several respects. Besides the communication links with the ground which we mentioned earlier, intersatellite links are being considered for some communication satellites. Solar power stations would need a clear path for the energy beam. It has been recently suggested that solar power stations might use a low earth orbit and that such a system would have some advantages over the geostationary orbit. If both systems, in low orbit as well as in the geostationary orbit, are developed, and both systems have numerous satellites, then steering clear of other energy beams and preventing undesirable reflections might be an interesting but highly ambitious exercise in coordination.

Space manufacturing activities more than any other would exceed the physical dimensions of space stations. A manufacturing station would require a free path between the celestial body which is being tapped for material and the mass catcher. The trajectory certainly should not be traversed by another body if the mass driver is in operation. Besides, a shipment of material, even if it misses the catcher, should not impact on another active space object.

Closer at hand is the problem of shadowing. Most satellites and stations use as a primary energy source solar radiation backed up by batteries. Should solar radiation be cut off for a longer period than what the batteries had been designed for, some functions might be interrupted. The shadow of a space object is long; it is more than one hundred times as long as its dimension. A 20 km solar power station would throw a shadow extending over 2000 km which in the geostationary orbit corresponds to almost 3^0 in longitude. A small communication satellite designed to work in a close neighborhood of a solar power station would have to have either a capability of steering out of the shadow or to have an alternate source of energy.

D. *Technical and International Solutions*

Some of the above problems require a technical solution. It is just a question of taking into consideration, at an early state in the planning process, all possible relations with other space objects which might be encountered by that particular space mission during its active as well as inactive lifetime.

Other problems require a solution by international regulation. Space traffic may, at first, not need traffic rules as firm as those which apply to road traffic or to collision avoidance in air traffic. Some rules for space traffic could follow the idea of the noncompulsory Traffic Separation Schemes adopted by IMCO or the spirit of the Rule of Good Seamanship. It may be a challenging task for the IAF to provide scientific and technical background for all measures which would increase safety of space traffic and would accomodate space missions side by side. It would then be up to the international community to adopt regulatory or recommendatory measures wherever and to whatever degree is found necessary. After all, the operators of space objects discharge larger responsibilities than the many operators of vehicles on roads, in the sea, and in the air.

MANAGING TORT LIABILITY RISKS IN THE ERA OF THE SPACE SHUTTLE

*Gerald J. Mossinghoff**

On August 8, 1979, the President approved the National Aeronautics and Space Administration ("NASA") Authorization Act, 1980,[1] which, in addition to authorizing NASA's fiscal year 1980 program, added a new section 308 on "Insurance and Indemnification" to the National Aeronautics and Space Act of 1958[2] (the "Space Act"). That new section gives NASA broad and flexible authority to facilitate an orderly and equitable allocation of third-party tort liability risks among those involved in the operation and use of the Space Shuttle. The underlying purpose of the new section 308 is to further Congress' and the Administration's policy of encouraging widespread commercial and other non-U.S. Government use of the new national capability that the Space Shuttle represents.

In this article, the author will summarize the reasons why NASA proposed the new section, discuss its provisions, and outline the steps NASA is now taking to implement those provisions. The new section 308 itself is set forth in Appendix A, and its formal "sectional analysis" is provided in Appendix B.[3]

A. *Reasons for the New Authority*

Since early in NASA's history it has launched payloads for commercial users into space on a reimbursable basis. Typically, these payloads fly alone aboard one of NASA's

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[1]National Aeronautics and Space Administration Authorization Act, 1980, Pub. L. No. 96-48, 93 Stat. 348 (1979). The new section 308 was added by section 6 of Pub. L. No. 96-48, the "National Aeronautics and Space Administration Authorization Act, 1980." That section 6, which was effective October 1, 1979, also amended paragraph 13 of subsection (c) of section 203 of the National Aeronautics and Space Act of 1958 [42 U.S.C. 2473(c)(13)] to increase NASA's settlement authority "for bodily injury, death, or damage to or loss of real or personal property resulting from the conduct" of NASA's functions from $5,000 to $25,000. Prior to the effective date of section 6 of Pub. L. No. 96-48, claims against NASA under section 203(c)(13) in excess of $5,000 had to be certified by the Comptroller General before appropriations were available to pay the claims [31 U.S.C. 724 (a) as amended by Pub. L. No. 95-26, 91 Stat. 96 and Pub. L. No. 95-240, 92 Stat. [107]; NASA now has authority to settle claims up to $25,000 without such certification. (Text of section 308 is included in Appendix A and an analysis of this section is included in Appendix B, *infra*).

[2]National Aeronautics and Space Act of 1958, 42 U.S.C. 2451 *et seq.* (1979).

[3]Section 308 was enacted exactly in the form recommended by the NASA Administrator in his letters of January 30, 1979, to the Speaker of the House of Representatives and the President of the Senate. The sectional analysis forwarded with the Administrator's recommendation therefore provides an authoritative exposition of the intent underlying the new section. See H.R. Rep. No. 52, 96th Cong., 1st. Sess. 221 (1978); S.Rep. No. 207, 96th Cong., 1st Sess. 43 (1978).

expendable launch vehicles, for example, the Delta launch vehicle or the Atlas Centaur vehicle. Under NASA's current policies, commercial users are required to obtain third-party liability insurance (or self-insure for third-party liability) and that insurance (or self-insurance) must protect the United States from potential tort liability resulting from injury to third parties, *i.e.*, those not a party to the launch agreement.

This policy has worked well. Under it non-U.S. Government users of expendable launch vehicles have procured substantial amounts of liability insurance, up to $300 million, for premiums of approximately $50,000 per launch. Undoubtedly, one reason the premiums have been reasonable is because of the proven safety of the launch vehicles used; there has been no third-party property damage or bodily injury resulting from any of NASA's launches.[4]

As those familiar with the United States Space Program know, the Space Shuttle is a manned reusable launch vehicle which, when operational, will replace all of this Nation's expendable launch vehicles. The Space Shuttle is capable of carrying a variety of payloads on a given launch. Its cargo bay measures 60 feet in length by 15 feet in diameter and it can carry up to 65,000 pounds of payloads. It can separate and deploy free-flying payloads into Earth orbit and, with a European-developed Spacelab in its cargo bay, can serve as a self-contained space station for periods of up to 30 days.

Payloads which will be carried in the Shuttle will include free-flying spacecraft for deployment in Earth orbit, owned by the United States, foreign governments, intergovernmental organizations or commercial concerns; "small self-contained payloads" which NASA would fly for small businesses, universities and others for research and development purposes at a low transportation cost, *e.g.*, $10,000; and the European-developed Spacelab in which experiments will be performed by NASA, the European Space Agency, other governments and commercial concerns. These payloads will be flown under NASA's existing policies either under reimbursable bases where NASA is reimbursed for the costs involved or under cooperative or interagency arrangements. A given Shuttle flight may also include one or more payload specialists (who are not Government employees) to operate onboard scientific instruments.

Under traditional United States tort law, if the Shuttle and/or its contained payloads were to cause damage to a third person, all of the users and NASA would have potential liability to the injured third person, based upon concepts either of negligence or absolute liability, *i.e.*, liability without proof of fault or negligence. Actual liability, of course, would depend on proof of a causal relationship between the damage or injury and the acts or failures to act of a user. Under the Convention on International Liability for Damage Caused by Space Objects, ratified by the Senate on October 6, 1972, and

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[4]There have been claims filed with NASA as a result of the well publicized Skylab reentry, but no allegations of physical bodily injury or property damages have been made. Since Skylab was a NASA program, the Government acted as a self-insurer; no commercial insurance was involved.

entered into force on October 9, 1973,[5] the United States Government would be absolutely liable to citizens of foreign States which are party to the convention, but all users could be liable as well to any injured person under conventional tort law.

The mix of payload users outlined above all but prevents an orderly and equitable allocation of risks of liability absent special authority. For example, if a university professor were to fly a small self-contained payload for a payment of $10,000 to NASA, third-party liability insurance could cost up to five times that much. Moreover, if a number of commercial users each attempted to acquire adequate insurance protecting itself on a given Shuttle flight, the estimated $500 million capacity of the liability insurance market could well be exceeded. Similarly, the employer of a payload specialist would, under the doctrine of *respondeat superior,* be required to insure against potential negligence of the payload specialist who could cause substantial third-party liability. In that later vein, NASA currently has contracts with the Massachusetts Institute of Technology and the University of California to provide payload specialists for a Shuttle/Spacelab flight, but those contracts are contingent upon NASA and the institutions' working out appropriate insurance/indemnification clauses. Finally, the amount and terms of insurance protection available are not known since the Shuttle has not yet flown in space, and since it potentially could cause damage not only on launch but also on landing.

Moreover, any system of third-party liability coverage, to be operationally sound, must permit last-minute changes to the manifest of any given Shuttle flight without renegotiation of insurance or indemnification provisions. This means there must be a standard provision agreed to in advance to accommodate changes in the mix of payloads to be flown on Shuttle flights.

B. *Section 308*

Under the newly enacted section 308 NASA is authorized "on such terms and to the extent it may deem appropriate" to provide liability insurance for any user of the Space Shuttle to compensate all or a portion of claims by third parties for death, bodily injury, or loss of or damage to property resulting from activities carried on in connection with the launch, operations or recovery of the Space Shuttle. NASA's appropriations are specifically made available to acquire such insurance, but only on the condition that they "shall be reimbursed to the maximum extent practicable" by the Space Shuttle users. That reimbursement is to be facilitated under reimbursement policies which have been established under section 203 (c) of the Space Act.

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[5]Convention on International Liability for Damage Caused by Space Objects, done at Washington, London and Moscow, March 29, 1972, entered into force for the United States, October 9, 1973; [1973] 24 U.S.T. 2389; T.I.A.S. 7762. For a text, see 1 J. Space L. 86-97 (1973).

Subsection (b) of the new section 308 specifically authorizes NASA to indemnify a Shuttle user against claims, including reasonable expenses of litigation or settlement, by third parties for death, bodily injury, or loss of or damage to property resulting from the launch, operations or recovery of the Shuttle, but only to the extent that such claims are not compensated by liability insurance of the user. The Administration is specifically empowered to issue regulations regarding the exercise of the authority to so indemnify users, and it is required that those regulations must take into account "the availability, cost and terms of liability insurance." Also, it is provided that such indemnification "may be limited to claims resulting from other than the actual negligence or willful misconduct of the user." In commenting on that provision, NASA pointed out in its sectional analysis that if NASA deems it appropriate, it is able "to tailor the extent of the indemnification to the particular circumstances of a given flight, indemnifying the user totally or, for example, indemnifying the user only with respect to damage or injury which did not result from the user's willful misconduct."[6] The proviso by its very terms is permissive, and not mandatory, and in general it would seem that the overall intent of the new section 308 will be best achieved by indemnification of broad rather than limited coverage. Thus it is anticipated that, at least initially, NASA will not limit its indemnification in any way, even though it has the express authority to do so.

In subsection (f) of the new section 308 "space vehicle," a term used earlier in the Space Act in section 103, is specifically defined to include the Space Shuttle and other components of a Space Transportation System.[7] The term "user" is defined to include "anyone who enters into an agreement with the Administration for use of all or a portion of a space vehicle, who owns or provides property to be flown on a space vehicle, or who employs a person to be flown on a space vehicle." The definition of the term "user" was not intended to be broad enough to encompass NASA's research and development contractors who provide components of the Space Transportation System under procurement contracts with NASA.

The term "third party" under the new section is defined to mean "any person who may institute a claim against a user for death, bodily injury or loss of or damage to property." Normally, this would not include persons who have contracted with NASA for the use of the Shuttle. With respect to those persons, NASA has under existing authority adopted a no-fault, no-subrogation approach whereby NASA and each user agree not to bring a claim against the other or any other user for damage to its property or for injury or death of its employees.

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[6]H.R.Rep. No. 52, 96th Cong., 1st Sess. 224 (1978); S.Rep. No. 47, 96th Cong., 1st Sess. 47 (1978).

[7]Section 103 of the Space Act, 42 U.S.C. 2452, refers to "aeronautical and space vehicles." The definition of "space vehicle" in the newly enacted section 308(f) is wholly consistent with the position of the Chief Counsel of the Federal Aviation Administration that the Space Shuttle is a "space vehicle" and not an "aircraft" under the Federal Aviation Act of 1958, 72 Stat. 731, 49 U.S.C. 1301 *et seq.* See 6 J. space L. 65 (1978).

C. *NASA's Implementation of Section 308*

NASA had indicated that in implementing the new authority of section 308 it will to the best of its ability require commercial users to insure against third-party liability.[8] This will be done either by requiring users to purchase insurance from commercial sources or by use of NASA appropriations to procure such insurance from commercial sources, with those appropriations being reimbursed to the maximum extent practicable by prorating the premiums for that insurance among several users. Also, if a given Shuttle flight is a predominantly Government flight, in which the Government would normally act as a self-insurer, but if the flight included one or more commercial payloads, NASA would be authorized to indemnify the owners of those commercial payloads for any third-party liability. It is NASA's intent to implement the proposed section in a way that requires commercial users to pay their proportionate share of insurance protection unless those users are flying small self-contained payloads, for example, or are sponsoring institutions providing payload specialists services to NASA.

NASA intends through a formal notice in the *Federal Register* to solicit on-the-record comments and suggestions from interested parties on how best to implement the new authority. Although that authority specifically allows NASA to use its appropriations to acquire insurance for users of the Shuttle, that way of proceeding is viewed as being far more complex, and therefore far less desirable, than having the users themselves deal with insurance underwriters through established brokerage arrangements. An overriding requirement, however, as pointed out above, is that whatever mechanism is established, it must allow for last-minute changes in the manifests of Shuttle flights without opening insurance and liability provisions to renegotiation.

At the same time NASA is requesting comments on the implementation of section 308, it is negotiating allocation-of-risk provisions with early users of the Space Shuttle to be included in the launch services agreements with those users. Although the final versions of those provisions have not been agreed to, it is anticipated that they will require the user to obtain, at no cost to NASA, liability insurance protecting the user and the United States Government in an amount which would cover all "worst-case" accidents that can be foreseen. Currently, that amount is projected to be $500 million. In return for that coverage, NASA would use its authority under section 308 (b) to indemnify the users for any liability in excess of that amount. NASA is also proceeding to insert in its contracts for payload specialists services, appropriate indemnification provisions running to the contractors providing payload specialists to be flown on the shuttle. Similarly, NASA is drafting indemnification provisions to be included in the agreements under which NASA will fly small self-contained payloads.

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[8]U.S. House Comm. on Science and Technology, Hearings Before the Subcommittee on Space Science and Applications on H.R. 1786, 96th Cong., 1st Sess. (Feb. 22, 1979).

D. *Conclusion*

The "Insurance and Indemnification" provision recently added to the Space Act was tailored specifically to permit NASA to allocate third-party liability risks among the users of the Space Shuttle in a fair and orderly way. In the "clearance" of that section within the Executive Branch,[9] prior to its being recommended to the Congress, there was a view that it could serve as a precedent in other areas. One can speculate whether that will prove to be the case. However, it is clear that NASA's implementation of the new authority and the experience thus gained will provide valuable data to the Government concerning the allocation of risks among those involved in new public programs.

[9]Such clearance—which in the case of section 308 involved the Department of Justice, the Department of the Treasury, the Department of Commerce, the Department of Housing and Urban Development, and the Office of Federal Procurement Policy—is required by Office of Management and Budget Circular A-19.

APPENDIX A

INSURANCE AND INDEMNIFICATION

Sec. 308. (a) The Administration is authorized on such terms and to the extent it may deem appropriate to provide liability insurance for any user of a space vehicle to compensate all or a portion of claims by third parties for death, bodily injury, or loss of or damage to property resulting from activities carried on in connection with the launch, operations or recovery of the space vehicle. Appropriations available to the Administration may be used to acquire such insurance, but such appropriations shall be reimbursed to the maximum extent practicable by the users under reimbursement policies established pursuant to section 203 (c) of this Act.

(b) Under such regulations in conformity with this section as the Administrator shall prescribe taking into account the availability, cost and terms of liability insurance, any agreement between the Administration and a user of a space vehicle may provide that the United States will indemnify the user against claims (including reasonable expenses of litigation or settlement) by third parties for death, bodily injury, or loss of or damage to property resulting from activities carried on in connection with the launch, operations or recovery of the space vehicle, but only to the extent that such claims are not compensated by liability insurance of the user: *Provided,* That such indemnification may be limited to claims resulting from other than the actual negligence or willful misconduct of the user.

(c) An agreement made under subsection (b) that provides indemnification must also provide for:

(1) notice to the United States of any claim or suit against the user for the death, bodily injury, or loss of or damage to the property; and

(2) control of or assistance in the defense by the United States, at its election, of that suit or claim.

(d) No payment may be made under subsection (b) unless the Administrator or his designee certifies that the amount is just and reasonable.

(e) Upon the approval by the Administrator, payments under subsection (b) may be made, at the Administrator's election, either from funds available for research and development not otherwise obligated or from funds appropriated for such payments.

(f) As used in this section—

(1) the term "space vehicle" means an object intended for launch, launched or assembled in outer space, including the Space Shuttle and

other components of a space transportation system, together with related equipment, devices, components and parts;

(2) the term "user" includes anyone who enters into an agreement with the Administration for use of all or a portion of a space vehicle, who owns or provides property to be flown on a space vehicle, or who employs a person to be flown on a space vehicle; and

(3) the term "third party" means any person who may institute a claim against a user for death, bodily injury or loss of or damage to property.

APPENDIX B

SECTIONAL ANALYSIS OF SECTION 308, "INSURANCE AND INDEMNIFICATION"

The new section 308 includes six subsections, (a) through (f).

Subsection (a) authorizes the Administrator to provide liability insurance to any user of a space vehicle to compensate them for claims by third parties for damage resulting from described activities. The Administration is authorized to provide such insurance in its sole discretion on such terms and to the extent it may deem appropriate. Thus, for example, the Administration could require certain Shuttle users to obtain through NASA and pay for an equitable share of third-party liability insurance. On the other hand, the Administration could, in its discretion, exempt other Shuttle users, for example, small self-contained payloads, from the requirement of obtaining insurance or paying for it.

This subsection authorizes the Administrator, for example, to procure insurance for a number of Shuttle flights in the future based on a projected schedule. In doing so, he is authorized to use for the purchase of such insurance appropriated funds available to the Administration. In turn, he is required to seek reimbursement of the appropriation used, to the maximum extent practicable, from the users under general Shuttle reimbursement policies established pursuant to section 203(c) of the National Aeronautics and Space Act of 1958, as amended. This could be accomplished by charging users a fixed price for the insurance based upon an estimate of the cost of insurance, the number of Shuttle flights and users to be protected by the insurance policy, and other relevant factors. Any other reasonable method of charging users for such insurance may be adopted, depending on NASA's experience and the insurance coverage available. It is not anticipated that NASA would use its appropriated funds to protect the U.S. Government (including NASA when flying its payloads) from liability; however, the subsection is broad enough to permit that if the Administrator determines that to do so would be desirable and appropriate in any particular case, for example, depending on the mix of payloads to be flown on a given Shuttle flight.

Subsection (b) authorizes NASA, in its discretion, to provide in any agreement entered into by it and a user of a space vehicle (as defined in subsection 308 (f), for the indemnification of the user against claims by third parties (as defined in subsection 308 (f)) for damage resulting from activities carried on in connection with the launch, operations, or recovery of the space vehicle, but only to the extent that such claims are not compensated by liability insurance of the user. It requires the Administrator to issue implementing regulations which take into account the availability, cost, and terms of liability insurance.

The agreement to indemnify may be inserted in several different types of agreements with users of a space vehicle, including but not limited to, agreements under which NASA provides Shuttle launch services and other Government services and agreements under which non-U.S. Government persons provide to NASA payload specialist services onboard Shuttle flights.

It is specifically provided that the indemnification may, if the Administration deems it appropriate, be limited to claims other than those resulting either from the actual negligence of the user or from willful misconduct of the user, or both. Under this authority, the Administration will be able to tailor the extent of the indemnification to the particular circumstances of a given flight, indemnifying the user totally or, for example, indemnifying the user only with respect to damage or injury which did not result from the user's willful misconduct.

Indemnification is only applicable to claims of third parties who are defined in subsection 308(a)(f)(3) as "any person who may institute a claim against a user for death, bodily injury or loss of or damage to property." It is envisaged that a third party would not normally include persons who contract with NASA for launch services, since NASA expects to include in its launch agreements a provision under which the person procuring launch services agrees that he will not make a claim (and that he will hold NASA and other users harmless) for damage to his property or employees caused by NASA, other users or any other person involved in space transportation system operations during such operations. In turn, NASA and other users would promise not to bring a claim against the user for damage to their property or employees. The result would be that each person flying on a space vehicle would be required either to insure or self-insure his own property.

The indemnification authority is applicable to damage resulting from activities carried on in connection with the launch, operations, or recovery of a space vehicle. The term "space vehicle" is defined in subsection 308(f)(1) to include spacecraft and other payloads that may be launched, with the term specifically including the Space Shuttle. The Administrator's implementing regulations would define technically and in detail the activities carried on that would be protected by indemnification and the extent and duration of such protection.

Subsection (c) provides that certain described conditions must be contained in any agreement providing for indemnification under section 308. Specifically, it requires that (1) notice be given to the United States of any claim or suit against a user for damage; and (2) control of or assistance in the defense by the United States, at its election, of that suit or claim.

Subsection (d) provides that no indemnification payment made under subsection (b) may be made unless the Administrator or his designee certifies that the amount is just and reasonable.

Subsection (e) provides that upon the Administrator's approval, indemnification payments under subsection (b) may be made either from any funds available for NASA's research and development activities not otherwise obligated or from funds appropriated specifically for such indemnification payments. A decision on whether to use existing appropriations or seek additional appropriations from Congress specifically to pay meritorious claims rests with the Administrator. It is the intent of this subsection that no authorized NASA program should be curtailed or terminated because of such indemnification payments.

Subsection (f) provides a definition of three terms used in section 308.

The term "space vehicle" is defined in subsection (f)(1) as any object intended for launch, launched or assembled in outer space, specifically including the Space Shuttle and other components of a space transportation system, together with related equipment, devices, components and parts. This is intended to include, but not be limited to, Spacelab, upper stages, and any payload to be flown onboard a Shuttle for a user.

The term "user," as defined in subsection (f)(2), includes anyone who enters into an agreement with the Administration for use of all or a portion of a space vehicle, who owns or provides property to be flown on a space vehicle, or who employs a person to be flown on a space vehicle. It could include as one "who owns or provides property to be flown on a space vehicle", a person who intends and has made appropriate arrangements to retain ownership of property at any time during flight; *e.g.*, a manufacturer of an upper stage who may retain title to the upper stage during space flight. The definition also includes as one "who employs a person to be flown on a space vehicle" an entity such as a university which would provide under a contract with NASA its employee's services as a payload specialist for a particular Shuttle flight.

The term "third party," as defined in subsection (f)(3), means any person who may bring a claim against a user for damage sounding in tort. As explained previously in connection with subsection (b), a "third party" would not normally include users who contract with NASA for launch services; however, there may be circumstances under which such a person could be a "third party" for the purposes of section 308.