Legal Issues and Answers For Commercial Users of the Space Shuttle

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I. INTRODUCTION

A new age in space exploration has dawned with the first flight of the space shuttle Columbia on April 12, 1981. The success of this revolutionary system of transportation in space has turned a science fiction dream into an incredible reality, confirming the predictions of science fiction writers more than a century ago.[1] Regular trips to the moon, daily journeys into space, and stops at space stations will be routine events before very long.[2] Public enthusiasm for the shuttle program has been phenomenal, and the shuttle is completely booked through 1986.[3]

The space shuttle is being developed with a wide variety of uses in mind—scientific, military, and commercial, for example. Commercial use of the space shuttle by private American or foreign companies presents an unprecedented opportunity for private business to participate in the exploration of space. This participation needs to be encouraged, not only as a source of federal revenue, but also as a source of technological expertise and business management. In order to accomplish this, however, a whole new spectrum of legal issues will have to be faced. Ironically, much of the law is old—contracts, torts, conflicts, insurance, and international law, to name a few. It is the application of the law to advanced technology which is new, and which is now being established as a whole new discipline called "space law." The challenge for the next decade not only will be technological—it also will be legal, for there are few "experts" now in space law.[4] Commercial users are going to require some "experts," however, to answer some difficult questions before they make a substantial financial commitment to use the shuttle.[5] NASA and the legal community must recognize the concerns of the private users, and attempt to resolve them in a manner equitable to all. The future of commercial endeavor in space depends on it.

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1. *See*, JULES VERNE, A TRIP TO THE MOON (1865); *see also* H.G. WELLS, THE TIME MACHINE (1895), THE WAR OF THE WORLDS (1898), THE FIRST MEN IN THE MOON (1901).

2. The National Aeronautics and Space Administration (NASA) is recommending permanently manned space stations as the next primary focus of the space program. AV. WK. & SPACE TECH., July 27, 1981, at 23, and NASA anticipates that it will require only six shuttle trips to build a space station beginning approximately 1989. Young & Crippen, *Columbia's Astronauts' Own Story: Our Phenomenal First Flight*, NAT'L GEOGRAPHIC, Oct. 1981, at 497.

3. Young & Crippen, *supra* note 2, at 502.

4. Robinson, *Private Management and Operations of the Space Shuttle: Some Legal Problems Related to Market Entry*, 13 AKRON L. REV. 601 (1980).

5. Commercial shuttle users will be charged $90 million per flight to occupy the shuttle's 65,000 pound capacity cargo bay beginning Oct. 1, 1985. Wash. Post, June 17, 1982, at A7.

OPERATION OF THE SPACE SHUTTLE

The space shuttle is part of NASA's manned space transportation system (STS) and is unique in the history of aviation and space technology in many ways. It has been described as both an "aircraft" and a "space object," but the distinction thus far has been of little significance.[6] The shuttle is composed of three elements: the orbiter, the external tank, and the solid rocket boosters. The orbiter most resembles an airplane and is about the size of a DC-9 jetliner. It contains the work and living quarters for up to seven people and includes a 60-foot-long payload bay for storing cargo. The orbiter is launched vertically like a rocket, but lands like a glider, and is unique in that it can be reused after each flight. The external tank is initially attached to the orbiter and contains over one million pounds of liquid hydrogen and oxygen which is burned at the time of launching by the orbiter's main engines. At launching the orbiter rides on its fuel tank, and then just before reaching orbit, drops the empty fuel tank which disintegrates and falls to the ocean.[7] Two solid rocket boosters are bolted onto the external tank to provide over 5 million pounds of thrust to lift the orbiter and the tank off the ground. Once the solid fuel is exhausted, explosives fire the boosters away, and they drop off into the ocean where they are recovered and reused.[8]

Nothing as big as the space shuttle has ever been put into orbit, and nothing with wings has ever flown over 17,000 miles an hour. Yet, it has been said that it is the space shuttle's brains as much as its brawn that has made it the most ambitious flying machine ever built.[9] From nine minutes before lift-off until just before touchdown, the space shuttle is almost totally automated, and during critical phases of flight, its computers can perform 325,000 operations a second.[10] In addition, a tracking and data relay satellite system will soon be implemented to provide nearly continuous monitoring and help reduce the probability of experiment failure, reduce the need for on-board data storage, and allow for in-flight modifications of experiments.[11]

The technical capabilities of the space shuttle and its cargo are almost

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6. The Federal Aviation Administration (FAA) has determined that the space shuttle is not an "aircraft" within the meaning of the FAA Act. Thus, it is not subject to air worthiness, operational, navigational, or economic regulations of the FAA, one of the main concerns of NASA. Robinson, *supra* note 4, at 604, 605. *See also* Martin, *Legal Ramifications of the Uncontrolled Return of Space Objects to Earth*, 45 J. AIR L. & COM. 457 (1980); Mossinghoff & Sloup, *Legal Issues Inherent in Space Shuttle Operations*, 6 J. SPACE L. 47 (1978).

7. Gore, *When the Space Shuttle Finally Flies*, NAT'L GEOGRAPHIC, Mar. 1981, at 317.

8. NASA anticipates that the space shuttle launch system may be used for up to 100 missions. *Wings for a New Era*, SKY & TELESCOPE, June 1981, at 478.

9. Gore, *supra* note 7, at 327; *see also*, AV. WK. & SPACE TECH., Apr. 6, 1981, at 41.

10. Gore, *supra* note 7.

11. The sixth shuttle mission due to be launched will combine verification of large new shuttle

beyond the imagination. Whole new vistas in science, medicine, and electronics promise to emerge from the new space law aboard the shuttle. The possibilities are infinite: a communications satellite with a 300-foot antenna can be assembled in space by a shuttle crew and can handle 250,000 calls at once from wrist radios, can relay hundreds of television channels, and can deliver mail electronically.[12] Procedures not possible on earth will be simple to accomplish in space: the zero gravity of space will permit industries to make purer crystals for microelectronics, clearer glass for fiber optics, and stronger alloys from metals that refuse to mix in the earth's atmosphere. One user is already planning to conduct pharmaceutical experiments on the shuttle in the very near future and expects to make drugs in orbit by 1986.[13] About 200 other businesses, foreign governments, and individuals have also reserved space for a variety of experiments which can be conducted in self-contained payloads called "getaway specials" that require no shuttle services, such as power or deployment. These experiments for research and development purposes will be flown on a space-available basis provided they weigh less than 200 pounds and occupy less than 5 cubic feet of space.[14] Technology is ready; now only the legal framework remains to be established.

II. Evaluation of Obvious Risks

Although the development of the space shuttle has been accompanied by an unprecedented amount of caution and preparation, it is clear that some risks of personal injury and property damage remain. There are three stages of a shuttle mission: the ascent phase, the orbital phase, and the descent phase. Each stage presents different possibilities of accidental damage or injury.[15] Danger exists in the ascent phase from a catastrophic failure of the shuttle itself, from the jettisoned rocket boosters, and from fragments of the external tank which may not disintegrate into the atmosphere. The likelihood of damage or injury, however, is extremely remote. First of all, the shuttle launch program includes abort plans in which the boosters and external tank can be prematurely jettisoned so that the orbiter can make an emergency landing shortly after take-off.[16] Secondly, falling debris from the rocket boosters or fuel tank are calculated by NASA to fall

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program elements with deployment of the first tracking and data relay satellite. Av. Wk. & Space Tech., Jan. 10, 1983, at 42.

12. Young & Crippen, *supra* note 2, at 498.

13. *Id.*

14. NASA Space Transportation System Users Handbook, § 1 at 8.

15. Rothblatt, *International Liability of the United States for Space Shuttle Operations*, 13 Int'l Law 471 (1979).

16. Av. Wk. & Space Tech., June 3, 1982 at 14.

over remote parts of the Indian or South Pacific Oceans so that the possibility of fragments falling on populated areas is very slight. And finally, since the launch ranges for the shuttle are situated over water, the chance of any mishap during the ascent phase is extremely remote.[17]

During the orbital phase, there is a danger of collision between the orbiter, or an object which the orbiter places in orbit, and an object which is already in orbit.[18] It is estimated that over 4,000 objects are already in orbit, and this figure will increase substantially in the next decade.[19] Coupled with the fact that nearly all space activities occur within certain preferred orbital paths,[20] it appears that the risk of collision will greatly increase. However, the converse is actually true, since the space shuttle system has increased capabilities to avoid space collisions. The orbiter can retrieve endangered satellites by placing them in the cargo bay,[21] and it can alter a satellite's orbit by attaching and firing rockets. Furthermore, the ground tracking system can anticipate and avoid collisions by remote control computers, thus reducing the possibility of harm. Therefore, any increased likelihood of collision resulting from the increased number of objects placed into orbit can be offset by the space shuttle's increased ability to prevent collisions.[22] Again, the risk of damage or injury during this phase of the space shuttle's operation is small.

The last phase of the space shuttle's operation is the descent phase when the orbiter reenters the atmosphere, burns off excess energy, and glides onto earth. The orbiter descends at about 15,000 feet a minute,[23] and the heat generated by reentry is over 2,000°F. The shuttle is protected, however, by more than 30,000 silica tiles which dissipate the heat and prevent the orbiter from burning up on reentry into the earth's atmosphere. Risks exist during this phase, however, from the loss of tiles due to the impact of the blast-off and the reentry,[24] loss of control of the orbiter when entering the earth's atmosphere at such high speeds, and possible collision with other aircraft located in the path of the descending orbiter. These risks are minimized, however, by the most sophisticated computer systems[25] and the most comprehensive training programs possible. Most

17. Rothblatt, *supra* note 15, at 474.

18. *Id.*

19. 21 NASA SATELLITE SITUATION REPORT 5 (Oct. 31, 1981).

20. Rothblatt, *supra* note 15, at 474.

21. A new remote manipulator arm designed to operate from the orbiter's cockpit can retrieve a satellite or other payload weighing up to 32,000 pounds. AV. WK. & SPACE TECH., Sept. 7, 1981, at 60.

22. Rothblatt, *supa* note 15, at 475.

23. Gore, *supra* note 7, at 344.

24. Some tiles were lost during the launch of the Columbia on Apr. 12, 1981, but apparently no additional tiles were lost during reentry. The tile problem proved not to be as troublesome as originally anticipated. SCI. NEWS, Apr. 18, 1981, at 244. Loss of tiles on the subsequent flights has also proved to be minimal.

25. Five complete and independent computer systems control the space shuttle—four main

of the problems which could arise during this phase have been anticipated by NASA and solutions have been provided.[26] While no venture such as this can be perfectly fail-safe, the chances of accident or injury during the last phase of shuttle operation are also very small.

III. Major Concerns of Commerical Users of the Space Shuttle

The use of the space shuttle by private commercial users[27] presents a unique opportunity for private business to advance technology[28] as well as to increase profits. Thus private business is eager to play its part in the development of the space shuttle. If the obvious risks, as noted above, are so small, and the liability of the United States Government is so great,[29] what are the concerns of commercial users?

A. *Conflicts in the Rights of Multiple Users*

Private business has been involved in space technology for over 25

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computers, with a fifth as a backup system. If one or more disagree with the others, the majority controls. Av. Wk. & Space Tech., Apr. 20, 1981, at 20. *See also* Gore, *supra* note 7, at 328.

26. *E.g.*, the reentry flight path is predetermined and cleared of all other aircraft by the FAA, minimizing the risk of collision. Mossinghoff & Sloup, *supra* note 6, at 51.

27. Technically a "user" is defined in the NASA Launch Services Agreement as

> any United States Government (including NASA) or non-United States Government person or entity who by virtue of a contract or other arrangement with NASA, has arranged for or otherwise provided payloads or SSUS (Spinning Solid Upper Stages) services or persons to be flown on the shuttle. The "user" is the particular person or entity who is party to this Agreement.

NASA Launch Services Agreement, Art. XII, ¶ 38. The term "private commercial user" is used by the author to mean any party to a NASA Launch Agreement except the United States Government.

28. It is well known in the scientific and business community that the development of many now successful technologies, *e.g.* micro-electronics, would be years behind in development, but for the impetus of the space program.

29. The liability of the United States has been established by numerous international treaties and conventions and by federal statutes, *e.g.*, Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Jan. 27, 1967, United States-England-U.S.S.R, 18 U.S.T. 2410; Convention on International Liability for Damage Caused by Space Objects, Oct. 9, 1973, United States-England-U.S.S.R., 24 U.S.T. 2389; Convention on Registration of Objects Launched into Outer Space, Sept. 15, 1976, United States-England-U.S.S.R., 28 U.S.T. 695; the Federal Tort Claims Act, 60 Stat. 842 (codified in scattered sections of 29 U.S.C.); National Aeronautics and Space Act of 1958, 42 U.S.C. §§ 2451, 2484; National Aeronautics and Space Administration Act of 1980, 93 Stat. 348 (1979). The liability of the United States under these laws has been thoroughly discussed by other authors, and will not be covered in this article. *See*, Cristol, *International Liability for Damage Caused by Space Object*, 74 Am. J. Int'l. L. 346 (1980); Diederiks-Verschoor, *The Operator's Liability with Regard to Transport of Goods by Space Shuttle*, 13 Akron L. Rev. 689 (1980); Martin, *Legal Ramifications of the Uncontrolled Return of Space Objects to Earth*, 45 J. Air L. & Com. 457 (1980); Mentor, *STS-Legal Connotations*, 13 Akron L. Rev. 629 (1980); Mossinghoff, *Managing Tort Liability Risks in the Era of the Space Shuttle*, 7 J. Space L. 121 (1979); Rothblatt, *International Liability of the United States for Space Shuttle Operations*, 13 Int'l Law 471 (1979); Wolcott, *Some Aspects of Third Party Liability in Space Shuttle Operations*, 13 Akron L. Rev. 613 (1980).

years. Satellites have been launched and placed into orbit since 1957,[30] and almost 13,000 space objects have been launched into orbit since then.[31] But all of these launchings have involved one satellite at a time and thus only one responsible party—either the launching government or the manufacturer or owner of the satellite. Now the space shuttle permits more than one satellite, payload, or other technological experiment to be launched and to function simultaneously on a shared shuttle flight.[32] This raises a whole host of questions and problems for individual users: 1) Will one user have priority over another? 2) If so, how will priority be determined?[33] 3) What happens if one payload or experiment delays the scheduled launch, or causes damage to another experiment? 4) How will liability of multiple users be assessed—by percentage of space used in the cargo bay, by percentage of number of users on a particular flight, by cost or risk of experiment? NASA has attempted to answer some of these questions by requiring a no-fault, no-subrogation, inter-party waiver of liability under which each party agrees to be responsible for any damage which occurs to its own property.[34] Thus NASA will be responsible for all damage caused to the space shuttle by either NASA or a user,[35] and all users will be responsible for all damage to their own property. This does not provide all the answers to all the questions, but it does make an attempt to allocate the risks according to who can best bear the burdens.[36]

B. *NASA's Right to Delay a Launch or to Cancel or Jettison a Payload*

While these particular risks are specifically defined in NASA's Launch Agreement, they are still of concern to the commercial user, and may still be subject to further negotiation if the present terms prove to be unworkable or financially prohibitive. According to present terms, NASA has authority to delay lift-off of a launch for up to 72 hours or to suspend or postpone a

30. Sputnik I was launched by the Russians on Oct. 4, 1957.

31. NASA Satellite Situation Report, *supra* note 19.

32. "Shared Shuttle Flight" is defined as "a shuttle flight that may be shared by more than one user." NASA Launch Services Agreement, Art. III, ¶ 26.

33. A modification of 14 C.F.R. §§ 1214.1-1214.2 has been proposed which provides NASA with guidelines to establish priority for one payload over another previously scheduled payload. Priority will be given first to a payload urgently required for national defense or security, and second to a significant experimental or exploratory scientific payload which has a critical launch opportunity. A payload which is critical to the establishment of the Space Transportation System (STS) will also have priority.

34. NASA Launch Services Agreement, Art. V, ¶ 3.

35. NASA will be responsible for damage caused by a user in the space shuttle (which could involve billions of dollars) only while the user is involved in STS operations. NASA Launch Services Agreement, Art. V.

36. Other solutions to these questions will be discussed in § IV, *infra*.

launch of a payload under certain specifically-described circumstances.[37] These conditions include safety, weather conditions, NASA's equipment malfunction, failure of the user to meet "significant" obligations under the Launch Agreement, and certain other conditions which may be beyond NASA's control.[38] NASA may also shift the scheduled launch of cargo from one mission to another mission. A delay in a launch or a need to shift cargo presents a multitude of problems for users as well as for NASA. All cargo must be compatible with each other and must be integrated with the entire shuttle operation. This involves coordinating and orchestrating technical elements, safety, science or defense priorities, and insurance coverage. Insurance arrangements completely satisfactory for one launch, for example, may be wholly inadequate for another launch which contains a different mix of cargo.

NASA has repeatedly attempted to assure users that its authority to suspend and postpone a launch will be reasonably limited, and jettison of a user's payload will only take place if the particular payload presents an immediate or unresolvable danger to human life, another payload, or the shuttle flight.[39] Furthermore, NASA claims that jettison will occur only after a reasonable attempt has been made to place the payload in a safe configuration, and then only after consultation with the user. Only increased use of the space shuttle by commercial users, however, will prove whether or not NASA's authority to suspend or jettison payloads will result in abuse or discrimination.

C. *NASA's Right to Terminate the Agreement*

NASA reserves the right to terminate the Launch Agreement, in whole or in part, (i) upon a declaration of war by the United States, (ii) upon a declaration of a national emergency by Congress, (iii) upon failure of Congress to provide NASA with "adequate appropriations," and (iv) upon a written declaration by NASA that launch services are "beyond NASA's control."[40] While users have not expressed serious concern over termination because of war or national emergency, they have expressed concern over the latter two reasons.[41] NASA has indicated that it will not terminate the agreement frivolously, but users are not satisfied with the escape language—"adequate appropriations" and "beyond NASA's control"—since they are obligated to reimburse NASA for all amounts due under the

37. NASA Launch Services Agreement, Art. IV, ¶. 4.

38. Address by S. Neil Hosenball, Risks in Commercial Space Ventures, Am. Inst. of Aeronautics-Astronautics, Long Beach, CA (May 12-14, 1981).

39. *Id.*

40. NASA Launch Services Agreement, Art. VII, ¶ 1.

41. Hosenball, *supra* note 38.

Launch Agreement for launches which have actually occurred and for optional shuttle services requested by them which were actually provided or for which costs were actually incurred. NASA claims its right to terminate is equitably balanced by the right of the user to terminate the agreement at any time for any reason. While the user does have such a right, the equities still lie in favor of NASA since it will be easier for NASA to secure an alternate user, than it will be for a user to secure an alternate launch system.[42]

D. Costs for Services and Provisions for Reflight and for Orbit

The Launch Agreement is supplemented by a Payload Integration Plan (PIP) which provides a detailed technical statement of work to be performed by NASA, including a description of all "standard" and "optional" services. "Standard" services are those which are included by NASA in a basic fixed price, and "optional" services are those "extra" services for which a user must pay an additional amount.[43] NASA claims that prior to gaining experience in actual operation of the space shuttle, it is unable to provide a comprehensive list of what is "standard" and what is "optional." Thus it still reserves the right to make that determination throughout negotiations with a commercial user. This, of course, places the user in a difficult and uncertain position faced with spiraling costs which are not yet defined.

Another problem related to "standard" vs. "optional" services concerns NASA's guarantee for reflight. As part of the "standard" flight price, NASA has included a fee for a reflight guarantee, which means that if the first scheduled launch of a payload is "unsuccessful," NASA will provide a reflight of that payload at no additional cost to the user.[44] NASA, however, defines the success of the launch to be that the payload reaches the orbit of the shuttle mission—not the higher orbit required for the payload. A guarantee for the higher orbit would require an additional cost to be sustained by the user by an additional fee for "optional" services or by an additional premium for insurance. Either way, it means an additional cost to the user to get his payload into the proper orbit, even though the failure of the first launch was not the user's fault.

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42. The United States is also operating the Delta Launch System, and the European Space Agency (ESA) offers the Ariane. A private German company, OTRAG, has conducted some private commercial launches. Space Services, Inc., an American company, also recently launched a Minuteman booster off the coast of Texas. Other private companies are also attempting to enter the field. Address by Bockstiegel, Present and Future Regulation of Space Activities by Private Industries, ALI-ABA Int'l. Conf. on Doing Bus. in Space: Legal Issues & Prac. Probs., Washington, D.C. (Nov. 12-14, 1981).

43. NASA Launch Services Agreement, Art. II, ¶ 1. *See also*, NASA Space Transportation User Handbook, § 3, at 1.

44. The guarantee is not applicable if the first launch attempt is unsuccessful due to the fault of the user. NASA Launch Services Agreement, Art. II, ¶ 1. *See also*, 14 C.F.R. § 1214.103 (1982).

E. NASA's Express Limitation of Liability for Breach of Contract

NASA has expressly provided in the Launch Agreement that no action may be brought against it or its contractors for damages or for other relief for any delay in launch services.[45] NASA agrees in the Launch Agreement to use its "best efforts" to provide proper and timely launch services, and anticipates that this language is sufficient and equitable since NASA only charges a user for actual or projected costs for launch services. There is no protection for the user, however, for costs resulting from delay, non-performance, or mal-performance, and it is clear that these costs may be considerable since many experiments may involve critical time elements, and many users may have enormous investments of capital tied up in these projects. Additionally, there may be a problem defining the term "best efforts" with NASA demanding the most liberal interpretation, and the users claiming the contrary. In order for commercial users to secure full protection of their contract rights, it appears that they will have to make arrangements for private insurance coverage, again, at additional expense.

F. Third-Party Liability

Perhaps the paramount concern of commercial users of the space shuttle is their liability for injuries to third parties. Even though statistically the probability of injury is low, the possibility is always present, and if an accident occurs, there is a potential for a multi-billion dollar claim. The NASA Launch Agreement requires all commercial users to obtain third-party liability insurance naming both the user and the United States Government as insureds.[46] The user is obligated to protect NASA and itself from third-party liability until the orbiter lands without causing damage to third parties or until the payload impacts the earth without causing damage to third parties, whichever occurs last.[47] The amount of insurance and the terms and conditions of insurance must be approved by NASA, and NASA obligates each user to obtain the maximum available in the world market up to $500 million, provided that amount can be obtained at a reasonable premium.[48] If NASA determines that it is not feasible for the user to obtain such insurance or that the user is unable to obtain adequate insurance,

45. There are two exceptions in this provision: (1) if NASA fails to obtain from all users, and certain other parties, a waiver of liability against negligent users who damage property or injure employees, a claim may be brought against NASA for this breach of contract; (2) if NASA fails to protect a user's "trade secrets" in data furnished to NASA pursuant to the Launch Agreement, an action may also be brought. Hosenball, *supra* note 38.

46. NASA Launch Services Agreement, Art. V, ¶ 2.

47. Hosenball, *supra* note 38.

48. NASA Launch Services Agreement, Art. V, ¶ 2.

NASA has the authority to provide for commercial insurance and/or indemnification and charge the user a reasonable fee.[49] The big question is: how much insurance is available in the world market? There is some controversy as to the maximum available at the present time, but many in the insurance community believe the maximum to be $500 million per user, per shuttle mission.[50] This poses a serious problem for multiple users on shared shuttle flights, since sufficient insurance may not be available for all users.[51] NASA has agreed to indemnify all users for liability in excess of the amount of insurance they are able to secure,[52] but this indemnification is not absolute.[53] Additionally, the proposed users' insurance policies contain various exclusions, which, again, subject the users to additional liability. Thus, if the user obtains an insurance policy with exclusions, the user is a self-insurer up to $500 million, to the extent of the exclusions, and NASA will not indemnify the user until the $500 million mark is exceeded.[54] While certain users will not be required to purchase liability insurance and will be indemnified by NASA,[55] it is clear that the majority of commercial users are extremely concerned over insurance and indemnification issues, and further negotiation between NASA and the users is absolutely required so that the risks involved in the development of the space shuttle will be equitably apportioned.

The development of any new industry which benefits the entire public requires government subsidy or indemnification at least during the early stages of development. The space program is no exception. Without adequate government indemnification, contractors, subcontractors, and users of the space shuttle will not be able to provide the creative ideas and research and development which are necessary for the establishment of a safe and profitable space transportation system. Therefore, insurance and indemnification issues must be resolved promptly to assure dynamic commercial participation in the space shuttle program.

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49. National Aeronautics and Space Act of 1958, 42 U.S.C. §§ 2451-2484 (1976 & Supp. IV 1980).

50. Schrodt, *Insurance for Space Ventures: Is There Enough to go Around?*, 350 J. Com., Nov. 20, 1981 at 1A.

51. Some solutions to this problem will be discussed in § IV, *infra*.

52. NASA LAUNCH SERVICES AGREEMENT, Art. V, ¶ 2e(2).

53. First of all, NASA believes that the amount each user is able to secure is $500 million; therefore, NASA will not indemnify a user until the $500 million liability mark is exceeded. Additionally, indemnification is not provided if a user is negligent or is guilty of willful misconduct, and indemnification is not available to contractors or subcontractors of users. NASA LAUNCH SERVICES AGREEMENT, Art. V.

54. Hosenball, *supra* note 38.

55. They include: (1) those flying small self-contained payloads; (2) those providing payload specialists under NASA contracts; (3) those exempted by NASA for public interest reasons; and (4) agencies of the United States Government. 45 Fed. Reg. 74,500 (1980).

IV. Some Solutions for Financial Protection of Commercial Users

A. *Provide for Private Insurance and Centralize the Insurance Operations*

An obvious solution for limiting financial liability is private insurance. Insurance is presently available to the commercial user and is certainly a viable answer to many problems discussed earlier. At present there are several different types of insurance on the market: 1) ground property or preignition insurance, 2) launch insurance, 3) satellite life insurance, and 4) liability insurance.[56]

Satellite ground property insurance has been available for individual users and satellite owners for some time to protect against loss or damage during the manufacture, storage, transit, and launch site assembly phases. Coverage is also available to protect against launch delays and for launch delay penalties which may be incurred by the satellite owner. Coverage terminates with intentional ignition of the launch vehicle. Launch insurance is then available to cover loss or damage due to "launch failure." This is the most exposed phase of any satellite project, and indemnity is usually provided for the cost of a replacement spacecraft, the cost of re-launch services, and the cost of delay expenses.[57] Users must carefully define "launch failure" and secure coverage for all necessary contingencies, such as failure to achieve proper orbital position, failure to be at proper longitude, failure to maintain proper fuel and power supplies, and failure to orbit or sustain the payload in good physical condition. Launch coverage usually extends 180 days in order to cover both the movement of the satellite from transfer to the final geosynchronous orbit and roughly the first 160 days of the satellite at the final station—a period usually devoted to the testing and final check-out of the satellite before operational use. The user will then be interested in satellite life insurance to insure that the satellite or other experiment, will function as planned once it is placed in proper orbit. Again, it will be necessary for the insured to carefully define the conditions under which a loss occurs in order to maximize protection. Finally, the commercial user must provide for third-party liability coverage. In the space business, liability insurance is the most difficult area to provide adequate protection. There are two basic factors involved. First is the fact that the history of the space transportation system is extremely limited, and the exposure in the event of a loss is enormous. Second is NASA's requirement, as mentioned above, that each user secure on each shuttle mission $500 million worth of

56. Marsh & McLennan, Satellite Insurance: An Overview; *see also*, Margo, *Some Aspects of Insuring Satellites*, Ins. L.J., Oct. 1979, at 555; and Johnson & Higgins, A Report on Spacecraft Insurance ( ).

57. Johnson & Higgins, *supra* note 56.

insurance. These problems are not insurmountable, however, and the insurance industry is anxious to participate in the commercialization of space.

What is necessary is to define the capacity of the world insurance market and to create a system to disseminate information to and from insurance agents and brokers. This means establishing a centralized insurance group which will specialize in underwriting space risks and which will register and keep on file the names of all insurance companies who wish to participate in insuring space projects.[58] Each insurance company can register the amount of funds available at a particular time to insure a particular mission, and all information can be entered on computers and can easily be retrieved. NASA and all commercial users, contractors, and manufacturers will then know what is available, when it is available, and who wants to participate. Financial and risk analysis can be performed at this central clearinghouse, and risk and rate information can easily be made available to all potential customers. NASA and the commercial users would then know what the maximum insurance capacity is at any given time; all responsible insurance companies would be given the opportunity to participate in the risk management of the space program; and a space risk expertise would be developed which would benefit both the insurers and the insureds.

B. Broker the Shuttle Operation

Centralizing the shuttle insurance business solves the problem of how much insurance is available and who is willing to participate. But it does not solve the $500 million insurance requirement for each multiple user on each mission and the priority and risk allocation problems inherent in shared shuttle flights. These problems call for one private company or a joint venture of several companies knowledgeable in space shuttle operations to purchase each shuttle mission and to "broker" the entire operation. One centralized source then would pay for an entire mission, and would be responsible for the $500 million maximum insurance as the sole "user," and would subcontract out the mission to various users allocating the cargo space and the insurance premiums among them. The "broker" would be a "mission manager," or "commercial cargo consignee" and would be responsible for the entire technical operation of the mission, the compatibility of the various payloads, the allocation of the risks, and the priority as to who

58. Some proposals for insurance "pools" or "consortiums" or "facilities" have been discussed by individual insurance companies or brokers, but to date no central space risk facility is operational. Insurance has been provided for early satellites through the London Aviation Market, the Associated Aviation Underwriters (AAU), and the United States Aviation Underwriters (USAU). The Marine Market has now entered the satellite launch and life insurance field, and other insurance markets are investigating entering the space risk business.

flies.[59] No responsible user would be denied access to a shuttle mission, and professional technical management would result. NASA would be relieved of tedious day-to-day operational decisions, such as deciding which services are standard and which are optional, and NASA could concentrate on the launch services and on basic research and development, leaving the payload integration and management problems to the commercial mission manager.[60] NASA's budget problems would also be relieved, as the commercial manager would assume responsibility for a variety of tasks such as assuring the safety of the individual cargo elements, allocating the shuttle resources, and negotiating the individual launch agreements. Centralized brokering of a shuttle mission would result in no overlapping or wasted insurance coverage since one "user" would purchase a more efficient umbrella policy covering all risks. Costs would be reduced and users would benefit from such a brokered flight since each user would pay only for his allocated share of the entire cargo launch package, and the coverage for each launch would be more easily coordinated by the mission manager or commercial cargo consignee. Also, the liability would be more clearly focused on the one mission manager rather than on multiple users with different insurers who may attempt to disperse their responsibilites.

Private business has demonstrated its success in the past in developing new industries in the public interest, and the commercialization of space should be no exception.[61] A commercial mission manager, created by a consortium or joint venture of private aerospace companies with technological and management expertise, would greatly advance the space program. Private brokering of the space shuttle, therefore, should be given serious consideration by NASA.

C. *Change NASA's Requirements*

If the insurance and management problems of the space shuttle cannot be resolved by centralizing the insurance operations and brokering the shuttle operations, then certain requirements presently proposed by NASA must be changed. Since the capacity of the world insurance market seems to be at or near its maximum and multiple users are each required to obtain

59. Of course priority would always be given to payloads affecting national defense or security.

60. NASA Administrator, James M. Beggs, has stated that he wants to divest the agency of shuttle operational responsibility starting about 1985. "NASA is not an operating agency," he has said; "we are in the research and development business." Av. Wk. & Space Tech., Mar. 1, 1982 at 20.

61. From railroads to automobiles to airlines, the success story is clear. Now it is predicted that industries as diverse as engineering, advertising, manufacturing, repair, communications, and sales, among others, will benefit from ventures into outer space. Barham, *Count-Up For Space Insurance*, J. Ins., Jan.-Feb. 1982, at 26.

that maximum, the conflict must be resolved. There is no problem, however, as the NASAct and corresponding regulations do authorize alternative actions:[62] 1) NASA can purchase an insurance policy for each mission of the space shuttle and can allocate the premiums among the users on that mission; 2) NASA can designate one user to purchase a single insurance policy for all the users on a particular flight and, again, allocate the premiums; and 3) NASA can indemnify all the users on a particular mission and charge a fee for the indemnification.[63] The only difficulty with these solutions is that they may present certain administrative problems, and they could result in putting NASA in the insurance business—a position NASA, at present, rejects.[64] The solutions are feasible, however, and are clearly authorized by law. They do warrant careful consideration as a means of providing financial protection to commercial users of the space shuttle.

V. Conclusion

The space shuttle Columbia has now flown 6 successful missions. The next flights are already scheduled to include commercial payloads. Therefore, the time is now to resolve the legal issues and to provide for the financial protection necessary for commercial use of the space transportation system. The concept of scheduled travel in space, conceived a century ago and popularized only recently by all the "Star Trekkies" is really not a surprise. We all knew it would happen; the only question was—when? Now the dream of spaceships and space stations is a reality, and we must deal with the consequences. If science can create the product, then surely law can protect the system. Continued exploration in space depends on it.[65]

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62. The NASAct of 1958, Pub. L. No. 96-48, § 308, 93 Stat. 345, 348 (codified as amended at 42 U.S.C. § 2458(b) (Supp. IV 1980)); 14 C.F.R. 1214.13 (1982).

63. The premiums could even be placed in an indemnification fund to pay future claims.

64. Statement by S. Neil Hosenball, General Counsel, NASA, ALI-ABA Int'l Conf. on Doing Bus. in Space: Legal Issues & Prac. Probs., Washington, D.C. (Nov. 12-14, 1981).

65. At the time this article went to press, 6 space shuttles had been launched. The sixth shuttle mission on the space shuttle Challenger is due to be launched in late March or early April, 1983, as soon as cracks in the main engine can be repaired. Av. Wk. & Space Tech., Mar. 7, 1983, at 23.