

ENVIRONMENTAL LIABILITY ISSUES OF ROCKET EXHAUST UNDER INTERNATIONAL SPACE LAW

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Abstract

Rocket exhausts cause potential damage to the earth's environment. Legal liability for environmental damage is an accepted doctrine, but it has not yet been applied with regard to rocket exhausts. International space law contains rules governing liability for damage to the earth from space activities, but these rules have not yet been applied to rocket exhausts. It is proposed that operators of rockets which damage the earth's environment be made proportionately liable for the damage they cause. This will result in incentives to produce less pollutive means of reaching space, and will provide a source of funding for mitigating the harm caused by rocketry.

Rockets Cause Potential Damage to the Earth's Environment

There appears to be broad consensus that rocket exhausts pose a real, albeit relatively small, threat to atmospheric quality and the ozone layer. On October 18, 1991 it was reported by the Xinhua

General Overseas News Service that an international scientific study:

"concluded that rockets blasting into space generate pollutants that deplete stratospheric ozone, increase acid rain, contribute to global warming and reduce air quality. Solid-fuel rockets are the biggest source of rocket pollutants which damage the atmosphere, according to Dr. Jerry Grey, Science and Technology Policy Director for the American Institute of Aeronautics and Astronautics. The burning of a common component, ammonium perchlorate, can produce tons of hydrochloric acid and chlorine, which acts as a catalyst to break down ozone, he added. The study showed the United States used more solid rockets than any other nation...."

U.S. solid-fuel rockets which damage the atmosphere include the Space Shuttle, the Air Force Titan IV, and the Orbital Science's Pegasus air-launched rocket. The Shuttle and Titan cause much more pollution than the Pegasus. However, the Shuttle and Titan are more immune to regulation as government programs than

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is the commercially operated Pegasus. As noted in an August 27, 1990 story in the Los Angeles Times:

"Each launch of the Space Shuttle or the Air Force's Titan IV does more to deplete the fragile ozone layer... than the annual ground-level emissions of chlorofluorocarbons from most individual (industrial) plants," a report by the National Toxics Campaign Fund of Boston said "Shuttle launches are exempt from air quality regulations...."

"Rockets Blamed for Ozone Loss, " Los Angeles Times, Aug. 27, 1990 at p. B3. For example, while NASA and Air Force could be exempt from a U.S. class action tort suit under the Federal Tort Claims Act, Orbital Sciences Corp. would not enjoy such immunity as a private company polluting the atmosphere. The ozone layer being affected by solid-fuel rockets screens out harmful ultraviolet light from the sun. Studies show that its depletion is giving rise to an increase in skin cancer, and may also be causing an increase in cataracts and immune system disease. In 1978 NASA predicted that every 40 shuttle launches cause a .25% ozone depletion. Acid rain is thought to be another by-product of solid rocket exhaust. A recent article in Aerospace America summarized the environmental hazards of rocket exhausts as follows:

Concerns have been raised that hydrochloric acid (HC1) and other exhaust products could possibly cause harm to the environment. Current SRBs contain up to about 20% HC1 in the exhaust products due to the use of ammonium perchlorate as an oxidizer in the propellant.

There are two areas of environmental concern -- acid rain and ozone layer

depletion. Acid rain can be considered on local and global scales. Locally, Kennedy Space Flight Center to short term acidification of on-site mosquito control ponds and vegetation. Even with the HC1-producing propellants currently used in the Shuttle, these effects are minimal.

Considered across the globe, 10 Shuttle launches per year would contribute only 0.01% of all the acid-producing chemicals produced per year in the U.S.

In regard to higher altitudes, all rockets, including liquids, release or create products that help deplete the ozone layer. All produce oxides of nitrogen, a major contributor to ozone destruction, as a result of afterburning within the atmosphere, and both hydrogen and chlorine can destroy atmospheric ozone.

However, rocket launches with solid rocket boosters, even at much higher than present launch rates, would produce only a very small fraction of reactants released worldwide that can deplete the ozone layer.

"Solid Virtues a Solid Bet," Aerospace America, June 1991 at p.24. This article also noted that nearly every launch system in the world uses solid fuel to augment a liquid fuel core, although the Orbital Sciences Pegasus and NASA Scout are notable all-solid fuel exceptions. Another angle on the environmental risks of rocket exhaust was provided by a recent study performed by the Pentagon's Office of Defense Research and Engineering. This 1991 study proposed replacing the military's chemical-fueled rockets with nuclear-engine rockets. The nuclear engine would heat and eject its working fluid

which would become exhaust. The nuclear engine itself would be blown up in space. According to the Pentagon study, the radioactive debris would not reach the ground, would not persist "for very long" in the atmosphere and "would cause less environmental damage than standard solid fueled military rockets, whose exhausts have been implicated in the destruction of the earth's protective ozone layer." "Pentagon Considering Reactor for Missiles," New York Times, Aug. 20, 1991, p.C1.

In summary, whether solid-fuel rocket exhausts are more or less threatening to the ozone layer than nuclear rockets, or whether rocket exhausts are a small or very small contribution to global atmospheric pollution, it is clear that such exhausts are causing potential damage to the earth's environment. Accordingly, it is now appropriate to examine liability for such damage under international space law.

International Liability for Rocket Exhausts

International space law contains two sources of guidance for rules governing liability for damage caused to the earth, or persons on it, by the pollutive effects of rocket exhausts. The first source is the Treaty on Principles Governing the Activities of States in the Exploration and use of Outer Space, Including the Moon and Other Celestial Bodies, Jan. 27, 1967, 18 U.S.T. 2410, T.I.A.S. 6347, 610 U.N.T.S. 205 (effective Oct. 10, 1967) [hereinafter cited as "Outer Space Treaty"]. The second source is the Convention on International Liability for Damage Caused by Space Objects, March 29, 1972, 24 U.S.T. 2389, T.I.A.S. 7762, 961 U.N.T.S. 187 (effective Oct. 9, 1973) [hereinafter cited as the "Liability Convention"]

Outer Space Treaty

Article III of the Outer Space Treaty provides that States shall conduct activities such as rocket launches "in accordance with international law...." This provision enables international environmental law to be applied to rocket launches. Also, international law is largely incorporated into the domestic law of those States subscribing to specific treaties, not to mention the universal applicability of international common law. Hence, it should be possible to use the domestic courts of the United States to pursue a tort case against a company causing environmental harm via rocket exhausts, using the Outer Space Treaty as a touchstone for jurisdiction.

Article VII of the Outer Space Treaty provides that States are "internationally liable for damage" caused to "natural or juridical persons" by the launching of an object into space. Pursuant to this Article, the United States Government would be liable for damages caused even by private sector launch activities. For example, citizens in States under the ozone hole could ask their government to make a claim on their behalf against the U.S. Government for its contribution to the ozone hole via its public and private rocket launching activities.

Liability Convention

Article II of the Liability Convention provides that States are "absolutely liable to pay compensation for damage" caused by activities such as rocket launchings to persons on the surface of the earth. This means that a class of medically injured persons due to ozone depletion does not have to prove that rocket launchings are conducted carelessly or with reckless disregard for environmental effects. They only need prove that the rocket exhaust pollution caused their medical problems.

Article VII of the Liability Convention says that the Convention does not apply to damage caused to citizens of the same country that launched the rocket. This means that U.S. citizens cannot use the Liability Convention against the U.S. Government.

Article XI of the Liability Convention provides that damaged persons can pursue claims for harm outside the scope of the Liability Convention. However, one cannot use the Liability Convention to receive damages for the same harm being pursued in courts.

Article XII of the Liability Convention provides that compensation due for harm caused by space activities shall "provide such reparation in respect of the damage as will restore the person, natural or juridical, state or international organization on whose behalf the claim is presented to the condition which would have existed if the damage had not occurred."

This standard, if applied to persons who incur or die from cancer due to ozone depletion, could result in very high damages indeed. U.S. courts regularly value foreshortened lives in the millions of dollars.

Substantive Defenses

A country may be presented with a damage claim under the Liability Convention, or a company may face a class action lawsuit for skin cancer or other maladies as a result of rocket exhaust induced depletion of the ozone layer. Various defenses may be raised in these cases. Two such defenses are explored here, namely, that (1) the rocket exhausts did not cause the harm because they are but a minor contributor to ozone depletion, and (2) the particular defendant

or alleged liable state is but one of several contributors to rocket exhaust.

It is well-settled that a contributing tortfeasor may be held liable as readily as all of the contributing tortfeasors. For example, Article V of the Liability Convention provides that "Whenever two or more States jointly launch a space object, they shall be jointly and severally liable for any damage caused." The same Article protects "the right of State sustaining damage to seek the entire compensation due under this Convention from any or all of the launching States which are jointly and severally liable."

Similarly, in U.S. domestic tort law, one of several contributing tortfeasors can be held liable for the entire harm caused to a victim, even if the harm caused by each tortfeasor cannot be specifically isolated. For example, if several companies pollute a river with toxic chemicals, a victim of the pollution need sue only one such polluter to recover a judgement. See generally, Annotation, Measure and Elements of Damages for Pollution of Well of Spring, 76 A.L.R. 4th 629 (1991).

Policy Issues

It may be argued that rocket launching companies should not be held liable for their environmental pollution for policy reasons. Among these reasons could be (1) discouragement of space exploration, (2) distraction of focus from worse polluters, and (3) potential loss environmental research data due to fewer rocket launches.

None of these policy reasons appear to be persuasive. Liability for environmental harm caused by rocket exhausts will not discourage space exploration, but will encourage clean space exploration. For over a generation A.C. Clarke has

propounded the concept of skyhook as a clean and much more effective means of moving mass from earth to space. Little attention is paid today to the skyhook because instead rockets seem to be so much cheaper. They are not cheaper, it is just that their true costs are hidden from us as a depletion of the ozone layer and a consequent huge increase in health care and illness costs. Tort liability for environmental damage by rocket exhausts would make the true cost of these launch systems apparent, and would shift attention to clean launch systems.

It is also not likely that tort suits against rocketry firms would detract attention from worse polluters. While it is true that, as a group, air conditioners and certain types of industrial plants cause much more ozone depletion than do rockets, nevertheless, as single polluters, solid-fuel rocket systems are second-to-none. The visibility of a tort lawsuit against a rocket firm is likely to send a signal to more diffuse communities of polluters that they are next in line to pay for their rape of the earth's environment.

Finally, it is unlikely that tort lawsuits against rocket firms would actually diminish our ability to gather environmental information via satellite. The need for this information is clear. All that the tort lawsuits would do is force the environmental satellite operators to use cleaner rockets. If such rockets are more expensive, they are only apparently so, for surely the solid rocket costs of potentially millions of cases of skin cancer, immune system damage and UV-induced cataracts are much greater.

Summary

Our legal system evolved from a patriarchal religious system which de-

emphasized the value of earth nourishment in favor of earth exploitation. Earlier pre-Judaic matriarchal cultures had emphasized the primacy of earth in its natural state. As a result of our patriarchal system, it is considered normal to "use up" the earth, such as depleting its ozone, for material gain.

Recently, it is being recognized that a patriarchal philosophy that worked when the world was a frontier no longer works when the world is a fragile oxygen tent for five billion persons. See, e.g., J. Gabrynowicz, "Space Law and Feminist Jurisprudence," Proc. 34th Colloquium on the Law of Outer Space, p. 171. It is now gradually being recognized that the earth must be nourished and cared for; that Mother Nature must be respected and not taken-for granted.

Tort law always existed to ensure that those whose action caused un-negotiated, un-agreed-to costs, be made to pay for those costs. Class action tort law extends this principle to society at large. International space liability law extends this principle of accountability to the entire world.

By holding private and public rocket launching entities causing disproportionate pollution accountable for the damage they cause, we will encourage alternative clean launch technologies. Private U.S. launching companies which lack the protection of the Federal Tort Claims Act are a logical first choice for liability judgements for atmospheric pollution.