With regard to space orbits and the potential exploration of celestial bodies, access to land areas for human research or settlement requires expanding and putting in place "equitable access" agreements, especially for both basic and applied scientific research. Equitable access provisions would provide for special areas or "zones" for research where the term "access" does not grant ownership. We note the term "access" does not create ownership of a position or segment of the orbit in the space frontier, but only gives the possessor the right to use it. In balancing equitable access, efficiency, and the needs of the developing countries, the authors of this paper have suggested in previous publications that the creation of a tax-free "economic zone" or "research zone" on Mars could be the key to how a few hundred inhabitants from a score of Earth Nation-States could maintain a multilateral balance covering tens of thousands of hectares on Mars.[58]

A multilateral agreement should set forth the necessary attributes of an efficient and equitable approach to respect the property of celestial bodies – notably Mars and the Moon – as a common property that cannot be claimed by any one State or consortium of multinationals doing research on a spacecraft or on the surface or subsurface of celestial bodies. However, such a system of multilateral management must provide for the allocation of rights, and the power to exclude, use, and dispose of property interests. All of these rights require the protection of sovereign power for the provision of which the Nation-State has been developed and is suited according to space laws that have been evolving since 1967. The current and developing space property laws and adjoining issues of liability are not completely incompatible with such a system, but are vague and in-

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sources Conservation Service, *Conservation Security Program,* http://www.nrcs.usda.gov/programs/csp/ (last visited May 16, 2009). These programs range from equitable access to farmland to freshwater. The United Nations program Secure and Equitable Access to Land (SEAL) has similar goals for sub-Saharan Africa. *See* Partnerships for Sustainable Development, *Secure and Equitable Access to Land,* http://webapps01.un.org/dsd/partnerships/public/partnerships/23.html (last visited May 16, 2009).

[58] James Hurtak & Matthew Egan, *Consequences for Space Law-Making of Water Discovery on Mars*, 29 ANNALS OF AIR & SPACE LAW 393-422 (2004).

consistent with respect to new situations, e.g., competition for water resources on a foreign planet, finding of other life forms, extraordinary events, etc. This could be because such events, until the recent press releases regarding the strongest evidence to date of flowing water on Mars and the tantalizing possibility that such a potential discovery will yield a biological historical record in the form of fossils, had seemed farfetched. It seems time to be ahead of the curve in developing an environmental and research agenda that will provide adequate protections and still create incentives for exploration.

We believe a very good strategy would be to amend existing laws and, by treaty, explicitly approve a system of multinational rights – such a system could apply only to space travel or could, more generally, become positive international law. Better yet, however, due to the gamut of issues and the new terminology needed for possible near-Earth orbital zones and environmental protection zones for Martian resources,[59] we suggest a series of new agreements with a framework of responsibilities, trade-offs, and language that sets forth a research and policy agenda that provides for information-sharing and environmental protection. Such a course of action would highlight the importance of Mars and the Moon as future exploration zones and would be based on the concept of "reasonable use" of Martian and lunar properties as a basis for protecting national and non-national property rights and govern property appropriation issues.

V. CROSS-WAIVERS OF LIABILITY

The notion of "absolute" or "strict" liability, the duty to compensate not subject to exoneration or a determination of fault, has become an important part of space launch and exploration.[60] Without relying on the traditional notions of fault or

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[59] *Id*.

[60] Sections 519 and 520 of the Restatement (Second) of Torts define strict liability for "ultrahazardous activity" a standard adopted by many of the states in the United States. Section 519 provides: (1) One who carries on an abnormally dangerous [or ultrahazardous] activity is subject to liability for harm to the person, land or chattels of another resulting from the activity, although he has exercised the utmost care to prevent the harm. (2) This strict liability is limited to the kind of harm, the possibility of which makes the activity abnormally dangerous. Section 520 contains a list of "the factors to be

negligence, recent instruments provide for certain exceptions to liability resulting from acts of God.[61] The Convention on International Liability for Damage Caused by Space Objects (hereinafter "Liability Convention") was the most important document for establishing a system for apportioning liabilities for accidents regarding space activities.[62]

Under the Liability Convention, if a space object causes damage on the surface of the Earth or to aircraft in flight, absolute liability attaches to the launching state.[63] This is based on the notion that space launch involves "ultrahazardous activity" a rule of tort law that requires that entities that engage in activities that entail potential harms that cannot be mitigated are strictly liable for the harms they cause.[64] The launching state is defined as the "State which launches or procures the launching of a space object . . . [or] . . . a State from whose territory or facility a space object is launched."[65] In cases of accidents occurring in outer space or Earth orbit ("elsewhere than on the surface of the Earth"), liability is determined by fault. If there is more than one launching state, joint and several liability exists

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considered in determining whether an activity is abnormally dangerous." RESTATEMENT (SECOND) OF TORTS § 519, comment b (1997). These factors include the risk of harm, its likely scope, ability to eliminate the risk, whether the activity is uncommon, whether the activity is inappropriate to a particular place, and the value of the activity. Moore v. R. G. Indus., 1984 U.S. Dist. LEXIS 24010 (N.D.Ca.1984); *see also* Manfred Lachs, *Challenge of the Environment*, 39 INT'L & COMP. L.Q. 663 (1990); Manfred Lachs, *Views from the Bench: Thoughts on Science, Technology, and World Law*, 86 AM. J. INT'L L. 673 (Oct. 1992) [hereinafter *Views from the Bench*]; M. Spada, *Risks of space market and liability in commercial space ventures,* IEEE AEROSPACE CONFERENCE 159-166 (Mar. 5-12, 2005); Henri A Wassenbergh, *International Space Law: A Turn of the Tide*, 22 AIR & SPACE LAW 334, 339 (1997).

[61] Paris Convention on Third Party Liability in the Field of Nuclear Energy, July 29, 1960, 956 U.N.T.S. 251 [hereinafter 1960 Paris Convention]; Brussels Supplementary Convention to the Paris Convention on Third Party Liability in the Field of Nuclear Energy, Jan. 31, 1963, 1041 U.N.T.S. 358; Vienna Convention on Civil Liability for Nuclear Damage, May 21, 1963, 1063 U.N.T.S. 265.

[62] Explicit cross-waivers of liability with regard to the Space Station Freedom were adopted in the United States in 14 C.F.R. § 1266, et. seq.; *Views from the Bench*, *supra* note 60.

[63] Lara L. Manzione, *Multinational Investment in the Space Station: An Outer Space Model for International Cooperation?,* 18 AM. U. INT'L L. R. 507 (2002).

[64] GLENN H. REYNOLDS & ROBERT P. MERGES, OUTER SPACE: PROBLEMS OF LAW AND POLICY 303 (2d ed. 1997).

[65] Manzione, *supra* note 63.

between or among them, and a standard of comparative negligence may be employed, if appropriate.[66]

Reading the Liability Convention in concert with the Outer Space Treaty requires State liability for all activities in outer space, whether undertaken by governmental, non-governmental organizations, or private entities acting within their territory. A State may thus be liable for the acts of a corporation registered in its territory that procures a launch in a different State, irrespective of the host State's knowledge or involvement in the launch.[67] This creates incentives for States to either regulate the commercial launching enterprises located within their boundaries or to monopolize space launch and exploration.

Commentators have suggested that the absolute liability inhering from the Liability Convention makes private investment in space exploration too risky. In order to promote space exploration, use, and investment, governments have allowed entities to use cross-waivers to contract around the liability requirements, at least as they stand between contractors, subcontractors, users or customers, and suppliers of any kind. A good example of this is contained in Article 16 of the IGA, which reduces liability in and between participating States and their contractors.

The Liability Convention applies to situations not specifically covered by the cross-waiver and requires claimants to present their claims through diplomatic channels. The extent of liability is to "be determined in accordance with international law and the principles of justice and equity."[68] This is to say that while participants in a joint venture can contract with one another regarding personal liability, they cannot contract around international law that holds them absolutely liable for damage done to non-participants or the public.

Cross-waivers provide protections against liability between participants, thus greatly reducing the risk of liability between partners and their contractors. NASA agreements involving

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[66] *Id*.

[67] *Id*.

[68] Mary B. McCord, *Responding to the Space Station Agreement: The Extension of U.S. Law into Space*, 77 GEO. L. J. 1933 (1989).

Space Shuttle flights are required to contain broad cross-waivers of liability among the parties and their related entities to encourage participation in space exploration, use, and investment. The purpose of this clause is to extend this cross-waiver requirement to contractors and related entities under their contracts. This cross-waiver of liability is broadly construed under US domestic law to achieve the objective of encouraging participation in space activities.[69]

The cross-waiver utilized by the Space Station Agreement is similar to that used by NASA in its Launch Service Agreements with private commercial entities.[70] It requires partners to waive all claims against other partners, their related entities, or employees of the other partners or their related entities, for damage arising out of protected space operations. For purposes of the Space Station Agreement, protected space operations include "all launch vehicle activities, Space Station activities, and payload activities" whether they occur "on Earth, in outer space, or in transit between Earth and outer space," as long as these activities are conducted in furtherance of implementing the Space Station Agreement.[71] Protected space operations do not include "activities on Earth which are conducted on return from the Space Station to develop further a payload's product or process for use other than for Space Station related activities."[72]

> The cross-waiver does not apply to:
> (1) claims between a Partner State and its own related entity or between its own related entities;
> (2) claims made by a natural person, his/her estate, survivors, or subrogees for injury or death of such natural person;
> (3) claims for damage caused by willful misconduct;
> (4) intellectual property claims.[73]

Since these exceptions create openings for future claims for which the Space Station Agreement does not provide guidelines, future cross-waiver provisions for joint ventures in space explo-

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[69] NASA F.A.R. Sup. 5228-41.
[70] *See* McCord, *supra* note 68.
[71] *Id.*
[72] *Id.*
[73] *Id.*

ration should be modified to be as inclusive of new situations as possible.

Adequate cross-waiver provisions for international joint ventures for a Mars expedition or other space exploration should be based in part on the NASA and the Space Station Agreements' cross-waivers, but should either be modified to account for the issues raised by several commentators cited above, or COPUOS or another of the UN space governing bodies, such as the International Mars Space Committee (IMSC) suggested below, should be responsible for apportioning liability between partners in space faring activities that fall outside the specific contract provisions of the cross-waivers.

Cross-waivers should also not be extended by international instrument to deprive innocent parties of just compensation for accidents they had no part in creating. Thus, if a space mission is lost shortly after takeoff and natural people are, for example, injured by debris or nuclear fallout, absolute liability should inhere. Having a rule of absolute liability for those injured by space launch accidents or returns creates a strong incentive for safety and works to protect people from accidents over the long term. If participating governments want to reduce liability, they can indemnify the entities that participate in launch activities up to a certain liability level as the United States had done with nuclear power plant operations.[74] This is a subsidy of sorts, but if practiced carefully, it can also work to increase mission safety.

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[74] An example of this is the United Sates' Price-Anderson Act (42 U.S.C. § 2210). The Price-Anderson Act requires civilian nuclear power companies to purchase the maximum amount of insurance available to them (roughly $300 million). Then, the civilian nuclear power companies are each liable for an amount that would be paid into a fund in the case of an accident. Currently, the contributions are roughly $100 million and the fund itself is roughly $10 billion. Beyond that, the United States government agrees to indemnify the nuclear industry for the cost of an accident above and beyond the $10 billion threshold. The Act has been criticized as a subsidy on the cost of safety for nuclear power plants, but was used as a way of stimulating civilian production of nuclear power. The United States Supreme Court upheld the Act's constitutionality in Duke Power Co. v. Carolina Environmental Study Group, 438 U.S. 59 (1978). In *Duke Power*, the Court held that the Act bore a rational relationship to the goals sought by Congress, namely to support the development of nuclear power. This overrided the fact that the indemnification agreement would subvert victims' tort claims and treat them differently than other industrial accidents.