second), would destroy that microorganism. This does not, of course, accommodate the problems of "space walking" while in geostationary orbit, etc.

necessarily accepting the factual inflexibility of that presumption, one can evaluate the thoroughness in coverage of the regulations as they apply to equipment, objects, living matter and personnel who, in addition to the crew, are exposed to extraterrestrial matter while on Earth.

a. §1211.100 - Scope

> This part establishes: (a) NASA policy, responsibility and authority to guard the Earth against any harmful contamination or adverse changes in its environment resulting from personnel, spacecraft and other property returning to the Earth after landing on or coming within the atmospheric envelope of a celestial body; and (b) security requirements, restrictions and safeguards that are necessary in the interest of national security. (Emphasis added.)

The principal areas of weakness in this definition of scope of the regulations are: (1) NASA responsibility and authority are nowhere defined in the regulations. As discussed previously, the cited sections 203 and 304 of the Space Act are insufficient authorization for the extent of the regulatory application - they go only to responsibility for developing appropriate policy; (2) 18 U.S.C. 799 provides pertinent authority only for violation of the regulations and not for the quarantine provisions, themselves. If, in fact, no authority exists for the quarantine regulations, then the dependent criminal provision also must fail; (3) Article IX of the Outer Space Treaty, as a source of recognized and sufficient authority upon which to premise quarantine regulations, is valid domestically, but only to the extent it may be self-executing; (4) citing

of NASA Management Instructions as authority is not acceptable - it offers a self-serving statement with no derivation from legislative authority which would give it substance to support the regulations.

In a different complexion, §1211.100 is weak in that the regulations do not define meaningful parameters of "atmospheric envelope" - concisely, there is no definition at all. At best the geo-instability of planetary atmospheres and the absence of a readily recognizable demarcation between atmosphere and outer space, makes the determination of whether "fly-by" missions have been exposed to extraterrestrial matter extremely difficult in almost all situations not involving total, or near total, atmospheric immersion. Earth's moon is a good example of a celestial body having an atmospheric envelope - thereby qualifying for the regulations - but it likely is an atmospheric quantity of insignificance.

Finally, the scope of security restrictions and safeguards are stated to be necessary in the interest of national security. Since, as will be seen later, the principal source of authority for the regulations is premised upon Article IX of the Outer Space Treaty, it would appear that the security provisions of the regulations are more in the interest of international security from unacceptable disruption of Earth's total biosphere. Even if, in fact, NASA determined to use only part of the

authority provided by Article IX, i.e., restrict the interest of the regulations to national security, that limited exercise would fall should it be decided judicially that Article IX of the Treaty is not self-executing.

b. §1201.102 - Definitions

(1) Extraterrestrially exposed - the absence of definition

"...(b) 'Extraterrestrially exposed'means the state or condition of any person, property, animal or other form of life or matter whatever, who or which has:

(1) Touched directly or come within the atmospheric envelope of any other celestial body; or

(2) Touched directly or been in close proximity to (or been exposed indirectly to) any person, property, animal or other form of life or matter who or which has been extraterrestrially exposed by virtue of subparagraph (1) of this paragraph." (Emphasis added.)

Still within the context of applicability of the quarantine provisions, the principal question to arise in §1201.102 involves the word "directly", i.e., just how direct must the direct touching be of "any other celestial body" as required by subsection (b)? If one assumes a literal interpretation of the provision, then actual contact with the surface of the planet must occur. If this is true, will the quarantine, as well as criminal, provisions apply to spacecraft and/or personnel which, or who approach the immediate surface of a celestial body having no functionally recognizable atmospheric envelope - such as Earth's moon; which, or who,

after having been contaminated by stirred-up surface dust or other free-floating matter, returns directly to Earth's biosphere, or indirectly through crew transfer procedures and contamination transfer involved in the Apollo manned missions? Accordingly, in the event of a literal interpretation of the definition of "extraterrestrial exposure", the quarantine provisions would not be applicable. Subsection 1201.102 (b)(2) does not close the gap since the direct or indirect exposure to persons, living matter and other objects which have been directly exposed relies upon the latter having been exposed pursuant to §1201.102(b)(1), i.e., direct contact with a celestial body or atmospheric envelope. The difficulty appears to lie in the inability to measure atmospheric contact meaningfully.

If a liberal interpretation of "touched directly" is to be followed, then there should be standards scientifically derived - either from actual investigation and evaluation, or from permutations based on such investigation and evaluation - set forth in the regulations, or properly incorporated by reference. It is rather easy to see the extreme difficulties presented by the liberal interpretation of "touched directly" since, regardless of the specific level of contamination probability determined acceptable through scientific methodology, it takes survival of only one asexually reproductive pathogenic complex to increase quite drastically the risk of back contamination, and the consequent need for

the LRL. In short, the applicability of the regulations should be sufficiently inclusive in the initial stages of an unknown mission environment so as to dissipate any need for a liberal interpretation. As experience is gained and practical knowledge is increased, the extent of applicability of the quarantine regulations may be more liberally interpreted in favor of a potential quarantine detainee or article, rather than in a dragnet fashion to include all reasonably speculative situations.

(2) "Quarantine" - incarceration or imprisonment and ultra vires police power? 188/

"...(c) Quarantine means the detention, examination and decontamination of any person, property, animal or other form of life or matter whatever that is extraterrestrially exposed, and includes the apprehension or seizure of such person, property, animal or other form of life or matter whatever. (Emphasis added.)

The term "incarceration" is rarely used in law, but does appear occasionally in statutes. According to Black's Law Dictionary, "[w]hen so used, it appears always to mean confinement by competent public

188/ In the absence of specific quarantine authority to examine and decontaminate a detainee, the question arises whether anything more than isolation and detention is an abuse of police power, especially if an individual is forced to submit to an examination and decontamination procedures. Further, without certainty as to what pathogen, toxin, etc., is being sought, such examination and preventive decontamination procedures could become a prolonged exploratory situation. In this context, see generally, R. L. Roettinger, The Supreme Court and State Police Power; A Study in Federalism (1957); and O.K. Fraenkel, The Supreme Court and Civil Liberties; How the Court has Protected the Bill of Rights (1963).

authority or under due legal process...." 189/ On the other hand, "imprisonment" is the act of "...confining a man in prison; the restraint of a man's personal liberty; coercion exercised upon a person to prevent the free exercise of his powers of locomotion." 190/ Further, confinement "may take place without the actual application of any physical agencies of restraint (such as locks or bars), but by verbal compulsion and the display of available force." 191/

"Imprisonment" may be effected by a private person as well as competent public authority. If the imprisonment is unjustified, it flows from

> "[t]he unlawful arrest or detention of a person without warrant, or by an illegal warrant, or a warrant illegally executed, and either in a prison or a place used temporarily for that purpose, or by force and constraint without confinement...[f]alse imprisonment consists in the unlawful detention of the person of another, for any length of time, whereby he is deprived of his personal liberty." 192/

It is seen, therefore, that if quarantine confinement is by competent authority, or pursuant to due legal process, then the act may be referred to as incarceration and, hence, legitimate. However, "competent" has been defined in the present context as "having sufficient ability or

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189/ Black's Law Dictionary 903 (4th ed. 1951).
190/ Ibid, pp. 889-890.
191/ Id.
192/ Op. cit., supra note 189. See, also, Eberling v. State, 136 Ind. 117, 35 N.E. 1023 (S. Ct. dnd., 1894), Mahan v. Adam, 144 Md. 355, 124 A. 901, 904 (Ct. App. Md., 1924).

authority; possessing the requisite natural or legal qualifications." 193/ Further, "competent authority" has been defined, in application to courts and public officers, as having "jurisdiction and due legal authority to deal with the particular matter in question." 194/ If, in fact, specific quarantine legislation or other sources of authority do not permit detention for the purposes set forth in NASA's regulations on extraterrestrial exposure, then it may well be argued that "competent authority" does not exist for the quarantine of extraterrestrially-exposed people, objects and any other such matter whatever which may be found on Earth.

Since the Administrator of NASA is not authorized by legislation specifically to quarantine, it is highly questionable whether the ultimate confinement of persons or property by a duly designated NASA quarantine officer can be accomplished within the constraints of due legal process. 195/

193/ Op. cit., supra note 189, Black's at p. 355.

194/ Ibid. See, also, Charles v. Charles, 41 Minn. 201, 42 N.W. 935 (July 1889).

195/ See §1211.105 - Relationships with Departments of Health, Education and Welfare and Agriculture, wherein uncertainty as to adequacy of quarantine authority is clearly reflected right in the regulations by reference to the policy that if either of these two Departments invoke their respective quarantine authority, NASA will not invoke its own [subsection (a)]; if the Departments elect not to invoke their quarantine authority, then NASA shall exercise its own [subsection (b)]. It is provided in subsection (c) that "NASA shall quarantine NASA astronauts and other NASA personnel as determined necessary..." regardless of any action, or absence thereof, taken by the Departments of Health, Education and Welfare, and Agriculture. The principal question arising, here, is whether all persons party to a voluntary Crew Participant Quarantine Agreement to serve as a member of the LRL Crew Reception Area Team, or the Sample Operations and Analysis Team, are actual NASA employees or

§1211.104(a)(2) provides, in part, that

> "[t]he quarantine may be based only on a determination, with or without the benefit of a hearing, that there is probable cause to believe that such person, property, animal or other form of life or matter whatever is extraterrestrially exposed." (Emphasis added.) 196/

Quite obviously, the incidents involving accidental, and officially unanticipated, exposure will require fairly rapid, if not instantaneous, determinations as to whether immediate quarantine is necessary. In these circumstances, 197/ it is absolutely imperative that the quarantine authority relied upon is clear and sufficient to support unquestionably the necessary actions. 198/ Otherwise, due legal process will have been denied (1) by the absence of effective authorizing legislation, and (2) during the act of immediate incarceration.

195/ (Continued) personnel. It is quite possible that certain individuals, specifically Principle Investigators, might consent with NASA to work in the LRL as one of the teams pursuant to the conditions of the voluntary quarantine agreement, but in fact and law only be serving as an agent for NASA during one specific mission and for one specific objective; e.g., microbial analysis of a lunar sample core taken during the Apollo 16 mission. Query: The application agreement notwithstanding, would §1211.105(c) be applicable?

196/ See §1211.104(a)(7) wherein it is provided that the Administrator, shall, in his discretion, "[h]old such hearings at such times, in such manner and for such purposes as may be desirable or necessary under this part."

197/ The preconditional agreement to quarantine by volunteer NASA employees, and others working in recovery and LRL operations, is discussed at a later point.

198/ Since, insofar as the quarantine regulations are concerned, there is no prescribed duration of confinement, the need for unequivocal authorizing legislation is even that much more imperative. See, therefore, §1211.102(d) which provides that " '[q]uarantine period' means a period of consecutive calendar days as may be established in accordance with §1211.104(a)." §1211.104(a)(1) provides, in

2. NASA Employees - Application Commitment and the Crew Participant Agreement

Voluntary acceptance of quarantine and other attendant requirements for working as a member of the Crew Reception Area (CRA) crew and the Sample Operations and Analysis (SOA) team at the LRL is manifest in a two-step agreement. The first step is an "application" to serve as a crew or team member, and the second step is an

198/ (Continued) part, that "the quarantine period as it applies to various life forms will be announced," i.e., after the Administrator determines "the beginning and duration of a quarantine period with respect to any space mission." The provisions sanctioning the policy dictates of the regulations, as set forth in §1211.104, are of a nature to make totally unacceptable, in the absence of sufficient and precise legislation, the easy manner in which the regulations can be abused; e.g., §1211.104(a)(5) - "[p]rovide for guard services...to maintain security and inviolability of quarantine stations and quarantined persons...," and §1211.104(b)(3) - "[d]uring any period of announced quarantine, no person shall enter or depart from the limits of any quarantine station without permission. During such period, the posted perimeter of a quarantine station shall be secured by armed guard." See, also, §1211.104(b)(5) which provides that "[a]t the earliest practicable time each person who is quarantined by NASA shall be given a reasonable opportunity to communicate by telephone with legal counsel or other persons of his choice." (Emphasis added.) In addition to the "rights" of the "incarcerated accused", which rights are made quite vague by the subjective phrases "earliest practicable time" and "reasonable opportunity", one would almost anticipate additional wording to the effect that "the accused immediately shall be apprised of his rights in such a manner that he understands them." The point here is not to emphasize questionable regulatory promulgation decisions, or the criminal aura (the criminal provision should not be confused with the quarantine provisions) surrounding quarantine procedures dictated by legitimate concern for preserving national security and for protecting Earth's biosphere pursuant to Treaty provisions. Rather, the point is to emphasize the lack of certainty as to what, if any, the actual source of quarantine authority is.

addendum-type agreement, entitled "Crew Participant Quarantine Agreement," describing what is expected of selected crew members (and SOA Team members who become CRA crew members if a "spill" occurs), and what the respective duties and rights are of the member and of NASA/MSC.

a. The Application [199]

The "application" is a written accord between an individual and his employer. The individual may be an astronaut or NASA employee and, hence, fall under the dictates of §1211.105(c) of the quarantine provisions, i.e., astronauts and all NASA personnel shall be quarantined as determined necessary. The individual also may be a Principle Investigator representing either himself, a university, or some other institution or academy and, hence, neither an astronaut nor NASA personnel. At best, he might be considered an agent of NASA in a limited respect. Consequently, in the event the "application" should stand as a binding contract substituting in the absence of legitimate legislative quarantine authority, the quarantine regulations would not cover all situations intended.

199/ See Appendix D, infra, for the Application. The Application and the Agreement are considered part of the same document and are listed as MSC Form 84 [May 1969 (OT)].

In looking at the substantive provisions of the application, it appears that, within the framework of enforceability in a court of equity, the stated duties are more precatory than realistic. The most significant provision is paragraph 2 in which the applicant agrees voluntarily to

> "(a) assume the obligation of serving throughout the simulated confinement or active quarantine period; (b) relinquish and waive any and all rights and remedies that might be asserted or relied on by me, or any other person claiming through me, to be relieved from the Agreement or released from the confinement and active quarantine, for any reason whatever, in advance of the time officially fixed for its termination as determined by authority of the NASA Administrator; and (c) forego, waive, and release any and all claims I might otherwise have against, and covenant not to sue, at any time, any individual for wrongful confinement or restraint during the confinement or active quarantine period." (Emphasis added.)

The application appears basically weak for two principal reasons. If the quarantine authority were sufficient it would stand alone and not require an attempt to bind employees by contract. Even if the quarantine authority is adequate, there can be no enforcement of detention in simulated conditions since there is no threat to national security, public health and welfare. 200/ Secondly, "breach" of contract under these circumstances invokes civil penalties and equitable restitutions, not criminal regulations. If the application and agreement is intended only

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200/ It is interesting to note yet another reflection of official doubt as to the efficacy of quarantine authority. This doubt lies not only in the general tenor of the Application and attendant Agreement, but also in the specific language of the Application which recognizes the possibility of "false imprisonment."

to delineate responsibilities between employee and employer for what is a very expensive and time-critical undertaking, insertion of penalty clauses for breach may serve as an effective deterrent against frivolous failure to observe agreed duties and rights. Finally, under the broad concept of parens patriae, governments - Federal and State - will not permit its citizens to contract away their Constitutionally-guaranteed rights, except under rare, well-controlled and specifically defined circumstances.

b. The Agreement

The Agreement essentially is a delineation of what selected CRA crew members, and SOA Team members who become crew members through a "spill" or other contaminating accident, are expected to do, specifically and generally, during simulated and active quarantine, and what can be expected from NASA during those periods of quarantine. The Agreement suffers, for the most part, from the same weaknesses as the Application. It is interesting to note, however, that paragraph 5 of the Agreement is detailed regarding the type of emergency services which would be provided by NASA during simulated quarantine operations - even to the point of discussing the approval of release from confinement for "medical treatment or hospitalization outside of the LRL." No such delineation of services in context with active quarantine operations appears anywhere in the Agreement. In fact, the entire question, and all the issues it would raise regarding the lawfulness of quarantine procedures for extraterrestrial exposure and contamination, is studiously avoided.

B. CONCLUSION

It is seen that, although NASA's quarantine regulations apply in theory to all types of U.S. civilian manned and unmanned space missions, they in fact do not cover a few situations not quite so theoretical; e.g., aborting of a lunar mission where contamination already has occurred without direct contact with the lunar surface. It also has been observed that not only is there a general absence of important definitions for the regulations, those definitions which do appear often are incomplete, occasionally impertinent, and provide a sense of uncertainty as to the validity of the provisions and a vagueness in their scope of applicability.

The stated authority for the quarantine provisions have the appearance of a shotgun effect, i.e., any and all sources of authority having even the remotest relevance are cited. Even self-serving policy directives are quoted as authority. The overall effect is to cloud the integrity of the Interagency Committee on Back Contamination with an aura of dubious policy motivations and minimal constructive concern with the law as it is. This view seems to be confirmed by the Application and attendant Agreement the CRA crew members and SOA Team members must sign, and which attempts to bind each signatory to the waiver of certain rights flowing from quarantine incarceration; e.g., the right to sue for "false imprisonment." This is yet another indication that the ICBC, through the actions of NASA, was willing to accept the risk of improper and unsubstantiated regulatory conduct in order to minimize

exposure of the back contamination issue to the public, and in order to ensure there was no program derogation, in the time-frame set for the Apollo 11 mission, caused by lengthy administrative procedures if the public were to be permitted consultative participation and/or scrutiny in the development of the back contamination standards and quarantine regulations.

VII. AUTHORITY TO CONTROL AND ENFORCE THE BACK CONTAMINATION PROGRAM

The issue, put concisely, is whether the Administrator of NASA, acting alone or in conjunction with certain other Government officials, has the authority to (1) apprehend, detain, examine, decontaminate and quarantine individuals; and (2) seize, examine, decontaminate, condemn and destroy animals, or other forms of life or property, if such individuals, animals or property should - through design or accident - be exposed to extraterrestrial matter obtained by, or involved in, a NASA space flight.

The legislative history of the Space Act of 1958 indicates the intention of the Congress to make NASA's authority for conducting research and exploration of space rather broad, principally because the scope of "space activities" was still in a highly speculative stage at the time of drafting. As noted in their Report, the Congressional conferees observed that

> "[t]he use of the word 'activities'...is intended to be broad in the area of outer space because no one can predict with certainty what future requirements may be....[T]he term 'activities' should be construed broadly enough to enable...[NASA] to carry on a wide spectrum of activities which relate to the successful use of outer space." 201/

201/ See House Report 2166, 85th Congress, 2d Sess., p. 17.

In view of the rather unrestrained language and apparent underlying intent of the Congress, it would appear that (1) extraterrestrial exposure or contamination is a natural result of certain space activities; (2) that transfer contamination of Earth's ecosystem logically may follow from such space activities involving recoverable personnel and objects; and (3) that NASA quite naturally has the statutory responsibility to protect Earth from adverse extraterrestrial exposure. In essence, as well as theory, this sequence of reasoning leads to the conclusion that the NASA Administrator has authority to control not only NASA and Contractor personnel vis-a-vis quarantine procedures, but he has authority to "regulate the conduct of every person and interfere with all property subject to the jurisdiction of the United States" [and it has been shown, above, that such jurisdiction may have direct extraterritorial applications and consequences], in conflict with the right of liberty and the right to property prescribed by the Federal Constitution. 202/ As

202/ Tentative support for NASA authority to quarantine is the Congressional approval for construction of the Lunar Receiving Laboratory. According to pertinent testimony at the hearings, it was understood that, insofar as NASA personnel and contractor employees are concerned who are intimately involved with a recoverable, extraterrestrially exposed mission, the LRL was to be the facility for quarantined astronauts and other extraterrestrially-exposed personnel and objects. Apparently, the Congress was not fully aware of the scope of the regulations until the day they were published and became effective, i.e., the day of the Apollo 11 launching. See, therefore, Hearings of the House Subcommittee on Manned Space Flight of the 90th Cong., 1st Sess. (on the NASA Authorization Act 1968), Part 2, pp. 398, 1340, 1342-1345.

seen in the following discussions of the explicit and detailed authorization by Congress for certain departments and agencies to quarantine, the absence of NASA's authorizing legislation with respect to promulgating quarantine regulations stands out in sharp contrast.

At first reflection, it appears that since the NASA Administrator has not been provided with necessary and proper legislative authority to quarantine, Congress has defaulted and NASA quite rightly has filled this void with its own regulations to protect Earth's ecosystem. In addition to the absence of legal precedence and Constitutionality of this approach, NASA has not stated, as a means of justifying promulgation of the quarantine regulations, that the Congress has defaulted. Rather, it appears that the Congress was kept functionally uninformed about the work of the ICBC and the difficulty it was having in finding existing authority to quarantine. To the contrary, NASA ultimately premised the regulations on what the ICBC determined was adequate existing legislation. The adequacy of this legislation is examined, below.

A. NASA

As referred to previously, Government Departments and agencies principally responsible for the protection of the public's health, agriculture and other life forms constituting a resource for man, 203/ pooled their respective statutory authorities in order to provide substance to

203/ See Code of Federal Regulations (CFR), Titles 7, 9, 42, 50 and Public Law 410, wherein those Government agencies responsible for protecting the public's health, agriculture and other living resources are identified clearly.

any regulations NASA might promulgate to enforce the back contamination program. Again, this was probably considered essential since NASA, by itself, did not appear at the outset to have adequate statutory authority to issue regulations sufficiently extensive in scope to cover all activities envisioned for protection of Earth's ecosystem from returning missions having come in contact with alien atmospheric envelopes and/or celestial bodies.

The principal source of potential authority, of course, is the Space Act of 1958. Specifically, section 203(b)(1) provides, in part, that

> "[i]n the performance of its functions 204/ the Administration is authorized...to make, promulgate, issue, rescind, and amend rules and regulations governing the manner of its operations and the exercise of the powers vested in it by law ...." (Fnt. added.)

204/ The aeronautical activities of NASA essentially are in the realm of advanced research and long-range technological development programs, as opposed to the management and implementation responsibilities of the Federal Aviation Administration for ensuring safe, economic and efficient air navigation (Fed. Avia. Act of 1958, as amended; 72 Stat. 731, et. seq.). See, therefore, National Aeronautics and Space Act of 1958, as amended, sections 102(c)(2) and (4) wherein it is provided, respectively, that aeronautical and space activities shall be conducted so as to contribute materially to "[t]he improvement of the usefulness, performance, speed, safety, and efficiency of aeronautical and space vehicles;" and "[t]he establishment of long-range studies of the potential benefits to be gained from, the opportunities for, and the problems involved in the utilization of aeronautical and space activities for peaceful and scientific purposes." (42 U.S.C. 2451)

At a glance, this broad sweep of authority may appear to provide NASA with more than sufficient authority to quarantine material and personnel exposed to extraterrestrial matter. However, since the act of quarantine involves the detention and/or incarceration not only of Government employees and property, but of private individuals and property as well, it is extremely difficult to interpret Congressional intent regarding section 203(b)(1) of the Act as giving NASA's Administrator carte blanche authority in this area without more specifically delineated constraints; especially since it involves the issue of deprivation of liberty and property covered by the Federal Constitution. 205/

205/ See, specifically, the 4th and 5th Amendments to the United States Constitution, U.S.C.A., which read, respectively, "The right of the people to be secure in their persons, houses, papers, and effects, against unreasonable searches and seizures, shall not be violated, and no warrants shall issue, but upon probable cause, supported by Oath or affirmation, and particularly describing the place to be searched, and the persons or things to be seized'; and "No person shall be held for a capital or otherwise infamous crime, unless on a presentment or indictment of a Grand Jury, except in cases arising in the land or naval forces, or in the Militia, when in actual service in time of War or public danger; nor shall any person be subject for the same offense to be twice put in jeopardy of life or limb; nor shall be compelled in any criminal case to be a witness against himself, nor be deprived of life, liberty, or property, without due process of law; nor shall private property be taken for public use, without just compensation." Whenever Congress has legislated authority to quarantine, such authority has been the subject of well-defined procedural constraints. See 42 U.S.C. 264, 266; 7 U.S.C. 150 dd, 160-161; and 21 U.S.C. 111 et seq. Under the analogous general authority for all heads of departments and agencies to issue regulations pursuant to 5 U.S.C. 301, no regulations have been issued which could result in the confinement of individuals and the seizure and possible destruction of property.

Section 304(a) of the Act offers a possible alternative approach to authorization of quarantine regulations by providing, in part, that

> "[t]he Administrator shall establish such security requirements, restrictions, and safeguards as he deems necessary in the interest of the national security."

Because of the possibility that space contaminated material could interfere severely with the human ecosystem, or adversely infect Earth's biosphere, it is reasonable to consider the possibility as contrary to the interests of national security and, therefore, a proper subject for the Administrator's "security requirements, restrictions, and safeguards." However, the entire Section 304 deals with matters such as personnel investigations within the framework of national loyalty, accessability of certain employees and private individuals to restricted data, preservation of the integrity of such data as it relates to the common defense and security, and acts of espionage in general. 206/ Subsection 304(c) provides for penalties applicable to the violation of security regulations and leaves little doubt as to the constraints on the

206/ See, specifically, §§304(a) and (b) of the Act, 42 U.S.C. 2455. Reference in these subsections to arrangements for investigations of personnel by the Civil Service Commission and referral to the Federal Bureau of Investigation for full field investigations of actual and prospective employees suspected of "questionable loyalty" is fairly conclusive that the security provisions of section 304 were not intended to include authority for the Administrator to promulgate quarantine regulations.

scope of the "interest of the national security." 207/ Subsections (d) and (e) provide for protection of officers and employees in the execution of security regulations and permits the use of firearms for proper enforcement of them. 208/ Consequently, it appears the proper conclusion is that the act of incarcerating persons or property pursuant to back contamination quarantine procedures does not derive its authority from Section 304 of the Space Act. This section is, essentially, authorization for passive preparation against, and defensive response to, acts which are initiated from without NASA, and does not encompass positive acts properly initiated pursuant to the general authority of the Space Act. 209/

Aside from the obvious scientific justification to provide for quarantine in the contamination control program, the United States has agreed by Treaty to take necessary steps to protect Earth's biosphere

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207/ Sec. 304(c) provides that "[w]hoever willfully shall violate, attempt to violate, or conspire to violate any regulation or order promulgated by the Administrator...for the protection or security of any laboratory, station, base or other facility, or part thereof, or any aircraft, missile, spacecraft, or similar vehicle, or part thereof, or other property or equipment in the custody of the Administration, or any real or personal property or equipment in the custody of any contractor...shall be fined not more than $5,000, or imprisoned not more than one year, or both." (Chp. 37, Title 18 U.S.C. 799).

208/ Sec. 304(e) of the Space Act, 42 U.S.C. 2456.

209/ See subsections 203(a)(13)(A) and 203(b) regarding authorization and procedures for settlement of claims.

from contamination. Therefore, international commitment by formal agreement, as well as practical necessity, compel the need for quarantine authority. Consequently, a final possible alternative 210/ for

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210/ Emergency authority pursuant to the Administrator's oath of Office, prescribed in 5 U.S.C. 3331, is omitted as an alternative since it is too remote and the history of back contamination consideration indicates ample planning time for the Governmental bodies involved. Any emergency authority invoked undoubtedly would not issue from the Administrator's oath. A situation could occur, of course, where instantaneous quarantine by NASA was required with a consequent attempt to invoke the theory of Presidential alter ego. See, therefore, In Re Neagle 135 U.S. 1 (1890), wherein the court determined that a Federal Government officer, who had killed an assailant of a Supreme Court Justice, in defense of the Justice, should be released on a writ of habeas corpus from the custody of a California county sheriff who had charged him with murder pursuant to California Law. The Court premised its determination, in part, on the President's Constitutional authority to ensure that the laws are faithfully executed and that this authority extended, by oath of office, to the Head of an Executive Department who authorizes the protection of Government officers performing their official duties. The implication in the instant situation is that if the NASA Administrator may be considered the President's alter ego, he may authorize in an emergency those steps necessary to protect NASA personnel and Government property from the potentially adverse effects of lunar contamination. This contention is defeated by the fact that (1) the Administrator is required by oath of Office to protect the Constitution, a principal provision of which protects a person from deprivation of liberty or property without due process of law; and (2) the Administrator of NASA is not the Head of an Executive Department. See, therefore, 5 U.S.C. 101, wherein Executive Department is defined. NASA is not included. See, also, Youngstown Sheet & Tube Co. v. Sawyer, 343 U.S. 579 (1952), wherein the authority of the President to ensure faithful execution of the laws is referred to and discussed at pp. 587, 610-612, 633, 646, 649 (fnt. 17), 660 and 661 (fnt. 3). Here, it was indicated that Re Neagle may no longer be viable since the President was held not to have the authority, by himself, to seize private steel mills in an emergency and in the interest of national defense.

authority of NASA to issue quarantine regulations is Article IX of the Outer Space Treaty. To reiterate briefly, Article IX provides that all States Parties to the Treaty shall conduct exploration of outer space and celestial bodies, and shall make use of those resources, in such a manner

> "as to avoid their harmful contamination and also adverse changes in the environment of the Earth resulting from the introduction of extraterrestrial matter and, where necessary shall adopt appropriate measures for this purpose." (Emphasis added.)

The first point which tends to negate Article IX as a source of NASA authority to promulgate quarantine regulations is the phrase "where necessary." At present, the state of the art does not permit absolute knowledge of the existence of alien life forms (let alone whether they are harmful to Earth's biosphere) until they have been introduced into the ecosystem and examined under laboratory conditions. The second, and perhaps most limiting factor is that the Treaty cannot be considered self-executing and, hence, adequate authority does not exist in that source for the Administrator to "adopt appropriate measures" for the purpose of safeguarding Earth from extraterrestrial contamination. 211/ Since regulatory implementation (i.e., quarantine

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211/ By its own terms, Article IX cannot be self-executing; e.g., the provision envisages that the United States, as well as other States Parties to the Treaty, "...shall adopt appropriate measures for this purpose" (emphasis added). In this respect, see Hackworth, V Digest of International Law, §490, pp. 198-199 (1943), wherein it is observed that "[l]egislative aid to give effect to treaties is often necessary...where administrative machinery is required in

regulations) would directly affect basic rights of citizens in such a way as to deprive them of their liberty and property, the intervening factor of appropriate legislative authorization by the Congress appears absolutely necessary. This legislation, of course, does not exist.

B. AUTHORITY OF THE DEPARTMENT OF HEALTH, EDUCATION AND WELFARE TO ISSUE BACK CONTAMINATION QUARANTINE REGULATIONS

The United States Public Health Service Act (Public Law 410, 78th Congress) provides authority for the Surgeon General 212/ to issue and enforce regulations designed to prevent the introduction and spread of communicable diseases into, and throughout the United States, its territories and possessions. The authority provides, in pertinent part, that

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211/ (Continued) order to carry out such terms, and where penalties are to be imposed for treaty violation, etc." Query: If the Outer Space Treaty is self-executing, is the violation of NASA's quarantine regulations and attendant criminal provision in fact a violation of a Treaty criminal provision? See, also, in Hackworth, Vol. V, §488, pp. 177-185, "Self-executing treaties." In the views of Chief Justice John Marshall, a treaty is not self-executing if "the terms of the [treaty]...import a contract, [and] when either of the parties engages to perform a particular act, the treaty addresses itself to the political, not the judicial department; and the legislature must execute the contract before it can become a rule for the Court." Foster and Elam v. Neilson, 27 U.S. (2 Peters) 253 at 314 (1829). See, also, Dembling and Aarons, The Evolution of the Outer Space Treaty, 33 J. Air. L.& Comm. 419 (1967), wherein no mention is made of whether the Treaty is self-executing or not.

212/ See 80 Stat. 1610, wherein responsibilities of the Public Health Service and the Surgeon General were transferred to the Secretary of Health, Education and Welfare pursuant to the 1966 Reorganization Plan No. 3.

"(a) The Surgeon General...is authorized to make and enforce such regulations as...are necessary to prevent the introduction, transmission, or spread of communicable diseases from foreign countries into the States or possessions....
(b) Regulations prescribed under this section shall not provide for the apprehension, detention, or conditional release of individuals except for the purpose of preventing the introduction, transmission, or spread of such communicable diseases as may be specified...in Executive orders of the President upon the recommendation of the National Advisory Health Council and the Surgeon General. 213/
(c) Except as provided in subsection (d) of this section, regulations prescribed under this section, insofar as they provide for the apprehension, detention, examination, or conditional release of individuals, shall be applicable only to individuals coming into a State or possession from a foreign country or a possession.
(d) ...regulations prescribed under this section may provide for the apprehension and examination of any individual reasonably believed to be infected with a communicable disease in a communicable stage.... Such regulations may provide that if upon examination any such individual is found to be infected, he may be detained for such time and in such manner as may be reasonably necessary." (Emphasis and fnt. added.) 214/

First, the applicable Public Health Service regulations are limited in scope to those situations involving the introduction and spread of communicable diseases throughout the U.S., its territories or possessions. One of the critical factors in the back contamination program is

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213/ The diseases which the President has so specified are listed in Executive Order 11070; also 42 CFR, Parts 71 and 72.

214/ 42 U.S.C. 264. For Public Health regulations dealing with the transportation of etiologic agents and vectors and etiologic agents as well as provisions for transporting etiologic agents, see 42 CFR, Chp. I, PHS, Part 71, Foreign Quarantine; Subpart J, Importation of Certain Things; Sec. 71.156; and 42 CFR, Chp.I, PHS; Part 72, Interstate Quarantine; Subpart C, Shipment of Certain Things; Sec. 72.25, respectively.

that initial contact of reentry vehicles, limited by the present state of the art, is with Earth's airspace and surface over and in international waters ("hard" landings by the U. S. S. R. in domestic territory, notwithstanding). As discussed previously, United States jurisdiction for the international application of its domestic quarantine regulations, is, at best, questionable at this point. One highly improbable exception may be the Public Health Service regulation which premises jurisdiction, in part, upon control of an area by the United States as follows:

> "A person shall not import into any place under the control of the United States, nor distribute after importation, any etiological agent...unless accompanied by a permit issued by the Surgeon General." (Emphasis added.) 215/

Although "control" is not defined, it may be argued that the splashdown area in international waters is under the de facto control of the United States for the period of recovery operations. However, this involves an issue which would undoubtedly be unacceptable in most international legal fora, depending upon the type, location and extent of interference caused by the control. Further, the regulation requires a permit based upon knowledge that an individual is carrying, or is contaminated with, an etiological agent. In most recoverable missions, if not all, this can be only post facto knowledge. The same is true of the basic premise of these regulations, i. e., that the agent is a known communicable disease

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215/ 42 CFR, Chp. I, Part 71, Subpart J, Sec. 71.156(a).

when, in fact, it can be known only after laboratory examination to identify any extraterrestrial life form which might have been brought back from a space mission. 216/

Subsection (c), above, is self-explanatory to the extent that a State and a possession are well defined in international law and "foreign country" has yet to be construed as covering outer space and non-terrestrial celestial bodies. Subsection (d), above, would be applicable only to the extent that experience or previous space missions have provided the knowledge that equipment and/or personnel reasonably may be expected "to be infected with a communicable disease in a communicable stage...." For these reasons, it is submitted that necessary authority to quarantine in support of the back contamination program does not rest with the Secretary of the Department of Health, Education and Welfare.

C. AUTHORITY OF THE DEPARTMENT OF AGRICULTURE TO QUARANTINE PURSUANT TO THE BACK CONTAMINATION PROGRAM

Statutory provisions exist which authorize the Secretary of Agriculture to quarantine any "article of any character whatsoever" capable

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216/ At most, under these circumstances a determination can be made on the basis of suspicion - a ground which very likely would be insufficient for the determination. Several State courts have distinguished between probable cause for reasonable belief that a person has been exposed to a contagious or infectious disease (which a State's statute requires for quarantine) and suspicion of exposure. The courts have held that suspicion is not enough; see People v. Robertson, 134 N.E. at 815 (Ill. 1922); Ex Parte Shepard 195 Pac. 1077 (Calif. 1921); and Wragg v. Griffin, 170 N.W. 400 (Iowa 1919).

of carrying any dangerous plant disease or insect infestation, but only if he has reason to believe that the article is (not may be) infested or infected, or that the quarantine is necessary to prevent the spread of a dangerous disease or infestation. 217/

The Secretary of Agriculture also has authority to quarantine any article or animal, but no person, in order to prevent the introduction or dissemination of a contagious, infectious or communicable disease of animals. 218/ Once more, the condition precedent to the Secretary of Agriculture's exercise of quarantine authority appears to be that first he must make a determination that a contagious, infectious, or communicable disease exists.

D. CONCLUSION

From the foregoing discussions it is seen that NASA, almost solely on a pro forma basis as the ICBC representative responsible for the space mission, has promulgated the quarantine regulations, even though the question remained as to which Department or agency had the necessary legislative authority. An attempt was made, within the regulations themselves, to rely on every source of legislation that, collectively, might provide adequate authority for the regulatory action.

217/ See 7 U.S.C. 150 dd, and 160-161.
218/ See 21 U.S.C. 111-134h.

However, by evaluating the legislation relied on, it was seen that neither collectively nor severally is there proper and sufficient legislation - or other emergency sources - necessary to provide adequate authority.

VIII. LEGISLATIVE AUTHORITY FOR THE QUARANTINE OF EXTRATERRESTRIALLY-EXPOSED MATTER -- CONSTITUTIONAL BARRIERS?

A. THE CONSTITUTION, THE SUPREME COURT AND POLICE POWER

Since the Supreme Court has consistently upheld the authority of a State to make reasonable quarantine regulations under the State's exercise of its police power, and since the Court also has recognized that it would be proper for Congress to enact quarantine legislation, 219/ it is submitted that there probably would not be a constitutional bar to the enactment of such legislation. Apparently, the authority the Congress has exercised in enacting provisions such as 42 U.S.C. 264 is the authority "[t]o regulate Commerce with foreign Nations, and among the several States...." and "[t]o make all Laws which shall be necessary and proper for carrying into execution the foregoing Powers and all other Powers vested by this Constitution in the Government...." 220/

There has been no direct confrontation before the Supreme Court regarding Congressional exercise of the quarantine authority and that of the "right of the people to be secure in their persons, houses, papers, and effects, against unreasonable searches and seizures." (4th Amendment to the Constitution); the right not to "be deprived of life, liberty,

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219/ See, therefore, Compagnie Francaise v. Louisiana State Board of Health, 186 U.S. 380 (1902), and Morgan Steamship Co. v. Louisiana Board of Health, 118 U.S. 455 (1886); see, also, Benton v. Reid, 231 F. 2d 780 (D.C. Cir. 1956).

220/ Article 1, sec. 8, U.S. Constitution, U.S.C.A.

or property, without due process of law" (5th Amendment to the Constitution) and the proscription that "[n]either slavery nor involuntary servitude... shall exist within the United States, or any place subject to their jurisdiction" (13th Amendment to the Constitution).

The U.S. Supreme Court has heretofore held Constitutional various State quarantine provisions that deal with an actual communicable disease, while any proposed quarantine legislation for back contamination would not; there would be only speculation - a possibility - that contaminated materials carry communicable diseases or may otherwise endanger Earth's biosphere. Bearing this distinction in mind, the issues arise whether (1) seizure pursuant to future legislation would be unreasonable and therefore in conflict with the 4th Amendment; (2) the permitted seizure, examination, decontamination and detention of contaminated persons or property would be an arbitrary, capricious and unreasonable act with no reasonable relation to a legitimate legislative purpose and, therefore, prohibited by the 5th Amendment; (3) procedures invoked in the quarantine are not suitable and proper and thus do not meet the procedural due process requirement of the 5th Amendment; and (4) whether the quarantine of contaminated persons results in an involuntary servitude prohibited by the 13th Amendment?

B. DUE PROCESS AND THE CONSTITUTION SERVED

Responding to the question whether it is unreasonable or arbitrary to seize and otherwise deprive contaminated persons of liberty or to

deprive persons of contaminated property by quarantine, it is submitted that no reasonable person could contend at this time that Earth's immediate ecosystem is immune from the danger of extraterrestrial contamination. Precisely because the danger of contamination to Earth's biosphere is unknown, and because the possibility exists that extraterrestrial bodies may harbor communicable diseases unknown to man, it is persuasively reasonable to permit quarantine in this sui generis situation. Therefore, since the 4th and 5th Amendments proscribe unreasonable seizures 221/ and arbitrary, capricious and unreasonable acts with no reasonable relation to a legitimate legislative purpose, 222/ it is submitted that proper quarantine legislation so oriented would not violate the U.S. Constitution.

If what is required by the procedural due process aspect of the 5th Amendment is "that kind of procedure...which is suitable and proper to the nature of the case, and sanctioned by the established customs and usages of the courts," 223/ then this requirement may be met by specific and carefully drawn legislation. In brief, the procedure

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221/ Carroll v. United States, 267 U.S. 132, 147, 149 (1925).
222/ Boylan v. United States, 310 F. 2d 493, at 498-499 (9th Cir. 1962) cert. denied, 372 U.S. 935 (1963); see also Compagnie Francaise, supra note 219, at p. 393.
223/ Ex Parte Wall, 107 U.S. 265, at 289 (1883); see, also, Cafeteria Workers v. McElroy, 367 U.S. 886, 895 (1961).

envisioned would be an administrative determination based on probable cause that the person or material had been contaminated. This determination undoubtedly would be reviewable on application for a writ of habeas corpus, though the quarantined person would not be permitted to appear before the Court. 224/

If, then, a person is deprived of liberty or property with due process of law, it appears that legislation could not be successfully contested on the ground that the quarantined person is thus required to perform an involuntary servitude which is proscribed by the 13th Amendment. The argument would be specious. Insofar as a person's liberty is taken from him, it would be done with due process of law in accordance with the 5th Amendment; and insofar as the 13th Amendment proscribes involuntary servitude, no enforced compulsory service or labor would be required under such new legislation.

C. CONCLUSION

It is seen, finally, that although proper and sufficient legislative authority does not exist at present to justify the back contamination quarantine regulations, there is no real obstacle, Constitutional or otherwise, to enactment of new quarantine legislation by the Congress to accommodate the sui generis situation of contamination of Earth's biosphere by extraterrestrial matter.

224/ See 28 U.S.C. 2241 et seq. for provisions dealing with the writ of habeas corpus. See, also, United States v. Shinnick, 219 F. Supp. 789 (E.D. N.Y. 1963).

IX. PROPOSED LEGISLATION FOR THE CLARIFICATION OF EXTRATERRESTRIAL EXPOSURE QUARANTINE AUTHORITY

A. JUSTIFICATION, FORM AND SCOPE

The foregoing discussions have questioned seriously the efficacy of NASA's back contamination standards. They also have shown the unconstitutionality, and questioned the total effectiveness, of the attendant quarantine regulations. The acute issue of acceptable risk involved, and the absence of meaningful international and domestic participation in the evolution of the standards and regulations, have been discussed within (1) the framework of international legal obligations to consult with other countries, and (2) possible injunction proceedings to delay recoverable space missions until back contamination standards and quarantine provisions have been opened to public scrutiny through judicial review.

The quarantine regulations have been exposed as lacking adequate legislative authority, even for domestic application - either from a single source or from cumulative sources. This does not mean, however, that formulation of adequate legislation would be either improper or difficult. Common sense and the Outer Space Treaty dictate that responsible measures with appropriate safeguards should be adopted to protect Earth, and therefore the United States, from potential adverse effects of contamination resulting from both manned and unmanned

space activities involving extraterrestrial exposure. Toward this end, the proposed legislation, set forth below and discussed in a section-by-section analysis, would provide the Administrator of NASA with authority to promulgate and enforce necessary back contamination standards and attendant quarantine regulations with the advice and consent of the Interagency Committee on Back Contamination and the approval of the President. The legislation would authorize the President to direct any Federal department, agency, or instrumentality of the executive branch to provide appropriate and available assistance, upon request, to NASA in executing and enforcing the standards and regulations promulgated pursuant to the legislation. Further, it would provide the President with authority to implement more effectively Article IX of the Outer Space Treaty, i.e., to negotiate bilateral 225/ and multilateral agreements for requesting and accepting the assistance of, or the rendering of assistance to, any State, possession, commonwealth, territory, the District of Columbia, foreign government, or international organization, in the implementation of domestic or foreign quarantine standards and procedures.

225/ Upon inquiry of the Department of State, Office of International Scientific and Technological Affairs/Space and Environmental Affairs, whether documents were available which covered arrangements between the United States and other countries regarding overflight rights, tracking rights, etc., necessary for recovery of astronauts, this writer was informed that arrangements were, for the most part, oral in nature. Those arrangements documented were not available to the general public.

Since there (1) is no express statutory authority upon which NASA may rely to enforce its agreements with astronauts, personnel and contractor employees who may be exposed to extraterrestrial contamination, and (2) are no guidelines for Executive implementation of quarantine procedures which could be applied extraterritorially to non-U.S. citizens and property, the need for comprehensive legislation is imperative. It should be recognized that regardless of the procedural and physical security measures undertaken by NASA to confine back contamination to NASA astronauts, employees and others under contract, there are easily foreseeable situations in which unauthorized persons, intentionally or inadvertently, may be exposed to extraterrestrial contaminants. Further, there is always the problem of a foreign citizen being exposed to a "spill", or some other form of extraterrestrial contamination, thereby providing a "leak" in the safeguard procedures through the inapplicability of quarantine requirements.

In all of these and similar hypothetical instances discussed throughout the present evaluation of the back contamination standards and quarantine regulations, the serious issue exists whether, in the absence of self-evident harmful effects to Earth's ecosystem by extraterrestrial exposure, a person or thing can be quarantined against his will or the will of the owner. The proposed legislation, set forth below, is designed to mitigate the acuteness of the issue by providing the authority necessary for NASA's Administrator and the President to deal with these

situations in a reasonable manner, both domestically and within the context of present international political realities.

B. DRAFT LEGISLATION AND SECTIONAL ANALYSIS

The proposed bill reads as follows:

A BILL

To amend the National Aeronautics and Space Act of 1958, as amended, to protect the United States and Earth from harmful contamination and adverse changes in the environment resulting from the introduction of extraterrestrially-exposed persons and matter, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That section 103 of the National Aeronautics and Space Act of 1958, as amended (42 U.S.C. 2452) is amended by adding at the end the following three subsections:

* * * *

103(3) The terms "Administration" and "Administrator" mean, respectively, the National Aeronautics and Space Administration, and the Administrator of the National Aeronautics and Space Administration or his authorized representative.

103(4) The "Interagency Committee on Back Contamination" (ICBC) means that Committee established under the auspices of the

National Academy of Sciences, effective August 24, 1967, consisting of one voting representative from the Department of Health, Education and Welfare, the Department of the Interior, the National Academy of Sciences, the Department of Agriculture, the Department of Justice, and the Department of State, who shall be permanent members, and any other instrumentality of the Executive branch that the President determines is essential to the full consideration, and promulgation, of back contamination standards and quarantine regulations. The ICBC also shall consist of one non-voting representative each from the Committee on Space Research and the World Health Organization, expert organizations of the United Nations, and one non-voting representative from any other international organization which the President determines is essential to the deliberations of the ICBC. All such non-voting representatives shall participate directly in consulting capacities for all business of the ICBC which the representatives of the National Aeronautics and Space Administration and the Department of State jointly determine, in consultation with the Department of Defense, is not of a classified nature.

103(5) The term "extraterrestrially contaminated" means the state or condition of any person, property, animal, or other form of life or matter whatsoever, who or which has been exposed:

(a) directly to the surface of the moon or of any other celestial body without having a predetermined acceptable level of protective

clothing or shielding; or

(b) directly to any non-Earth atmospheric or outer-space environment which the ICBC determines scientifically, or through predictive models, is likely to bring any person, property, animal, or other form of life or matter whatsoever into contact with known alien etiologic agents or which will surpass a probability level of direct contact as established by the ICBC in consultation with international organizations; or

(c) directly or indirectly to any person, property, animal, or other form of life or matter whatsoever who or which is extraterrestrially contaminated according to subsections 103(5)(a) and 103(b), immediately preceding.

103(6) "United States" means, for purposes only of subsection 203(b)(2) through 203(b)(10), inclusive, the States, the District of Columbia, the Commonwealth of Puerto Rico, the Canal Zone, the U.S. Virgin Islands, Guam, American Samoa, the Trust Territory of the Pacific Islands, and any other territory or possession of the United States, and all other airspace, waters, or land subject to total de facto control, as established by the ICBC, and which are located outside the United States, as defined herein, for the duration of recovery phases of specified space missions.

103(7) "Quarantine" means the detention of any person, property, animal, or any other life form or matter whatsoever, or the geographic isolation of any land, water, and airspace as defined in section 103(6), herein, for such time and in such reasonable manner as may be determined necessary by NASA, as published in the form of regulations and promulgated pursuant to the public rule-making provisions of the Administrative Procedure Act of 1946, as amended, upon the advice of the ICBC and with the approval of the President.

Analysis

It is not essential that the quarantine authority be implemented through amendment of existing legislation, i.e., the Space Act of 1958. Quite legitimately, and perhaps with more drafting ease, the authority could be established in the form of a separate Act. However, for present purposes, amendment of the Space Act is both logical and helpful, since (1) quarantine regulations and procedures will, of necessity and for the present, be parochial in scope, and (2) in the absence of total international participation in the promulgation of back contamination standards and quarantine procedures, and in view of total NASA control over all U.S. civilian space missions which have complete operational integration with available quarantine facilities, the logical location for quarantine legislation delineating the Administrator's responsibilities and authority is in the Space Act of 1958. With increasing, substantive international participation, it may well be that a separate Act would be

necessary, placing both policy and operational authority in the Department of Health, Education and Welfare and/or the Department of Agriculture. Another likely alternative would be an independent bureau or agency which also could interface with the World Health Organization as that entity becomes more a participant in the back contamination standards and quarantine rulemaking procedures.

The new definitions under section 103 are very important since they are, in part, the mechanisms upon which back contamination standards and quarantine regulations are opened for public scrutiny and substantive participation. Subsection 103(3) is simply pro forma, since the definitions of "Administration" and "Administrator" do not appear in the Space Act of 1958, as amended. However, subsection 103(4) defines the ICBC and provides for international participation, albeit with no voting rights and subject to essential, but minimal, control over information determined by NASA and the Department of State, in consultation with (not consent of) the Department of Defense, to be classified in nature.

Subsection 103(5) defines the operative term "extraterrestrially contaminated." This definition differs from that in the existing regulations in two principal ways. The first is exemption from application of the regulations of anyone or thing coming in direct contact with the surface of a non-Earth celestial body who or which is adequately

(i.e., completely) insulated. In the context of present space mission technology, this change, for the most part, is clarifying in nature. The second principal difference is extension of contamination coverage to outer space and to non-Earth atmospheric environments which the ICBC determines will cause contact with alien etiologic agents or which will surpass an established probability level of direct contact. Further, by definition the ICBC would assume both planning and operational roles, rather than one which is designed simply for providing advice and giving approval on a "before-the-fact" basis. Concisely, as elaborated upon in subsequent sections, the purpose is to remove back contamination problems from final consideration by NASA, alone, and place them with at least a quasi-independent entity that has the direct benefit of international, as well as domestic, public expertise.

Subsection 103(6) includes in the definition of "United States" non-sovereign territory, water, and airspace, the control of which the ICBC determines is essential to implement back contamination standards and quarantine procedures for a specific mission. Subsection 103(7) simply defines "quarantine" and constrains promulgation of quarantine requirements to (1) publication as regulations pursuant to public rule-making procedures of the Administrative Procedure Act, (2) advice of the ICBC, and (3) approval of such requirements by the President. The last constraint arises principally from the uniqueness of quarantine procedures to accommodate extraterrestrial exposure, i.e., the absence of knowledge about, or the existence of, Earth-alien pathogens and non-living matter which could provide a setting for easy abuse of the quarantine concept.

Sec. 2.

Subsection 203(b) is amended by inserting, after subsection 203(b)(1), the new provisions set forth below, and renumbering existing subsections 203(b)(2) through 203(b)(14) as 203(b)(11) through 203(b)(21).

203(b)(2). The Administrator, with the advice of the ICBC and approval of the President, is authorized to promulgate and enforce (with specific due regard for 5 U.S.C. 553-558, inclusive, and applicable international law) those quarantine regulations which are necessary to protect the United States and Earth from harmful effects resulting from exposure to any extraterrestrially contaminated person, property, animal or other form of life or matter whatsoever. In emergency situations where it is impractical to seek advice of the ICBC, the Administrator may, with the approval of the President, apply quarantine procedures which in his judgment are necessary to ensure protection of the United States and Earth, consistent with international law. Under no circumstances will the emergency quarantine procedures apply beyond ten consecutive days without review and approval by the ICBC.

Analysis

Of primary importance in subsection 203(b)(2) are (1) the requirement to promulgate regulations in accordance with the spirit and intent of the Administrative Procedure Act (timely publication and procedures for public participation in rule making, i.e., 5 U.S.C. 553 through 558), and (2) the provision for application of quarantine procedures which have not been subject to APA requirements because of an emergency situation. In recognition of the fortuitousness of such emergencies and the possibility of a relatively time-critical decision being required, the advice of the ICBC is not required. However, Presidential approval is mandatory, principally on the assumption that his deliberations would not be as time-consuming as those of the ICBC, and also on the assumption that the President's personal review and approval would minimize the possibility of abuse of the emergency quarantine authority.

It should be noted, also, that implementation of all quarantine regulations must be consistent with international law. This would not only prohibit implementation of such regulations in those non-sovereign areas, and under those circumstances, which customary or treaty law has determined inappropriate for unilateral application of sovereign jurisdiction, but also would permit - perhaps encourage - bilateral and multilateral arrangements to facilitate, throughout the political world, the safeguarding of Earth from adverse effects of extraterrestrial contamination. This requirement also constrains appropriately the definition

given under proposed subsection 103(6) for the "United States." In any event, it would necessitate a closer view of Article IX of the Outer Space Treaty by the United States as a Contracting Party to determine precisely how much international participation is required by that Treaty in the formulation of back contamination standards and quarantine procedures for U.S.(or U.S.-involved) space missions.

Finally, under no circumstances will emergency quarantine procedures be applied beyond a period of ten days without the ICBC's review and approval. This provision is consistent with the more cautious, and perhaps more realistic, regulatory authority deriving from a few State legislatures as a means of accommodating those situations in which Constitutional guarantees must, of necessity, be compromised.

Sec. 3.

203(b)(3). The Interagency Committee is hereby authorized to select a competent staff of experts necessary to execute the duties and responsibilities of the Committee. There are authorized to be appropriated such sums as may be necessary to carry out the provision of this subsection.

Analysis

This subsection is self-explanatory, providing both for ICBC staffing and the necessary attendant appropriations.

Sec. 4.

203(b)(4). The rules and regulations issued pursuant to subsection 203(b)(2) may provide for:

(i) the apprehension, physical examination, detention, quarantine or conditional release of any person determined by the Administrator or his authorized representative to be extraterrestrially exposed. Such person, in accordance with the authority granted in subsection 203(b)(2), may be detained or quarantined in a manner determined reasonably necessary in view of the known or unknown contaminants. Such detention or quarantine shall not exceed thirty consecutive calendar days calculated from the last known date a person, property, animal or any other form of life or matter whatsoever, is contaminated. Provided, that if the extraterrestrially-contaminated person suffers from a condition resulting from such contamination and which the President determines would be harmful to the United States or Earth if such person were released from quarantine, then the President shall direct by executive order that quarantine be continued until such time and in such reasonable manner as may be necessary. This provision in no way affects subsection 203(b)(2) as it relates to emergency situations wherein review and approval of the quarantine by the ICBC is necessary to extend such quarantine beyond ten consecutive days.

(ii) except with respect to persons, the seizure, inspection, quarantine, fumigation, disinfection, sterilization and destruction of property, animals, or other form of life or matter whatsoever in any situation where the Administrator or his authorized representatives determine there is probable cause to believe that such form of life or matter is extraterrestrially contaminated;

(iii) quarantine facilities, essential grounds, and anchorages within the United States, and at any point outside the United States as defined in subsection 103(6) which the President, through bilateral agreements, or multilateral treaty arrangements with the advice and consent of the Congress, may so designate;

(iv) the quarantine, in a reasonable manner and with the advice of the ICBC and approval of the President, of any area of the United States, or anywhere on Earth if consistent with international law, when there is good and sufficient cause to believe that such area is extraterrestrially contaminated; and

(v) the holding of hearings, by the Administrator with or without participation of the ICBC, at times and in a manner he determines desirable and necessary to assist in the execution of his duties, and for the purpose of creating a record for use in making any determination pursuant to subsections 203(b)(2)-

203(b)(9), inclusive, or for the purpose of reviewing any such determination.

Analysis

The nature of subsection 203(b)(4) is permissive, providing examples of the types of rules and regulations that may be promulgated and enforced consistent with the authority which would be granted by the proposed amendments. Such rules and regulations are largely self-explanatory and, in part, are somewhat analogous to authority legislated for the Secretaries of Health, Education and Welfare, and of the Department of Agriculture. 226/

Except in emergency situations, the duration of quarantine shall extend to, but not exceed, thirty consecutive days from the last date of extraterrestrial exposure. The period of thirty days is not altogether arbitrary. It allows a reasonable time, beyond the normal 21 day incubation period for most Earth-indigenous microbial diseases known to reach epidemic proportions, to accommodate potential extraterrestrial microorganisms or matter which might manifest latent adverse effects. Presumably, such adverse effects are likely to become evident within a period of thirty consecutive days. If it is determined during or at the end of thirty days that the contamination is harmful and classifiable by

226/ See, therefore, 7 U.S.C. 150dd, 160-161 and 164a; 20 U.S.C. et seq.; and 42 U.S.C. 264 and 267(a).

the Department of Agriculture and/or of Health, Education and Welfare as a communicable disease, then those Executive Departments may, of course, invoke their own respective quarantine authorities and continue the detention in the manner, and for the duration, prescribed by their rules and regulations. However, if the harmful effects continue and the etiology cannot be determined to be communicable in nature, then the President may, by executive order, continue the quarantine for such time and in such manner as may be reasonably necessary to ensure the safety of the United States and of Earth against a premature release of the contaminated subject.

Authority also is provided the President by subsections 203(b)(4)(iii) and (iv) to make formal and informal arrangements to facilitate an effective back contamination program world-wide. These provisions, by their permissive nature, would provide encouragement to the executive branch to seek international agreements and treaties for implementing a broadly applicable back contamination program (within the recognized constraints of classified information and national security of all countries which might participate).

Sec. 5.

203(b)(5). The Administrator may administer oaths and affirmations; take, or have taken, depositions; and require, on his own motion and by subpoena, the attendance and testimony

of witnesses, as well as the production of documentary evidence relating to any matter pending before him under the authority of subsections 203(b)(2)-203(b)(8). In the event of contumacy or failure to obey a subpoena, any district court of the United States within the jurisdiction of which said person guilty of contumacy or refusal to obey is found or resides or is domiciled or transacts business, upon application of the Attorney General, shall have jurisdiction to issue to such person an order requiring such person to appear before the Administrator, there to produce documentary evidence if so ordered, or there to give testimony touching the matter under investigation; and any failure to obey such order of the court may be punished by said court as a contempt thereof.

Analysis

For the most part, this subsection follows the pattern of 42 U.S.C. Supp. IV 1973g(c), and 5 U.S.C. Supp. IV 304, 556(c), which respectively, (1) provides for the subpoena power of the Civil Service Commission and a contempt penalty for contumacy and refusal, and (2) describes the subpoena power and procedures, therefor, of heads of an executive department, military department, or bureau thereof, and also delineates powers of employees - subject to published rules and regulations - in conducting a hearing of record.

Exercise of authority granted in this subsection may be essential, for example, in the determination whether a person, animal, or thing has been extraterrestrially contaminated, either directly or indirectly on a successive basis pursuant to the definition of "extraterrestrial exposure." Further, authority is provided through these procedures for the Administrator to determine where the alleged contaminee is located. Finally, the Administrator is authorized at his discretion to hold hearings of record for any matter that is properly within his sole responsibility in accordance with subsections 203(b)(2)-203(b)(8).

Sec. 6.

203(b)(6). The Administrator shall employ a staff of quarantine inspectors who shall be expert in the area of extraterrestrial contamination and attendant quarantine procedures. The membership of the staff shall be subject to the review and approval of the United States Public Health Officer. Any properly identified quarantine inspector is authorized, when so directed by the Administrator: (i) to stop and inspect, without a warrant, any person, property, animal, or other form of life or matter whatsoever, moving into the United States [as defined in subsection 103(b), herein] or in interstate commerce in order to determine whether he or it is extraterrestrially contaminated. The quarantine inspector must have adequate reason and sufficient cause to believe that the person, property, etc., stopped and inspected is

likely to be extraterrestrially contaminated; and (ii) to enter, with a warrant, any premise in the United States [as defined in subsection 103(b), herein] and to conduct any inspections and make any seizures necessary pursuant to rules and regulations promulgated according to the authority provided in subsections 203(b)(2)-203(b)(8), inclusive. Any judge of the United States or a court of record of any State, commonwealth, territory or possession, or a United States Commissioner or a United States magistrate, within his respective jurisdiction and upon proper oath or affirmation showing probable cause to believe that there is on certain premises an extraterrestrially-contaminated person, property, animal, or other form of life or matter whatsoever, may issue warrants for the entry of such premises to make any inspections or seizures provided for by the rules and regulations promulgated according to subsections 203(b)(2)-203(b)(7), inclusive. Such warrants may be executed by any authorized employee of the Administration.

Analysis

This subsection is clear and self-explanatory, and closely follows, for the most part, 7 U.S.C. 150ff and 164a, which provide, respectively, for inspections, seizures and the issue of warrants regarding quarantine authority and procedures of the Department of Agriculture, and for interception, without a warrant and under specified conditions, of certain plants moving into the United States or in interstate commerce.

Reference to magistrates is an accommodation of 28 U.S.C. Supp. IV 636, which provides, in part, that "[e]ach United States magistrate [appointed pursuant to 28 U.S.C. Supp. IV 631]...shall have within the territorial jurisdiction prescribed by his appointment...such additional duties as are not inconsistent with the Constitution and laws of the United States."

Sec. 7.

203(b)(7). The President is authorized to direct any Federal agency or department in the executive branch to assist the Administration, through the use of its personnel, equipment, supplies, facilities and other available resources which may be appropriate, in the execution of the quarantine-related authority, rules and regulations deriving from subsections 203(b)(2)-203(b)(7). The President may also direct that such assistance be made available, upon appropriate request and in such agreed manner, to countries with whom the United States has agreements or treaty arrangements covering the facilitation of a mutually-agreed international extraterrestrial back contamination and quarantine program. In either situation, when a Federal agency or department is so directed, the Administrator may invest the necessary employes of such agency or department with the same authority and concomitant protection provided in subsections

203(b)(2)-203(b)(8), or rules and regulations issued pursuant thereto, that may be invested in employees of the Administration. Such services, personnel, facilities, and equipment may be made available on a reimbursable basis. Any funds received by Federal agencies as reimbursement for use of its personnel, equipment, supplies, facilities and other available resources shall be deposited to the credit of the appropriation or appropriations currently available therefor. Any appropriations presently available, or that will be made available, to the Administration shall be used as necessary to assist in defraying the expenses of enforcing the quarantine rules, regulations, and other authority provided for in subsections 203(b)(2)-203(b)(8), inclusive.

Analysis

This subsection is patterned, in part, on 42 U.S.C. 2473a(6), which provides that the National Aeronautics and Space Administration shall "...use, with their consent, the services, equipment, personnel, and facilities of Federal and other agencies with or without reimbursement...." Such Federal and other agencies are directed to cooperate fully with the Administration in making such services, equipment, personnel, and facilities available. The subsection is supported further by 31 U.S.C. 686 which deals with expenditures for telegraph and telephone communication. Other legislation serving both as a pattern and

as supporting authority for this subsection are 42 U.S.C. 243, which provides that the U.S. Surgeon General may accept or render any necessary and available assistance to and from State and local authorities in the enforcement of quarantine regulations issued pursuant to 42 U.S.C., Subchapter II of Chapter 6A, and 50 U.S.C. 2292, which provides that Federal agencies and departments, at the direction of the President and under specified emergency conditions, shall assist States in confronting such conditions. Existing subsection 203(b)(6) of the Space Act of 1958 provides for such loans and services among private and governmental entities, but it was decided that for purposes of quarantine authority a separate provision should be proposed.

With respect to the provision for NASA and other Federal agencies and departments, at the direction of the President, to render assistance to, and accept it from, foreign countries in furtherance of the extraterrestrial quarantine authority, additional supporting authority may be found in the existing Space Act of 1958. Subsection 102(c)(7) [42 U.S.C. 2451(c)(7)], provides that "aeronautical and space activities of the United States shall be conducted so as to contribute materially to...

> (7) Cooperation by the United States with other nations and groups of nations in work done pursuant to this Act and in the peaceful application of the results thereof...."

Further, section 205 provides that

"[t]he Administration, under the foreign policy guidance of the President, may engage in a program of international cooperation in work done pursuant to this Act, and in the peaceful application of the results thereof, pursuant to agreements made by the President with the advice and consent of the Senate."

Sec. 8.

203(b)(8). Any person who violates any rule or regulation issued pursuant to authorization in subsections 203(b)(2)-203(b)(7), inclusive, or who enters or departs the limits of any quarantine station, ground or anchorage in disregard of quarantine rules and regulations, or without permission of the quarantine inspector, officer, or other proper official in charge, or who violates any rules or regulations deriving from an international agreement or treaty dealing with quarantine of extraterrestrially-contaminated objects, persons, or other life forms for which an appropriate sanction is not otherwise provided, shall be subject to a fine of not more than $5,000, or to imprisonment not to exceed one year, or both.

Analysis

This subsection is self-explanatory and patterned largely on 18 U.S.C. 799 [Sec. 304(c) of the Space Act of 1958], which provides that violation of any regulation of the National Aeronautics and Space Administration shall be a misdemeanor.

Sec. 9.

203(b)(9). a. Any claim for money damages against the United States arising out of an act or omission of any Government

employee or agent while acting within the scope of his employment, office, or agency, pursuant to subsections 203(b)(2)-203(b)(8), or the rules and regulations deriving therefrom, shall be governed by, and disposed of in accordance with, the provisions of Chapter 171 of Title 28, and subsection 2473(b)(13) of Title 42, except that:

(i) for the purposes of subsections 1346(b), 2672, and 2675 of Title 28, any injury or loss of property or personal injury or death sustained as a result of the enforcement, operation or execution of the authority provided in subsections 203(b)(2)-203(b)(8), herein, or the rules or regulations deriving therefrom, which has been caused by an act or omission of an employee or agent of the Government acting within the scope of his employment, office, or agency, shall be deemed to have been caused by the negligent or wrongful act or omission of an employee or agent of the Government;

(ii) Subsection 1346(b) and Chapter 171 of Title 28, and subsection 2473(b)(13) of Title 42, shall apply to claims for money damages arising from actions or conduct pursuant to subsections 203(b)(2)-203(b)(8), herein, and which are described in subsections 2680(a) and (f) of Title 28, or which arise out of false imprisonment as described in subsection 2680(h) of Title 28; and

(iii) In determining solely the circumstances where the United States, if a private person, would be liable to the claimant in accordance with the law of the place where the act or omission occurred, this subsection 203(b)(9) a.i. and ii. shall not be applicable.

b. The remedy against the United States provided by sections 1346(b), 2672, and 2675 of Title 28 and section 2473(b)(13) of Title 42, for damages for any injury or loss of property or personal injury or death, arising out of an act or omission of any Government employee or agent while acting within the scope of his employment, office,or agency pursuant to subsections 203(b)(2)-203(b)(8), herein, or rules or regulations deriving therefrom, shall be exclusive of any other civil action or proceeding by reason of the same subject matter against such employee or agent whose act or omission gave rise to the claim.

c. Subsection 203(b)(9)a., above, shall not be applicable to any claim for money damages for injury or loss of property or personal injury or death arising out of a willful violation of any rule or regulation issued pursuant to subsections 203(b)(2)-203(b)(8), herein.

Analysis

Subsection 203(b)(9)a. is based upon the Federal Tort Claims Act (28 U.S.C., Chap. 171) and the NASA provision for administrative settlement of claims [42 U.S.C. 2473(b)(13)] as the devices for compensating persons for injury or loss of property or personal injury or death sustained as a result of the enforcement and execution of the quarantine authority provided by the bill. Three exceptions are made to the provisions of the Federal Tort Claims Act and the NASA settlement provision. In paragraph 203(b)(9)a.i. provision is made for the conclusive presumption that if harm results from an act or omission of a Government employee or agent (the latter of which is intended to accommodate those persons directed by the President to render assistance and services in furtherance of the objectives of the quarantine authority) while acting within the scope of his employment, office or agency pursuant to the authority provided by the bill, or the rules and regulations deriving from such authority, the harm shall be deemed to have been caused by the wrongful or negligent act or omission of the employee or agent. On the other hand, this does not necessarily mean that the person harmed will have a cause of action under the law of the place where the act or omission occurred; nor does it prevent the Government from raising the defense that the employee or agent was not acting within the scope of his employment, office or agency, or that an exception provided in 28 U.S.C. 2680 is applicable.

As an alternative approach to subsection 203(b)(9)a., a provision could be drafted providing for a form of administratively-determined compensation or indemnification based upon 10 U.S.C. 2354, 21 U.S.C. 134a(d), 38 U.S.C. 216, 42 U.S.C. 2210 and E.O. 10789, 14 Nov. 1958, as amended, which implements 50 U.S.C. 1431. 227/

In paragraph 203(b)(9)a.ii., four defenses, whether considered jurisdictional in nature or not and normally available to the Government, are eliminated [i.e., the two defenses available in 28 U.S.C. 2680(a), generally referred to as the discretionary fund, the defense in 28 U.S.C. 2680(f), which is the quarantine exception, and the defense in 28 U.S.C. 2680(h) that deals with claims arising out of false imprisonment]. The remaining exceptions in 28 U.S.C. 2680(h) would be applicable to actions brought under the authority proposed in this bill, as well as under the rules and regulations deriving from that authority. The net effect of subsection 203(b)(9)a.ii. would be the availability of an action brought by a person for compensation if, for example, the harm is caused by a Government employee or agent who exercises due care in the execution of his responsibilities pursuant to the authority granted; or if the harm is caused by the exercise or performance, or failure to exercise or perform a discretionary function or duty; or if the harm

227/ In this respect, see also Frankel, Preventative Restraints and Just Compensation: Toward a Sanction Law of the Future, 78 Yale L. J. 229, 256 (1968).

arises directly from the imposition or establishment of a quarantine by the United States; or if such harm is the consequence of false imprisonment.

Paragraph 203(b)(9)a.iii. is designed to accomplish several purposes. First, it is intended to ensure that no argument will be made that the United States, considered a private person, would be privileged or otherwise immune from liability because a statute (i.e., the authority which would be granted in the proposed amendments) required that the "private person" act or fail to act, thereby causing the damage which serves as the basis of a complaint. Concisely, it strikes any vestige of law which would immunize or make privileged an act performed by a private person in the execution of a law. Second, this provision would supplement the conclusive presumption, set forth in subsection 203(b)(9)a.i., that the act or omission causing damage is deemed a wrongful act or omission. This would be accomplished by use of a fiction that the proposed amendments were not in force and could not be relied upon by the Government employee or agent whose act or omission caused the damage. Third, this provision would ensure that the United States is not designated improperly as the "good samaritan" by virtue of the proposed amendments, i.e., one who has volunteered to be conclusively liable for protecting the public from the danger of extraterrestrial contamination. Finally, section 203(b)(9)a. is in no manner intended to preclude actions for

compensation against the United States that may be brought under other law; for example, 28 U. S. C. 1491.

Subsection 203(b)(9)b. renders the remedy provided in subsection 203(b)(9)a. against the United States exclusive, so that no Government employee or agent acting within the scope of his employment or office pursuant to the proposed amendment, or rules and regulations deriving therefrom, would be liable personally for the consequences of an act or omission.

Subsection 203(b)(9)c. provides that if any injury, loss, or death arises from a willful violation (i. e., an act or omission where the person responsible or his principal knew that such an act or omission was a violation) of any rule or regulation deriving from these amendments, the remedy in subsection 203(b)(9)a. would not be available to him or his successors in interest.

Sec. 10.

203(b)(10). Any determination made under the authority of subsections 203(b)(2)-203(b)(8), inclusive, or any rule or regulation deriving therefrom that results or will result in the detention or quarantine of a specific person or property, shall be reviewable, as appropriate, on application for a writ of habeas corpus as provided in Chapter 38 of Title 28, United States Code, or on application to a proper Federal court for

injunctive relief. Any other provision of law notwithstanding, the body of the person or the property which has been detained or quarantined shall not be required to be produced at an attendant hearing, nor shall it be discharged from detention or quarantine pending the court's final order or judgment; nor shall it be discharged pending a review of that order or judgment on appeal.

Analysis

In this subsection the fact is made explicit that any determination to detain or quarantine a specific person or property as being suspected of extraterrestrial contamination, may be reviewed on application for a writ of habeas corpus or for injunctive relief. With respect to a writ of habeas corpus, this subsection would, of necessity, qualify the procedure by ensuring that the person or property would not be discharged on recognizance, bail, bond, etc., pending a final order or judgment, or pending a review of that order or judgment on appeal. Further, injunctive relief would be constrained to selective conduct or restraints on the part of the Government - in the absence of an adequate showing that detention or quarantine is justified - to ensure a continuing effectiveness of quarantine procedures being applied.

X. EPILOGUE

Based on a casual understanding of the problem, it may appear that intense concern with protecting the United States and Earth from unknown extraterrestrial life-forms or matter, as well as the unknown debilitating effects and disruptions of Earth's ecosystem, is a very questionable concern at most - an embarrassing interest at the least. However, the ensuing reiterative, but compact, listing of issues discussed at length, herein, strongly indicates those issues, as well as attendant procedures, are broad in scope and of impelling international as well as domestic concern. The principal issues, for the most part self-explanatory, are:

A. Whether all steps possible (as opposed simply to all reasonable steps) should be taken to protect against unknown consequences which might arise from experimentation with a largely unknown environment;

B. Whether, in fact, all proper steps were taken unilaterally by the United States to protect Earth's ecosystem from adverse effects of extraterrestrial back contamination;

C. Whether all peoples potentially affected by contamination of Earth's biosphere, or disruption of its total ecosystem, should be able to participate directly (including effective representation) in the decision-making processes surrounding the establishment of back contamination safeguards

and quarantine procedures, i.e., in adoption of the level of adequacy accepted for assurance of their safety;

D. Whether domestic politics and international politics of an ostensibly noncritical nature (man-on-the-moon by 1970) are reasonable and sufficient grounds to deny effective [indeed any] international participation in formulating procedures and laws which may, and will, apply to international seas, airspace, nonsovereign territory, and very likely, foreign territory and citizens;

E. Whether, in areas of questionable scientific experience, all members of the public likely to be affected by adverse consequences of scientific experimentation should have standing to sue, either individually or in class actions, for injunctive relief; and whether in such circumstances of unknown consequences a temporary injunction should be granted, sufficient in duration to permit full public analysis and evaluation of the activity enjoined - even if the Federal Government is the enjoined party.

F. Whether, in fact, many Federal agencies and departments of the executive branch are abusing seriously the public rule-making requirements of the Administrative Procedure Act by relying on the exception to notice and public

participation (i.e., "impractical and contrary to public interest") in those situations in which the public clearly is interested, but in which the promulgating agency's interest (often quite parochial) would be compromised by public participation;

G. Whether international organizations, such as the World Health Organization and other appropriate expert agencies of the United Nations, are properly structured to accommodate realistically the impelling international requirements arising from the unilateral conduct of a member nation (i.e., whether the deliberative machinery of the organization is sufficiently efficient not to discourage a nation or region from relying on that forum in critical and noncritical, everyday situations);

H. Whether quarantine regulations promulgated by the United States are applicable outside the territorial jurisdiction of the United States, and whether Article IX of the Outer Space Treaty obligates contracting parties to assist the United States in the extraterritorial application of those regulations;

I. Whether the National Aeronautics and Space Administration, or any other governmental entity in the United States,

can promulgate and implement quarantine regulations without specific legislative authority; and

J. Whether the health, welfare and security of the United States required the rapid promulgation, publication, and implementation of the quarantine regulations with minimal, if any, public participation therein.

From these questions, it can be seen that the overall issue of back contamination standards and quarantine procedures for the protection of Earth from adverse effects of extraterrestrial contaminants is not only critically important in its own right (particularly in view of the rapidly increasing, independent capabilities of new nations to participate in significant space activities), it also is very symptomatic of technological advances by one nation, or a select group, which precipitate unique situations with multinational consequences, but in which the affected nations have little or no influence. Since this appears to be an unfortunate facet of international, political reality, and since nations are not yet prepared to share the responsibility with other nations regarding the use of innovative technology, it appears that effective consideration of back contamination standards and quarantine procedures in an appropriate international forum is foreclosed for the present.

For these reasons, the legislation, proposed herein, providing for United States domestic quarantine authority, also provides for

significant international participation in the formulation of standards and procedures pursuant to that authority. If, in fact, such participation is not effective (because - among other issues - certain essential information is of military significance at present and, hence, unavailable to non-U. S. participants), the proposed restructuring for the Interagency Committee on Back Contamination would at least provide potential international expertise necessary for the time when consideration of extraterrestrial contamination problems is shifted to an international authority.

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APPENDICES

APPENDIX A

Set forth below are reports covering the first CETEX meeting (The Hague, May 12-13, 1958) and the second meeting of CETEX (The Hague, March 9-10, 1959). A memorandum dealing with the formation of CETEX, and issuing from the Secretary General of the International Council of Scientific Unions to the Secretaries of several international professional organizations, also is included for reference.

* * * * * *

CONSEIL INTERNATIONAL DES UNIONS SCIENTIFIQUES

INTERNATIONAL COUNCIL OF SCIENTIFIC UNIONS

Paleis Noordeinde,
THE HAGUE.

To: The Secretaries of IAU, IUGG, IUPAC, IUPAP, IUBS, IUPS, IUB.

From: The Secretary General ICSU.

Subject: Formation of an ad hoc Committee on Contamination by Extra-terrestrial Exploration (CETEX)

1. The Bureau of ICSU, at its Nineteenth Meeting, Paleis Noordeinde, The Hague, March 3-5, 1958, had before it the attached Resolution of the Council of the National Academy of Sciences of the United States.

2. The Bureau agreed unanimously to the formation of an ad hoc Committee to study this problem, which should frame its Report by July 1st 1958 for circulation to all National and Scientific Members of ICSU, prior to its consideration by the Executive Board and General Assembly at Washington.

3. Professor Marcel Florkin, Liege, was appointed Convenor; and in view of the urgent need for prompt action, the Bureau nominated a small Sub-Committee, consisting of the President, Treasurer, and the Convenor CETEX, to meet in Brussels immediately after the close of the Bureau meeting, to draw up a tentative list of members who might serve on the ad hoc Committee, which list should take account at once of the interests of the Unions and of a balanced geographical distribution.

4. I attach the list, as submitted to me by the Convenor

(Sgd.) H. SPENCER JONES
Secretary General

17 March 1958.

Resolutions adopted by the Council of the National Academy of Sciences on 8 February 1958

The launching of IGY satellites has opened space to exploration. Accordingly, attempts to reach the moon and planets can be anticipated, with reasonable confidence, within the foreseeable future.

The National Academy of Sciences of the United States of America urges that scientists plan lunar and planetary studies with great care and deep concern so that initial operations do not compromise and make impossible forever after critical scientific experiments. For example, biological or radioactive contamination of extraterrestrial objects could easily occur unless initial space activities be carefully planned and conducted with extreme care.

The National Academy of Sciences will endeavour to plan lunar or planetary experiments in which the Academy participates so as to prevent contamination of celestial objects in a way that would impair the unique and powerful scientific opportunities that might be realized in subsequent scientific exploration.

The Council of the National Academy of Sciences of the United States of America urges the International Council of Scientific Unions to encourage and assist the evaluation of possibilities of such contamination and the development of means for its prevention. The Council of the Academy also requests the International Council of Scientific Unions to do whatever else it may to preserve and foster the unaffected potentialities of space research.

Summary Record of CETEX Meeting

Paleis Noordeinde - The Hague
12 - 13 May 1958

1. THE MOON'S ATMOSPHERE The Moon's atmosphere contains only a small amount of matter, estimates range from 10 to 100 tons and is therefore extremely vulnerable to contamination. The release on the surface of any amount of volatile material within this range of magnitude such as might be given off from explosions of T.N.T. [x] for marking purposes is likely to alter the atmosphere for very long periods as it will probably take some years for the products to escape from the moon's atmosphere. Another factor which a change in the lunar atmosphere might bring about is an upset in the thermal equilibrium and careful computation will be required before the magnitude of this effect can be assessed. The possibility that the impact of a rocket vehicle may already be sufficient to alter the atmosphere by releasing trapped gases was rejected because the moon surface must occasionally be subject to bombardment by heavy meteorites.

The release of any chemical marker on the moon surface is therefore objectionable if it involves tons of material and if it has to be done, a flare releasing material quite unlike that normally present in the

x The explosion of a nuclear device would of course be even more harmful in this respect but its use must be rejected for other reasons given below.

lunar atmosphere should be used so that in subsequent investigations it can be clearly recognized as a contaminant introduced by man. Both in this connection and because of increased ease in detection a flare produced by burning metallic sodium in chlorine or bromine should be considered. The sodium D lines could be detected at low intensities if a monochromator is used to cut out scattered light of other wavelengths. Probably the quantity of material required to be visible through a telescope, though not to the naked eye, would be insufficient to cause serious contamination of the atmosphere. Even so this type of flare cannot be accepted until the possibility has been ruled out that the ionization of the sodium atoms by releasing electrons would not disturb the 'lunar ionosphere' which may be more susceptible than the lunar atmosphere.

Finally the moon's atmosphere will almost certainly be spoilt once measuring instruments are landed, since this requires deceleration which in the present state of the art would involve the release of chemical propellants in ton amounts.

From the foregoing it is clear that detailed exploration can very easily spoil the lunar atmosphere which should, if at all possible, be studied in the initial phases by objects which circuit the moon. Priority should be given to such studies and the committee urges that no flares be lit until information about the atmosphere has been obtained, or until it has been shown that an orbit sufficiently close to the moon cannot be

attained. An accidental hit by a vehicle which has failed to orbit would probably not be serious, since the moon's surface must occasionally be subject to bombardment by heavy meteorites and the release of trapped gases by impact will not therefore cause a departure from natural conditions.

2. MOON DUST The chemical composition of the dust on the moon's surface is of the greatest interest to a wide range of sciences. Knowledge of changes of composition at different levels would also be informative but may be impossible to obtain since bombardment by meteorites is likely to keep the dust mixed. Disturbance of the dust by rocket impact is unlikely to be harmful, as in view of the low density of the lunar atmosphere the disturbed dust particles will fall out locally and not travel all over the moon. For the same reason any contamination of the dust by space operations will be localised and will not prejudice future analytical work (but see section "6"), so long as no fusion or fission explosions are carried out.

The only serious danger of spoiling the moon's dust will come from nuclear explosions. These will release volatile fission products (in the extreme vacuum of the moon even elements like strontium are likely to behave as gases) which will enter the moon's atmosphere and will be rapidly distributed by diffusion. These radioactive atoms will be in a highly reactive form and on coming into contact with moon dust may form involatile compounds. In this way the whole surface

of the moon may acquire additional radioactivity which may interfere with subsequent radiochemical analyses that could be of the greatest value in particular for problems relating to the past history of the moon.

In this respect the explosion of a fusion device is likely to be more serious than that of a fission bomb since the former will give rise exclusively to volatile radioactive products, notably tritium, whereas the bulk of the volatile fission products are rare gases which will not combine with the moon dust. However the range of the small particles by which fission bomb activity is spread is likely to be very great on the moon and a serious danger of contamination would undoubtedly arise.

3. COSMIC DUST The possibility that valuable information concerning cosmic (i.e. interstellar and interplanetary) dust may be lost by disturbing the moon's surface has been considered but is unlikely to be serious. This interesting material is known to consist largely of low atomic number elements such as hydrogen, carbon, nitrogen and oxygen and many of the corresponding molecules will be volatilized by solar radiation. Hence only residues of high atomic number elements will remain on the moon and this material is no more informative than similar deposits of interplanetary material which can be found at the bottom of the oceans.

4. PANSPERMIA HYPOTHESIS The suggestion that moon dust might help in evaluating the hypothesis that dissemination of life in the cosmos occurred by transport of forms of life in the cosmic dust must be rejected for the same reason as that given in (3) above. Namely that solar radiation (in high vacuo) would decompose "bio-spores" just as it decomposes cosmic dust. Contamination by organic or living matter would therefore not be harmful in this connection although it must be avoided for another reason (see below).

5. CONTAMINATION OF THE MOON BY LIVING CELLS There is no possibility that the introduction of cells such as spores or bacteria might give rise to life on the moon of the same type (i.e. containing DNA) as on earth which might confuse later investigators. There are no cells on earth which grow or multiply in the absence of water and at the high vacuum of the moon no water can exist.

6. THE DEVELOPMENT OF COMPLEX MOLECULES The basic problem concerning the origin of life is how complex molecules (on the earth they are based on carbon) came to be built up and become replicated. It is conceivable that the interior of the moon dust may provide some valuable clues in this direction. It is not beyond the bounds of possibility that some "pre-life" processes may be occurring on the moon and these may be similar or different from those which had taken place on earth. If there are such processes then the introduction of "foreign" macromolecules from the earth may cause a serious upset

in the lunar processes. The earth macromolecules may under lunar conditions act as templates and provide new foci for "pre-life" growth. If such events were started indiscriminately all over the moon the pattern might be distorted. It is important to emphasise that living cells are not envisaged for this process and that in this connection a dead bacterium from an aseptic rocket would be as harmful as a live one. Admittedly the occurrence of any such growth reactions is remote but the problem is so important that we recommend that a simple precaution against endangering future studies is to limit the areas of landings on the moon and thereby to localise the effects - if any - of terrestrial templates.

7. CONTAMINATION OF MARS AND VENUS The problems of reaching the planets are of the same kind as those involved in lunar exploration and objects will no doubt be sent there relatively quickly after the moon has been reached initially by circumnavigation, if our findings under 1) above are heeded. The danger of contamination of these planets is mainly biological since there is a reasonable probability that the conditions on Mars are such that some terrestrial organisms might grow. Water, nitrogen, carbon oxides and light for photosynthesis are all available.

It is therefore of the greatest importance that space vehicles should not land either accidentally or deliberately on Mars (and possibly also Venus) unless all precautions have been taken to

exclude living organisms from them. Otherwise the most challenging of all planetary studies, that of extra-terrestrial life, may be put in jeopardy. The same precautions in regard to the development of complex molecules which have been dealt with in respect of lunar contamination in paragraph 6 above apply equally to both Mars and Venus.

Although the relative extent of the contamination from a nuclear explosion would be very much smaller than in the case of the moon it may none the less be sufficient to interfere with detailed radiochemical analyses under certain conditions. Also the effect of introducing radioactivity on another planet where there may be entirely different levels of background radiation from those found on earth could greatly influence any form of life found there. Although the objections against nuclear explosions on Mars and Venus may not be as compelling as in the case of the moon, they are nevertheless well justified until more information is available.

CETEX Meeting

Paleis Noordeinde - The Hague

12 - 13 May 1958

RECOMMENDATION

CETEX believes that there is a real danger that exploration attempts made within the next few years may produce contamination of extra-terrestrial bodies which would complicate or render impossible more detailed studies, when the technological problems of landing sensitive scientific instruments on the moon and planets have been solved.

CETEX is only concerned with genuine exploration intended to provide bona fide scientific data. Here there may be a conflict, because an experiment essential for one purpose may make it impossible for other types of studies to be made subsequently (e.g., the explosion of a nuclear device to provide seismic data on the interior of the moon or of the planets might make subsequent radio-chemical analysis meaningless).

CETEX has considered various dangers of contamination in outline, but did not have at its disposal sufficient scientific and technological data to enable it to propose a specific code of conduct, which should achieve a reasonable compromise between the perfectly proper ambition to start lunar - and possibly planetary - exploration at the earliest moment and the need to safeguard future research.

CETEX feels that such a code of conduct must be drafted with the minimum of delay. It proposes to the ICSU that interested and expert parties be asked by the National Members of ICSU to prepare detailed papers bearing on the topics raised in this initial Report; and, that thereafter these papers be made available to it for a second meeting before the end of 1958, at which detailed recommendations can be prepared with the aid of advisory experts.

Paleis Noordeinde,
THE HAGUE

Second Meeting of the

ad hoc Committee

on Contamination by Extra-terrestrial Exploration

The Hague, March 9 - 10, 1959

Summary Recommendations

CETEX was established in 1958 by ICSU to meet once to find out if the problem of contamination of extra-terrestrial objects by space vehicles represents a real problem. The report of this meeting which was held in May 1958 was that in the committee's view there is a real possibility that early experiments might spoil subsequent research. The committee therefore proposed to ICSU that a code of conduct be drawn up for space research with particular reference to the allocation of priorities and sequences of different experiments. CETEX stressed that such a report would require the active participation by experts, especially from the field of rocket technology. ICSU accepted this recommendation and at its general meeting in Washington in October 1958 asked CETEX to hold a second meeting. At the same time ICSU requested that National Academies of the U.S.A. and U.S.S.R. to assist CETEX with experts in rocket technology and with prepared documents.

CETEX at its second meeting held at The Hague in March 1959 was able only to start its assigned task because the complexities of the problem made it impossible for the necessary detailed information to be available.

In the interval between the first and second meetings COSPAR has been formed by ICSU to co-ordinate world wide space research and this new body enjoys the support of the American and Russian Academies. CETEX feels that the detailed functions proposed for its second meeting form an integral and important part of the duties of COSPAR and at this meeting CETEX confined itself to the general formulation of the problem and review of its initial report which has been slightly modified.

General principles governing space research

1. Space research offers a challenge and opportunities which should appeal to the most imaginative minds. The greatest encouragement must be given to novel and, unconventional approaches and no proposal should be sanctioned which would hamper the experimenters' freedom of action unless there are compelling reasons. On the other hand equally imaginative thinking is required when considering possible complications which can follow a particular type of experiment. Surprises are certain and unlikely possibilities must be borne in mind when dealing with the problem of contamination which is better defined as the problem of reducing the risk whereby one experiment may spoil the situation for other subsequent enquiries....

2. Ideally scientists should be asked to inform COSPAR as early as possible of each space experiment which is envisaged and of the methods to be used in its execution. The broadly based committee of COSPAR containing scientists from all disciplines may be able to see much more clearly than the space research specialists possible conflicts introduced by such experiments and may be able to suggest ways of overcoming these difficulties.

2. There are a number of obvious and necessary experiments which are bound to be done and here the COSPAR working group dealing with experiments may be able to suggest priorities. While it may not be possible to avoid all types of contamination a proper sequence can ensure that the collection of data is not thereby hindered. For example CETEX recommends positively that no "soft" landing, which requires the release of large quantities of gases, should be made on the moon until experiments have been successfully carried out - or at least all reasonable attempts made - to determine the nature of the moon's atmosphere.

4. In view of the great uncertainties which face space research all operationswhich are not capable of conveying meaningful scientific data are to be discouraged even if they do not appear to carry with them a known source of contamination. Risks with the unexpected must be taken as otherwise no space exploration is possible but such risks must be justified by the scientific content of the experiment.

Contamination endangering physical and chemical studies

1. The Moon's Atmosphere The Moon's atmosphere contains only a small amount of matter (it is estimated at less than 100 tons) and is therefore extremely vulnerable to contamination. The release on the surface of any amount of volatile material (having a molecular weight of greater than 60) within this range of magnitude such as might be given off from explosions for marking purposes or to slow down the vehicle for "soft" landings is likely to remain on the moon. Another factor which a change in the lunar atmosphere might bring about is an upset in the thermal equilibrium and careful computation will be required before the magnitude of this effect can be assessed. The possibility that the impact of a rocket vehicle may itself be sufficient to alter the atmosphere by releasing trapped gases was rejected because the moon surface must occasionally be subject to bombardment by heavy meteorites.

The release of any chemical marker on the moon surface is therefore objectionable if it involves tons of material. If it has to be done, a flare releasing material quite unlike that normally present in the lunar atmosphere should be used so that in subsequent investigations it can be clearly recognised as a contaminant introduced by man. Both in this connection and because of increased ease in detection a flare produced by sodium should be considered for this purpose. The sodium D lines could be detected at low intensities if a monochromator is used to cut out scattered light of other wavelengths. Probably the quantity of material

required to be visible through a telescope, though not to the naked eye, would be insufficient to cause serious contamination of the atmosphere.

The possibility that a flare of this type might disturb the lunar atmosphere due to the ionization of the sodium atoms by sunlight has been considered but such an effect is unlikely to persist for long periods.

From the foregoing it is clear that detailed exploration can very easily modify the lunar atmosphere which should, if at all possible, be studied spectroscopically from either earth or moon satellites. An accidental hit by a vehicle which has failed to orbit would probably not be serious, since the moon's surface must occasionally be subject to bombardment by heavy meteorites and the release of trapped gases by impact will not therefore cause a departure from natural conditions.

2. Moon Dust [x] The chemical composition of the dust on the moon's surface is of the greatest interest to a wide range of sciences. Knowledge of changes of composition at different levels would also be informative but may be difficult to interpret since bombardment by meteorites is likely to disturb the dust. For this reason mixing of some of the dust by rocket impact is unlikely to result in the loss of information.

The suggestion has been made in the recent scientific literature that there are unstable structures of a high free energy content

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x The possibility that valuable information concerning cosmic dust may be lost by disturbing the moon's surface has been considered but is unlikely to be serious. Analysis of the moon's dust can only provide a very incomplete picture of cosmic dust because many of the constituents will be volatilized by solar radiation.

(i.e. containing a high concentration of free radicals) on the moon, which may be caused to react explosively on coming into contact with organic substances from the earth. The suggestion has therefore been made that great care be taken to exclude organic substances from space vehicles likely to impact on the moon. The Committee could not support the view that such a hazard existed since such free radical structures would be triggered off by any impact which caused intimate mixing. Meteorites or some corpuscular radiation would act as a fuze and initiate an explosive chain reaction.

The man made object would do no more harm in this respect.

5. RADIOACTIVITY

A serious danger of spoiling the moon's dust will come from nuclear explosions. These will release fission products which under the conditions of extreme vacuum will enter the moon's atmosphere and be rapidly distributed. These radioactive atoms will be in a highly reactive form and on coming into contact with moon dust may form involatile compounds. In this way the whole surface of the moon may acquire additional radioactivity which may interfere with subsequent radiochemical analyses that could be of the greatest value in particular for problems relating to the history of the moon. The explosion of a fusion device is likely to be more serious than that of a fission bomb since the former will give rise mainly to volatile radioactive products, notably tritium, whereas the bulk of the volatile fission products are rare gases

which will not combine with the moon dust. However, the range of the small particles by which fission bomb activity is spread is likely to be very great on the moon and a serious danger of contamination would undoubtedly arise.

Although the relative extent of the contamination of the planets from a nuclear explosion would be very much smaller than in the case of the moon it may nonetheless be sufficient to interfere with detailed radiochemical analyses under certain conditions. Also the effect of introducing radioactivity on another planet where there may be entirely different levels of background radiation from those found on earth could greatly influence any form of life found there. Although the objections against nuclear explosions on Mars and Venus may not be as compelling as in the case of the moon, they are nevertheless well justified until more information is available.

Biological Contamination

Recommendation for immediate action The sterilization of space vehicles to prevent the spreading of spores and other terrestrial micro-organisms in the solar system is likely to present a number of technical problems that may not be easy to solve. CETEX suggests that COSPAR initiate a study immediately of the methods by which the inside of space vehicles can be sterilised bearing in mind the presence of delicate instruments that must not be damaged. As soon as possible

methods should be published by which this can be achieved and it should be urged that all space probes be sterilised in this way. Although CETEX feels that the possibility that life can persist on the moon is sufficiently remote to justify being neglected, all moon probes should be sterilised so that the difficult techniques of sterilization may be worked out in practice.

The outside of space vehicles need not be sterilized since exposure to the unfiltered solar radiation during flight will destroy all microorganism which have settled on the shell. The need for sterilization is only temporary. Mars and possibly Venus need to remain uncontaminated only until study by manned space ships becomespossible.

1. Contamination of the Moon by living cells There is no reasonable possibility by which the introduction of cells such as spores or bacteria might give rise to life on the moon of the same type (i.e. containing DNA) as on earth which might confuse later investigators. There are no cells on earth which grow or multiply in the absence of water and at the high vacuum of the moon no water can exist on its surface.

2. Contamination of Mars and Venus There is a possibility of biological contamination of these planets since there is a reasonable probability that the conditions on Mars are such that some terrestrial organisms might grow. Carbon compounds, light for photosynthesis and probably water and nitrogen are all available. It is therefore of the greatest importance that space vehicles should not land either accidentally

or deliberately on Mars (and possibly also Venus) unless all precautions have been taken to exclude living organisms from them. Otherwise the most challenging of all planetary studies, that of extra-terrestrial life, may be put in jeopardy. The same precautions in regard to the development of complex molecules which have been dealt with in respect of lunar contamination in paragraph 4 below apply equally to both Mars and Venus.

3. Panspermia Hypothesis The suggestion that moon dust might help in evaluating the hypothesis that dissemination of life in the cosmos occurred by transport of forms of life in the cosmic dust must be rejected because solar radiation (in high vacuo) would decompose "biospores" just as it decomposes cosmic dust. The possibilities by which a spore might travel through space inside meteorites involve so many improbabilities that they do not justify special consideration at this stage.

4. The development of complex molecules The basic problem concerning the origin of life is how complex molecules (on the earth they are based on carbon) came to be built up and become replicated. It is conceivable that the interior of the moon dust may provide some valuable clues in this direction. It is not beyond the bounds of possibility that some "pre-life" processes may be occurring on the moon and these may be similar or different from those which had taken place

on earth. If there are such processes then the introduction of "foreign" macromolecules from the earth may cause a serious upset in the lunar processes. The earth macromolecules may under lunar conditions act as templates and provide new foci for "pre-life" growth. If such events were started indiscriminately all over the moon the pattern might be distorted. It is important to emphasise that living cells are not envisaged for this process and that in this connection a dead bacterium from an aseptic rocket would be as harmful as a live one. The occurrence of any such growth reactions is remote and does not justify the imposition of any irksome restrictions on lunar exploration but where reasonably possible it should be borne in mind. A simple precaution against endangering future studies might be to limit the areas of landings on the moon and thereby to localise the effects - if any - of terrestrial templates.

APPENDIX B

Set forth below are recommendations of the Ad Hoc Committee for Annual Review of COSPAR Sterilization Objectives (May 1967).

* * * * * *

Comments on COSPAR Resolution 26.5

It is recommended that, as set forth in COSPAR Information Bulletin No. 33, pp. 54-55, 1×10^{-3} continue to be accepted as the upper limit to the probability of contamination over the entire period of biological exploration of Mars or other planets deemed important in the investigation of extra-terrestrial life.

In maintaining this probability it is recommended that:

(1) The period of biological exploration be considered to extend for about 20 years.

(2) As set forth in COSPAR Bulletin #33, p. 55, item (6), "Members of COSPAR should make available to it, within three months after launch, sterilization procedures and computations used for each flight to assure prevention of contamination of the planet consistent with the probability of 10^{-3} for the period of biological exploration".

(3) As a basis for calculations required for the basic probability of contamination of 10^{-3} the total landers, orbiters, and close fly-bys sent to Mars by all countries may approximate 100 during the period of biological exploration.

(4) Constraints in terms of probabilities should be implemented by specific procedures as soon as such procedures can be developed in details that can be applied to any mission.

(5) The items listed in Appendix A, especially items 1-4, should receive careful consideration in computations of probabilities of contamination.

(6) Continued discussion and exchange of information on methods and techniques used in meeting this standard be encouraged.

The Committee also made the following findings which should be useful to the Space Science Board and NASA:

1. The chances of release of VTO's onto planetary surfaces need continuing re-evaluation. Quantitative knowledge of methods of release of various types of VTO from within solid bodies is required. Such knowledge could lead to estimates of chances of release which would allow modification of sterilization techniques consistent with the demands of the COSPAR agreement.

2. We believe that micro-environments may well exist on the Martian surface where survival and growth of some kinds of VTO's present as contamination in a spacecraft will be of these types. In order to survive and grow, these organisms must be transported from their location in the spacecraft to a place where the suitable micro-environment exists without being killed by ultraviolet radiation, and must survive the freeze-thaw cycle in its new location. It is of considerable importance that reasonable estimates be made of the probability of each of these events.

A review of the possible values to be assigned to the combined probability of survival, dissemination, and growth of a VTO on Mars suggests that the value could well be as low as 10^{-8} or as high as 10^{-2}, and is more probably in the range of 10^{-4} to 10^{-5}. However, in view

of the existing uncertainties, the group considers a combined probability of 10^{-3} (without reference to prior heat sterilization) should be used as a working figure.

3. In view of the admittedly conservative character of this value (10^{-3}) it is important to avoid compounding conservative standards in other areas of the model, and in view of their practical implications, it is further more important to continue efforts to reduce these uncertainties.

4. Further investigation into areas where problems exist might well provide data which would aid in meeting the COSPAR criteria while increasing the probability of a successful mission. Techniques developed as a result of such investigations might lead to a reduction in the requirement of a final heat soak. The following is a list of areas where further study is needed:

1. Experiments to determine the dissemination of contaminants, viable terrestrial organisms (VTO's), during entry into a planetary atmosphere (accidental ablation, etc.).

2. Quantitative studies into fracture release mechanisms, including studies with known number of VTO's in a component.

3. Studies on vacuum kill rates for VTO's.

4. Sampling studies to determine the occurrence and frequency of sterile and contaminated components; such studies would aid in eliminating highly contaminated components and provide reliable numbers for the probability of internal contamination.

5. Studies of contamination introduced during assembly techniques such as potting, circuit board coating and component encapsulation.

6. Investigations into techniques for sterile mating of lock-up joints, with possible development of a self sterilizing sealant, and investigations of methods of killing locked up organisms.

7. Studies of the probability of release and dissemination of VTO's and fracture modes;

(a) at impact velocities between supersonic and hypersonic,

(b) at impact velocities of a few hundred feet per second.

8. Studies of the likelihood of various release mechanisms after successful landing such as aeolian erosion, heating and cooling fractures, chemical erosion, etc.

9. Investigation of sterile assembly techniques to arrive at reliable probabilities of contamination in the end product, including the likely nature of the contaminants.

APPENDIX C

Set forth below are the quarantine regulations published in the Federal Register by the National Aeronautics and Space Administration (14 C.F.R. 1204.509, et seq.).

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Chapter V--National Aeronautics and Space Administration

PART 1204--ADMINISTRATIVE AUTHORITY AND POLICY

Subpart 5--Delegations and Designations

EXTRATERRESTRIAL EXPOSURE

New §1204.509 is added, reading as follows:

§1204.509 Power and authority--to exercise authority with respect to extraterrestrial exposure.

(a) Delegation. The Associate Administrator for Manned Space Flight and the Associate Administrator for Space Science and Applications are hereby authorized to execute within their respective assigned program responsibilities the administrative actions specified in §1211.104(a) of this chapter, subject to the limitations prescribed in Part 1211 of this chapter.

(b) Redelegation. Authority may be redelegated in writing to subordinate officials with the power of further redelegation.

(c) Reporting. The officials to whom authority is delegated in this section shall insure that feedback is provided to the Administrator through official channels to keep him fully and currently informed of significant actions, problems, or other matters of substance related to the exercise of the authority delegated hereunder.

T. O. PAINE
Administrator

PART 1211--EXTRATERRESTRIAL EXPOSURE

New Part 1211 is added, reading as follows:

Sec.

Authority: The provisions of this Part 1211 issued under sec. 203, 72 Stat. 429, as amended (42 U.S.C. 2473); sec. 304, 72 Stat. 433 (42 U.S.C. 2455, 2456) and 18 U.S.C. 799 and Art. IX, Outer Space Treaty, TIAS 6347 (18 UST 2416).

§1211.100 Scope.

This part establishes: (a) NASA policy, responsibility and authority to guard the Earth against any harmful contamination or adverse changes in its environment resulting from personnel, spacecraft and other property returning to the Earth after landing on or coming within the atmospheric envelope of a celestial body; and (b) security requirements, restrictions

and safeguards that are necessary in the interest of the national security.

§1211.101 Applicability.

The provisions of this part apply to all NASA manned and unmanned space missions which land on or come within the atmospheric envelope of a celestial body and return to the Earth.

§1211.102 Definitions.

(a) "NASA" and the "Administrator" mean, respectively, the National Aeronautics and Space Administration and the Administrator of the National Aeronautics and Space Administration or his authorized representative (see §1204.509 of this chapter).

(b) "Extraterrestrially exposed" means the state or condition of any person, property, animal or other form of life or matter whatever, who or which has:

(1) Touched directly or come within the atmospheric envelope of any other celestial body; or

(2) Touched directly or been in close proximity to (or been exposed indirectly to) any person, property, animal or other form of life or matter who or which has been extraterrestrially exposed by virtue of subparagraph (1) of this paragraph.

For example, if person or thing "A" touches the surface of the Moon, and on "A's" return to the Earth, "B" touches "A" and, subsequently, "C" touches "B", all of these--"A" through "C" inclusive--would be extraterrestrially exposed ("A" and "B" directly; "C" indirectly).

(c) "Quarantine" means the detention, examination and decontamination of any person, property, animal or other form of life or matter whatever that is extraterrestrially exposed, and includes the apprehension or seizure of such person, property, animal or other form of life or matter whatever.

(d) "Quarantine period" means a period of consecutive calendar days as may be established in accordance with §1211.104(a).

(e) "United States" means the 50 States, the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands, Guam, American Samoa and any other territory or possession of the United States, and in a territorial sense all places and waters subject to the jurisdiction of the United States.

§1211.103 Authority.

(a) Sections 203 and 304 of the National Aeronautics and Space Act of 1968, as amended (42 U.S.C. 2473, 2455 and 2456).

(b) 18 U.S.C. 799.

(c) Article IX, Outer Space Treaty, TIAS 6347 (18 UST 2416).

(d) NASA Management Instructions 1052.90 and 8020.13.

§1211.104 Policy.

(a) Administrative Actions. The Administrator or his designee as authorized by §1204.509 of this chapter shall in his discretion:

(1) Determine the beginning and duration of a quarantine period with respect to any space mission; the quarantine period as it applies to various life forms will be announced.

(2) Designate in writing quarantine officers to exercise quarantine authority.

(3) Determine that a particular person, property, animal, or other form of life or matter whatever is extraterrestrially exposed and quarantine such person, property, animal, or other form of life or matter whatever. The quarantine may be based only on a determination, with or without the benefit of a hearing, that there is probable cause to believe that such person, property, animal or other form of life or matter whatever is extraterrestrially exposed.

(4) Determine within the United States or within vessels or vehicles of the United States the place, boundaries, and rules of operation of necessary quarantine stations.

(5) Provide for guard services by contract or otherwise, as may be necessary, to maintain security and inviolability of quarantine stations and quarantined persons, property, animals, or other form of life or matter whatever.

(6) Provide for the subsistence, health, and welfare of persons quarantined under the provisions of this part.

(7) Hold such hearings at such times, in such manner and for such purposes as may be desirable or necessary under this part, including hearings for the purpose of creating a record for use in making any determination under this part or for the purpose of reviewing any such determination.

(8) Cooperate with the Department of Health, Education, and Welfare and the Department of Agriculture in accordance with the provisions of §1211.105.

(9) Take such other actions as may be prudent or necessary and which are consistent with this part.

(b) Quarantine. (1) During any period of announced quarantine, the property within the posted perimeter of the Lunar Receiving Laboratory at the Manned Spacecraft Center, Houston, Tex., is designated as the NASA Lunar Receiving Laboratory Quarantine Station.

(2) Other quarantine stations may be established if determined necessary as provided in paragraph (a)(4) of this section.

(3) During any period of announced quarantine, no person shall enter or depart from the limits of any quarantine station without permission of the cognizant NASA quarantine officer. During such period, the posted perimeter of a quarantine station shall be secured by armed guard.

(4) Any person who enters the limits of any quarantine station during the quarantine period shall be deemed to have consented to the quarantine of his person if it is determined that he is or has become extraterrestrially exposed.

(5) At the earliest practicable time, each person who is quarantined by NASA shall be given a reasonable opportunity to communicate by telephone with legal counsel or other persons of his choice.

§1211.105 Relationship with Departments of Health, Education, and Welfare and Agriculture.

(a) If either the Department of Health, Education, and Welfare or the Department of Agriculture exercises its authority to quarantine an extraterrestrially exposed person, property, animal, or other form of life or matter whatever, NASA will, except as provided in paragraph (c) of this section, not exercise the authority to quarantine that same person, property, animal, or other form of life or matter whatever. In such cases, NASA will offer to these departments the use of the Lunar Receiving Laboratory Quarantine Station and such other service, equipment, personnel, and facilities as may be necessary to ensure an effective quarantine.

(b) If neither the Department of Health, Education, and Welfare or the Department of Agriculture exercises its quarantine authority, NASA shall exercise the authority to quarantine an extraterrestrially exposed person, property, animal or other form of life or matter whatever. In

such cases, NASA will inform these departments of such quarantine action and, in addition, may request the use of such service, equipment, personnel and facilities of other Federal departments and agencies as may be necessary to ensure an effective quarantine.

(c) NASA shall quarantine NASA astronauts and other NASA personnel as determined necessary and all NASA property involved in any space mission.

§1211.106 Cooperation with States, territories and possessions.

Actions taken in accordance with the provisions of this part shall be exercised in cooperation with the applicable authority of any State, territory, possession or any political subdivision thereof.

§1211.107 Court or other process.

(a) NASA officers and employees are prohibited from discharging from the limits of a quarantine station any quarantined person, property, animal or other form of life or matter whatever during an announced quarantine period in compliance with a subpoena, show cause order or other request, order or demand of any court or other authority without the prior approval of the General Counsel and the Administrator.

(b) Where approval to discharge a quarantined person, property, animal or other form of life or matter whatever in compliance with such a request, order or demand of any court or other authority is not given, the person to whom it is directed shall, if possible, appear in

court or before the other authority and respectfully state his inability to comply, relying for his action upon this §1211.107.

§1211.108 Violations.

Whoever willfully violates, attempts to violate, or conspires to violate any provision of this part or any regulation or order issued under this part or who enters or departs from the limits of any quarantine station in disregard of the quarantine rules or regulations or without permission of the NASA quarantine officer shall be fined not more than $5,000 or imprisoned not more than 1 year, or both (18 U.S.C. 799).

Effective Date. In light of the Apollo 11 space mission and the need to guard the Earth against extraterrestrial contamination, it is hereby determined that compliance with section 553 of Title 5 of the United States Code is impracticable and contrary to the public interest; therefore, the provisions of the Part 1211 are effective upon publication in the Federal Register.

T. O. Paine
Administrator.

APPENDIX D

Set forth below are the terms and conditions of the Application and Agreement relating to candidates for the Crew Reception Area crew and the Sample Operations and Analysis Team.

* * * * *

PLANNED SCHEDULE OF LUNAR RECEIVING LABORATORY OPERATION

Simulated Operation From (on/about)_____ To (on/about)_____

Regular Operation From (on/about)_____ To (on/about)_____

and for any additional required quarantine period from these operations.

APPLICATION

(To Serve as Member of CRA Crew or SOA Team)

I hereby voluntarily request to be designated and accepted to serve as a member of the Crew Reception Area Crew (CRA Crew) ☐ or Sample Operations and Analysis Team (SOA Team) ☐ in the course of my work and duties for my employer shown below. (Check one as applicable.)

1. There have been explained to me fully and I understand what would be involved, in both simulated and regular activities, insofar as reasonably foreseeable. This includes the manner, nature, purpose and duration of the operations and confinement and quarantine restrictions; my functions and duties as a crew or team member; and procedures and other requirements to be observed; and the fact that there are possible but unknown risks of injury, inconvenience or discomfort to crew and team members from possible disease or other harm, and to people other than crew or team members and to animals, vegetation and plant life if there should be escape from the LRL and spread of disease or other harm due to infectious, communicable or transmittable disease or toxic or otherwise active matter or materials brought from beyond the Earth and its atmosphere.

2. I have read and understand the Crew Participant Quarantine Agreement attached. In making this application and signing the Agreement, I voluntarily (a) assume the obligation of serving throughout the simulated confinement or active quarantine period; (b) relinquish and waive any and all rights and remedies that might be asserted or relied on by me, or any other person claiming through me, to be relieved from the Agreement or released from the confinement and active quarantine, for any reason whatever, in advance of the time officially fixed for its termination as determined by authority of the NASA Administrator; and (c) forego, waive, and release any and all claims I might otherwise have against, and covenant not to sue, at any time, any individual for wrongful confinement or restraint during the confinement or active quarantine period. However, I do not intend to release or waive any employee compensation for work and services or duty time, workman's compensation, contractual rights, or any liability of the Government.

3. To the best of my knowledge and belief, I am in good health and physical condition and am free of infectious disease, infirmity or ailment, except_____. (If none, so indicate.)

4. It is understood that upon acceptance of this Application and my entry on duty as a CRA Crew or SOA Team member, neither this Application nor any representation, commitment or waiver in it or in the Agreement may thereafter be withdrawn or modified. It is also

recognized that, during regular LRL operations, substitutions and releases of crew members from confinement and active quarantine will become contrary to the national interest and welfare and cannot be authorized due to the possible hazards until the active quarantine period is officially terminated.

5. I agree to and authorize the administration of any emergency medication or procedures deemed necessary by the physician(s) in attendance during the confinement or active quarantine period, and further agree that any physical or medical information (not identified as related to me individually) may be used for research reports and publication without further restriction by me.

6. Provided, that if I propose to serve as member of SOA Team, as indicated above and am accepted, I agree to comply with all applicable MSC and LRL rules, regulations, and standard operating procedures at all times and that in case of spill or other event necessitating quarantine, as determined by officer in charge of the LRL, to immediately assume the obligations of a CRA Crew member, including submission to all quarantine requirements. My signature is affixed also to the Crew Participant Quarantine Agreement, agreeing that this document is to be effective only in the event of the above conditions and the determinations of the appropriate LRL officer.

_____ _____

DATE EMPLOYEE

Employee of _____ (or)

Principal Investigator representing _____

(or) Other: _____

APPROVED:

_____

(LRL OFFICIAL)

NASA/MSC LUNAR RECEIVING LABORATORY

Crew Participant Quarantine Agreement

(IMPORTANT: Read carefully, both the application and the agreement below, before signing.)

_____
DATE

In consideration of my application, acceptance and designation as a member of the CRA Crew or SOA Team (who upon quarantine become members of the CRA Crew) for the Lunar Receiving Laboratory (LRL) at NASA-Manned Spacecraft Center, Houston, Texas, it is agreed by me and other CRA Crew members with each other and with NASA, that throughout the periods of simulated or regular operations indicated on the reverse side:

1. Each Crew member will observe and follow the simulated or active quarantine and confinement requirements and will perform and discharge the functions and duties designated for each in advance; and will also perform any special duties for which the member is competent, in event of and during an emergency, as specifically directed by the officer in charge of the LRL, or his designee.

2. It is understood that during the period of crew isolation by simulated or active quarantine in the LRL there will be provided without charge for each member so confined: (a) subsistence needs including food and sleeping quarters; (b) medical attention and drugs for any

illness or injury as feasible without breach of the active quarantine, including introduction into quarantine of outside specialists when found desirable and practical; and (c) all special clothing and equipment for protective purposes within the LRL and to insure continuity of crew activities, including prescription ground safety glasses of utilitarian design and extra hearing aids when usually worn.

3. Each crew member, will conduct himself in an orderly, faithful, honest and sober manner, and at all times be diligent in his respective duties, and to be obedient to the authorized directions of the officer in charge of the LRL, and of his supervisors in everything relating to the LRL and the supplies, equipment, materials and other matters in and at the LRL.

4. If any member of the CRA Crew considers himself to be aggrieved by any specific instruction or requirement occurring during the period of confinement, he shall represent the same to the officer in charge of the LRL in a quiet and orderly manner, who will thereupon take such steps as the case may require.

5. For simulated operations the period of confinement for all CRA Crew members shall be the number of calendar days fixed in advance by NASA; provided that in the event of serious accident or illness of a crew member during the confinement period planned the officer in charge of the LRL may in his discretion, after consultation with the

Director of Medical Research and Operations, MSC, or his designee, approve the release of the affected crewman from the confinement and simulated quarantine to permit medical treatment or hospitalization outside of the LRL. Such release of the affected crew member may be authorized without affecting the continued confinement under simulated quarantine of other crew members, unless other releases are authorized by the officer in charge of the LRL in his discretion and after consideration of pertinent factors such as the program results accomplished or remaining unaccomplished, costs to the Government, and feasibility.

6. During regular LRL operations involving lunar or other extraterrestrially-exposed materials or matter and prior to the date and hour determined by the Administrator of NASA or his designee for terminating the confinement and active quarantine for all CRA Crew members, such members each consent and commit themselves to be and remain within the LRL and agree to observe the confinement and quarantine requirements and to cooperate in enforcement of observance by other crew members. In regular operations the period of active quarantine extends from initial entry by crewmen and activation of the LRL seal through the minimum period fixed in advance and continuing until the time of termination of the active quarantine determined by the Administrator or his designee.

7. Obligations of and benefits to crew members under this Agreement are understood to be in addition to and not in derogation of, duties or compensation under their regular employment and tenure. This Agreement is executed only after completion of my application and the briefings referred to therein.

_____
CREWMAN

Witnesses:

_____
SPOUSE (Recommended but not essential)

APPENDIX E

The document set forth below is a copy of the interagency agreement establishing the Interagency Committee on Back Contamination.

Note: In view of paragraph 2.d. of the Agreement, wherein the definition of "regulatory agency" for purposes of the Agreement excludes the National Aeronautics and Space Administration, it is apparent that NASA officials either (1) initially did not consider that agency to have the necessary authority to promulgate quarantine regulations, or (2) may simply have believed the Departments of Agriculture, Interior, and Health, Education and Welfare possessed sufficient legislative authority for back contamination quarantine, without having to resort to evaluation of NASA authority. As seen previously, it was determined (apparently at the last moment, just prior to the Apollo 11 launching) that insufficient quarantine authority existed in the other departments and agencies and NASA was compelled to promulgate its own regulations without seeking adequate legislative authority from the Congress.

* * * * *

INTERAGENCY AGREEMENT

BETWEEN:

THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

THE DEPARTMENT OF AGRICULTURE

THE DEPARTMENT OF HEALTH, EDUCATION AND WELFARE

THE DEPARTMENT OF THE INTERIOR

THE NATIONAL ACADEMY OF SCIENCES

ON THE:

PROTECTION OF THE EARTH'S BIOSPHERE FROM LUNAR SOURCES OF CONTAMINATION

AUGUST 24, 1967

Interagency Agreement between the National Aeronautics and Space Administration, the Department of Agriculture, the Department of Health, Education and Welfare, the Department of the Interior, and the National Academy of Sciences on the protection of the Earth's biosphere from lunar sources of contamination

1. Purpose

This agreement, dated as of the 24th day of August, 1967, will confirm existing arrangements between the parties hereto relating to the protection of the Earth's biosphere from lunar sources of contamination, and provides for certain additional arrangements, including the designation of officials authorized to represent and act for each of the parties hereto in matters relating to protection against such back contamination.

2. Definitions

As used in this agreement -

a. The term "lunar astronaut" means an astronaut who has been exposed, directly or indirectly, to the lunar surface.

b. The term "back contamination" means direct or indirect contamination of the Earth's biosphere by matter of lunar origin, resulting from a NASA manned lunar exploratory mission.

c. The term "lunar exposed material" means:

(1) matter of any kind, including spacecraft and mission-related equipment, which has been exposed to the lunar surface, and

(2) any person, animal, or matter of any kind who or which has been exposed to:

(a) a lunar astronaut, or

(b) matter which has been exposed to the lunar surface.

d. The term "regulatory agencies" means the Department of Agriculture, the Department of Health, Education and Welfare, and the Department of the Interior.

e. The term "interested agencies" means the regulatory agencies, the National Academy of Sciences, and NASA.

f. The term "designated representative" means an official appointed pursuant to paragraph 3.

3. Designation of Officials

The head of each interested agency shall designate an official or officials of such agency each of whom shall be fully authorized to represent and act for it in all matters relating to back contamination. The head of each interested agency may from time to time change the person or persons he has so designated, upon notice to the other interested parties.

4. Interagency Committee on Back Contamination

a. Confirming, and in accordance with previous arrangements made by the heads of the interested agencies, there has been established an Interagency Committee on Back Contamination. The Committee's Terms of Reference are set forth in Attachment A.

b. At least one designated representative of each agency shall serve as a Committee member representing such agency.

c. The report, findings or advice of a Committee member who is his agency's designated representative shall be deemed a statement of the position of such agency, and a report, findings or advice of the Committee, if the members of the Committee unanimously agree to such report, findings or advice, shall be deemed the position of each of the interested agencies.

5. Notification Prior to Agency Action in regard to Back Contamination

a. The head of each regulatory agency, or the agency's designated representative, shall consult with the head or designated representative of each other interested agency prior to such regulatory agency's initiation of any action which may have any effect on any NASA lunar exploratory mission, or on any procedures of the other interested agencies relating to back contamination, unless such action is in accordance with the unanimous recommendation of the agencies represented on the Interagency Committee on Back Contamination.

b. The Administrator of NASA, or NASA's designated representative, shall consult with the head or designated representative of each other interested agency prior to NASA's

taking any of the following actions, unless such action is in accordance with the unanimous recommendation of the regulatory agency and National Academy of Sciences members of the Interagency Committee on Back Contamination:

(1) Adopting or changing procedures in regard to isolation and containment of lunar astronauts or lunar exposed material, if such procedures or changes relate to the prevention of back contamination.

(2) Adopting, or approving changes in, the plans or specifications, or procedures and standards for the containment testing, of the Lunar Receiving Laboratory.

(3) Adopting or changing procedures relating to the quarantine testing, analyzing, or other examination of lunar astronauts and lunar exposed material, or conducting such tests, analyses, and examinations in a manner other than in accordance with established procedures.

(4) Releasing lunar astronauts or lunar exposed material from quarantine.

c. (1) Notwithstanding subparagraphs a and b of this paragraph, in the event of any unexpected occurrence which in the opinion of the head of any interested agency, or any designated representative, or a NASA official having cognizance over any aspect of a lunar mission, warrants immediate action not in accord with previously established procedures, such official may, prior to consultation between his agency and any other, take such immediate action as he deems appropriate.

(2) In the event action is taken pursuant to this subparagraph c, the agency so acting shall, as soon as circumstances permit, notify, by telephonic or telegraphic means, each other interested agency of such action; and thereafter shall promptly submit a detailed report of such action and the justification therefor to each of the other interested agencies.

6. Release of Reports and Other Information to the Public

a. Responsibility and initiative for the release of all public information, including scientific and technical reports, related to lunar astronauts, lunar-exposed material or back contamination resulting from any NASA lunar mission shall be reserved to the Administrator of NASA or his designee, except that any other interested agency may release such information upon approval by NASA.

b. The NASA Assistant Administrator for Public Affairs or his designee shall function as the principal spokesman for the Committee. However, any member of the Committee may respond directly to queries from members of the public, including representatives of the news media, on matters falling clearly within the cognizance or expertise of the member questioned. Except as provided in subparagraph a, any interested agency, upon coordination with NASA, may release, independently or jointly with other interested agencies, information related to the membership and functions of the Interagency Committee on Back Contamination.

7. Funding

It is contemplated that neither the operation of the Interagency Committee on Back Contamination nor any other aspect of this agreement will result in any exchange of funds between the parties hereto.

8. Effective Period

This agreement becomes effective upon the date hereinabove set forth, and may be terminated by any party hereto upon 60 days advance written notice to each of the other parties.

National Aeronautics and Space Administration

Public Health Service
National Communicable Disease Center

Department of Agriculture

Department of the Interior

National Academy of Sciences

APPROVED:

James E. Webb
Administrator
National Aeronautics and
Space Administration

John W. Gardner
Secretary
Department of Health,
Education and Welfare

Orville L. Freeman
Secretary
Department of Agriculture

Stewart L. Udall
Secretary
Department of the Interior

Frederick Seitz
President
National Academy of Sciences

ATTACHMENT A

INTERAGENCY COMMITTEE ON BACK CONTAMINATION

Terms of Reference

1. Background

In developing the Apollo Lunar Program, the National Aeronautics and Space Administration recognizes that it must draw upon the specialized knowledge and experience of certain other agencies in order to protect the public's health, agriculture, and other living resources against the possibility of contamination resulting from returning lunar astronauts or lunar exposed material, and to preserve the biological and chemical integrity of lunar samples and the scientific experiments relating thereto with minimal compromise of the operational aspects of the Program. Therefore, pursuant to arrangements with the Secretary of Agriculture, the Secretary of the Interior, the Surgeon General, Public Health Service, and the President of the National Academy of Sciences, there has been established an Interagency Committee on Back Contamination.

2. Definitions

As used herein:

a. The term "Administrator" means the Administrator of the National Aeronautics and Space Administration or his designee.

b. The term "back contamination" means direct or indirect contamination of the Earth's biosphere, by matter of lunar origin, resulting from a manned lunar mission.

c. The term "lunar sample" means material returned from the surface or subsurface of the moon.

d. The term "lunar astronaut" means an astronaut who has been exposed, directly or indirectly, to the lunar surface.

e. The term "lunar exposed material" means:

(1) matter of any kind, including spacecraft and mission-related equipment, which has been exposed to the lunar surface, and

(2) any person, animal, or matter of any kind who or which has been exposed to:

(a) a lunar astronaut, or

(b) matter which has been exposed to the lunar surface.

3. Membership and Officers

a. The Committee shall consist of eleven members as follows:

(1) One representative of each of the following agencies:

(a) The Department of Agriculture

(b) The Department of the Interior

(c) The National Academy of Sciences

(2) Two representatives from the Public Health Service, National Communicable Disease Center

(3) Six representatives from NASA

b. An alternate designated by the agency concerned may attend and participate in the meetings of the Committee in the absence of a member, or by invitation.

c. The Committee Chairman and Deputy Chairman will be the Public Health Service members. The Administrator shall appoint an Executive Secretary from among the NASA members.

4. Functions

a. The Committee shall advise the Administrator concerning back contamination and the protection of the biological and chemical integrity of lunar samples. In furtherance of this function the Committee is authorized to:

(1) Consider and make recommendations concerning proposed quarantine protocols.

(2) Review the plans and specifications of the Lunar Receiving Laboratory, and recommend approval of procedures and standards for containment testing.

(3) Conduct inspections of the Lunar Receiving Laboratory during its construction, upon its completion, and immediately prior to manned lunar missions.

(4) Review and recommend the manner in which lunar astronauts, lunar samples, mission-related equipment, and other lunar exposed material are to be recovered and transported to places of quarantine.

(5) Review and recommend approval of quarantine procedures and tests, analyses, and other examinations on lunar astronauts, lunar samples, mission-related equipment, and other lunar exposed material.

(6) Consider the need for changes in the regulations of governmental agencies, and for additional or changed statutory authority for any government agency.

(7) Consider such other matters as the Administrator may from time to time determine to be appropriate.

b. It is anticipated that among the more important functions of the Committee will be that of advising the Administrator as to when and the manner in which astronauts and lunar samples may be released from quarantine.

c. It is intended that the Committee, in performing the functions assigned to it by this paragraph 4, or otherwise, shall advise the Administrator on matters of policy, rather than on technical details, although the complexities of the problems it will consider will require the examination of technical matters.

5. Subcommittees and Panels

a. The Committee, at such times and for such purposes as it deems appropriate may establish subcommittees composed of one or more Committee members. The Committee may utilize such a subcommittee in performing any of the functions assigned to it.

b. The Committee may recommend to the Administrator the establishment of panels to advise the Committee on technical matters and may recommend to the Administrator the persons qualified to serve on such panels.

6. Committee Reports, Findings and Advice

a. Reports, findings, and advice of the Committee, if agreed to unanimously by the Committee members, shall be submitted to the Administrator on behalf of the Committee by its Chairman. In the absence of unanimous agreement, each member shall submit a report, findings or advice, provided, however, that any two or more members may join together in a report, findings, or advice.

b. Copies of all papers submitted to the Administrator by the Committee or by any member thereof when acting as a Committee member, shall be forwarded to the heads of the Department of Agriculture, the Department of Health, Education and Welfare, the Department of the Interior, and the National Academy of Sciences.

7. Meetings

a. Meetings will be held at the call of the Chairman or NASA. The agenda will be formulated or approved by the Administrator or an official designated by him.

b. All meetings will be conducted in the presence of the Executive Secretary or another designated full-time salaried employee of NASA.

c. Persons other than Committee members or alternates may attend Committee meetings upon invitation by the Committee.

d. Minutes will be kept of each Committee meeting. These shall contain as a minimum:

(1) A record of persons present.

(2) A description of matters discussed and conclusions reached. Copies of all reports received, issued, or approved by the Committee will be made a part of the official record of the meeting and will be incorporated in the minutes by reference.

e. The accuracy of all minutes will be certified by the Chairman or a NASA representative, other than the Executive Secretary, present during the proceedings.

8. Responsibilities for Release of Information

The NASA Assistant Administrator for Public Affairs or his designee shall function as the principal spokesman for the Committee. However, any member of the Committee may respond directly to queries from members of the public, including representatives of the news media, on matters falling clearly within the cognizance or expertise of the member questioned.

9. Duration of Committee

The Committee shall cease to exist on March 1, 1968, unless the Administrator determines in writing not more than sixty days prior to such date that the Committee's continued existence is in the public interest.