

Whose Mess is it Anyway? Regulating the Environmental Consequences of Commercial Launch Activities

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Abstract

The existing body of international space law does not provide a comprehensive legal framework for the protection of the environment of space, nor does it specify rigorous environmental standards in relation to the conduct of space activities. Moreover, even the rather general obligations relating to environmental aspects of the exploration and use of outer space that are found in the United Nations Space Treaties are not particularly appropriate to, or directed towards launch activities. Although the Outer Space Treaty provides for 'international law' to apply to 'activities in the exploration and use of outer space', it is not entirely clear how readily these principles can be applied to the unique characteristics of space activities. To further complicate matters, many launches are now undertaken by non-governmental commercial entities, which are not per se bound by the United Nations Space Treaties, but rather are subject to local laws and the provisions negotiated in commercial launch service contracts.

This paper will consider both the public international law and private international law elements that may be relevant to the environmental considerations associated with launching, and will offer some suggestions as to how these should be strengthened, in terms of both treaty and national laws and also at the commercial contract level.

Introduction – the need for regulation to protect the space environment

It is an unfortunate reality that virtually all aspects of the use and exploration of outer space involve elements that are inherently damaging to the space environment. This has given rise to many (potential) environmental problems relating to space activities, as well as the question of whether, and how, such concerns can and should be addressed within the corpus of the international legal regulation of outer space. From even a cursory reading of the basic instruments, it is clear that the existing body of international space law does not provide a comprehensive legal framework for the protection of the environment of space; nor does it specify rigorous environmental standards in relation to the conduct of space activities as they may affect the Earth.

Having said this, it is relevant to note that the United Nations Space Treaties were largely concluded before what became known as the 'environmental movement' had taken firm hold.

Indeed, the 1972 Stockholm Declaration¹ is generally regarded as the first significant statement of fundamental international principles relating to the protection of the environment.² Yet, already by the time that the Stockholm Declaration was concluded, the most important fundamental principles relating to the use and exploration of outer space had been agreed and codified in the Outer Space Treaty³ and the

¹ Declaration of the United Nations Conference on the Human Environment (16 June 1972) UN Doc A/CONF.48/14/Rev.1 (1972 Stockholm Declaration).

² Rynn James Parsons, 'The Fight to Save the Planet: U.S. Armed Forces, "Greenkeeping," and Enforcement of the Law Pertaining to Environmental Protection During Armed Conflict' (1998) 10 *Georgetown International Environmental Law Review* 441, 455.

³ 1967 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and other Celestial Bodies, 610 U.N.T.S. 205 (Outer Space Treaty).

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Liability Convention.⁴ These instruments provided little of substance in terms of the protection of the (space) environment because, despite the publically expressed intentions of the space-faring States to engage in space in a way that would provide for planetary protection, there was no great concern about the environment of space, and certainly no appetite to be bound by rigorous environmental protection obligations that might be perceived as impeding the development of the many space activities that were emerging at the time.

However, a number of areas relevant to environmental issues have been considered in the fundamental instruments: in terms of the United Nations Space Treaties, the focus has been directed primarily towards the issue of back and forward contamination⁵ and environmental concerns associated with the exploitation of the natural resources of the moon and other celestial bodies.⁶

In addition, there have been a number of so-called 'soft law' instruments⁷ directed *inter alia* towards the use of nuclear power sources in outer space⁸

and, in more recent times, the increasingly pressing problem of space debris.⁹

In relation to the issue of space debris, this is a major area for concern. For example, on 12 March 2009, the three astronauts aboard the International Space Station (ISS), Americans Mike Fincke and Sandra Magnus and Russian Yuri Lonchakov, were forced to evacuate the main station and remain in the ISS escape vehicle for 9 minutes, while a piece of debris about 1 cm in length passed by.¹⁰ Had the debris hit and pierced the ISS, it is possible that a fatal loss of air pressure could have ensued. More recently, the six man crew on the ISS was again forced to take shelter in two Soyuz craft on 28 June of this year, when another piece of debris drifted past the Station.¹¹

Only one month before the first ISS incident (10 February 2009), an operational American commercial satellite (Iridium 33) and an inactive Russian communications satellite (Kosmos 2251) collided approximately 790 km above the earth, resulting in the total destruction of both. This was the first time that two intact satellites had collided and the collision resulted in approximately 700

⁴ 1972 Convention on International Liability for Damage Caused by Space Objects, 961 U.N.T.S. 187 (Liability Convention).

⁵ See Article IX of the Outer Space Treaty, which includes the obligation to conduct exploration of outer space, including the moon and other celestial bodies 'so as to avoid their harmful contamination and also adverse changes in the environment of the Earth resulting from the introduction of extraterrestrial matter...' For a detailed discussion of this provision, see Sergio Marchisio, 'Article IX', in Stephan Hobe, Bernhard Schmidt-Tedd and Kai-Uwe Schrogl (eds), *Cologne Commentary on Space Law, Volume I – Outer Space Treaty* (2009), 169-182.

⁶ See *inter alia* Article 7 of the 1979 Agreement Governing the Activities of States on the Moon and other Celestial Bodies, 1363 U.N.T.S. 3 (Moon Agreement).

⁷ For a discussion on the use of 'soft law' instruments in relation to the use and exploration of outer space, see Steven Freeland, 'For Better or for Worse? The Use of 'Soft Law' within the International Legal Regulation of Outer Space', forthcoming in (2011) *Annals of Air and Space Law*.

⁸ See 1992 Principles Relevant to the Use of Nuclear Power Sources in Outer Space, United Nations General Assembly Resolution No 47/68, UN Doc No A/RES/47/68 and United Nations Committee on the

Peaceful Uses of Outer Space (UNCOPUOS) Scientific and Technical Sub-Committee and International Atomic Energy Agency (IAEA), *Safety Framework for Nuclear Power Source Applications in Outer Space* (2009) <<http://www.fas.org/nuke/space/iaea-space.pdf>> (accessed 17 February 2011).

⁹ See, for example, United Nations General Assembly Resolution 62/217 (22 December 2007), which (at paragraph 26) endorsed The Space Debris Mitigation Guidelines of the United Nations Committee on the Peaceful Uses of Outer Space (A/62/20), (at para 27) agreed that 'the voluntary guidelines for the mitigation of space debris reflect the existing practices as developed by a number of national and international organizations', and (at paragraph 28) considered it 'essential that Member States pay more attention to the problem of collisions of space objects, including those with nuclear power sources, with space debris, and other aspects of space debris'.

¹⁰ See, for example, Maggie McKee, 'Debris threat prompts space station crew to evacuate' *New Scientist*, <<http://www.newscientist.com/article/dn16755-debris-threat-prompts-space-station-crew-to-evacuate.html>> (accessed 26 July 2011).

¹¹ See 'Space Debris forces ISS astronauts to evacuate the station', <<http://thewatchers.adorraeli.com/2011/06/29/space-debris-forces-iss-astronauts-to-evacuate-the-station/>> (accessed 26 July 2011).

additional pieces of hazardous debris being created, with the potential to cause additional decades-long pollution in space.

These recent high-profile events have highlighted the increasing hazards posed by space debris, particularly given that most such debris is, according to scientific data, accumulated in low-earth orbit, and thus poses a potential threat to virtually all space activities. Yet, it is clear that the existing legal principles are not adequate, even for this issue of crucial importance. The fact that, in 2007 and 2008 respectively, both China and the United States did not feel constrained by existing Space Law – in particular Article IX of the Outer Space Treaty – or other principles of international (environmental) law, when they proceeded to deliberately destroy their own satellites in space (thus causing additional space debris from the resultant explosions) only serves to point to the increasing urgency for the development of more rigorous international legal principles protecting the space environment.¹²

Incidents such as these demonstrate how important it is that we are made aware of the environmental dangers associated with space activities, the implications of such dangers and the range of possible solutions (to the extent that there can be a ‘solution’ to increasing environmental degradation of outer space), or approaches to such solutions, before we can embark on the development of a comprehensive set of measures that address the issue in the necessary detail.

Perhaps understandably in view of the type of incidents referred to above, to the extent there have been attempts (albeit inadequate) to regulate the environmental consequences of space activities, these have addressed the environment of *space* and *celestial bodies*. Indeed, the need to protect natural celestial environments was at least publically expressed (if not translated into rigorous legal regulation) as being ‘among the

earliest policies articulated at the dawn of the space age’.¹³

But what about protecting the Earth environment?

The need to develop more rigorous legal principles associated with space activities does not, however, just end with the outer space environment. There has been little attempt within the corpus of space law to directly regulate the environmental consequences of the launch phase from Earth, which is, of course, an integral part of the vast majority of space activities. Yet, it is self-evident that the launch phase of any space activity can be highly polluting, in terms of noise, the disengagement of parts of the launch vehicle and, in the case of some launch vehicles, by toxic emissions. Among a number of serious cases, there have, for example, been reports of, and studies conducted about the serious adverse environmental consequences (which have allegedly also given rise to very significant health problems) in the area around the Russian launch facility at Baikonur, now located in Kazakhstan.¹⁴

This lack of regulation regarding the environmental effects of launch activities represents an omission that may potentially have significant legal consequences. In the days when the vast majority of launches were conducted by States, concerns about environmental damage arising from launch activities were not of major import, either because the State would, of course, not sue itself and would restrict the ability of its nationals to bring action against it (if the launch had taken place within its own territory), or the situation was thought to be adequately addressed by the provisions of the Liability Convention,¹⁵

¹³ L.I. Tennen, ‘Evolution of the planetary protection policy: conflict of science and jurisprudence?’ (2004) 24 *Advances in Space Research* 2354, 2354.

¹⁴ For a more detailed description of the environmental concerns related to the Baikonur facility, see Lotta Viikari, *The Environmental Element in Space Law: Assessing the Present and Charting the Future* (2008), 29-31 and the corresponding footnotes.

¹⁵ Article II of the Liability Convention provides that: ‘A launching State shall be absolutely liable to pay compensation for damage caused by its space object on the surface of the earth or to aircraft in flight’. ‘Damage’ is defined in Article 1 (a) of the Liability Convention as:

¹² For background to these two incidents, see Steven Freeland, ‘The 2008 Russia / China Proposal for a Treaty to Ban Weapons in Space: A Missed Opportunity or an Opening Gambit?’ (2008) 51 *Proceedings of the Colloquium on the Law of Outer Space*, American Institute of Aeronautics and Astronautics, 261-271.

which contemplates the possibility of legal proceedings between States. Of course, as is well known, there have never been formal proceedings instituted under the terms of the Liability Convention.

Yet, the paradigm of space activities has changed over the past decades. Due to the complex nature of space activities and the unique nature of outer space, there are now many stakeholders that are involved. Although outer space was once the realm of (a small number of) States, it is now being utilised not only by many more countries (the latest estimates are that approximately 50–60 States have some form of space capability), but also by a variety of international intergovernmental organisations, regional organisations and, perhaps most significantly, by a vast array of private enterprise organisations.

Each of these groups is motivated in their particular space activities by factors that are not necessarily compatible with the ‘protection’ of the environment – indeed they may perhaps be *incompatible* with such concerns. At the very least, it is still the case that environmental concerns are not afforded a high priority in the planning, design, and implementation of space activities.

In addition, non-governmental entities that are engaged in space (and launch) activities are not bound by the United Nations Space Treaties, since they lack the international legal personality to be parties to such instruments and, in any event, these Treaties only permit States to become parties, although a number of them specifically provide that particular provisions shall also be deemed to apply to international intergovernmental organisations in certain circumstances.¹⁶ Although it was contemplated by the drafters of the United Nations Space Law Treaties that national space activities might also be undertaken by non-governmental entities, the

responsibility for such activities was imposed, from an international law perspective, on States. Article VI of the Outer Space Treaty imposes ‘international responsibility’ on States for ‘national activities in outer space’, undertaken either by ‘governmental agencies or by *non-governmental entities*’.¹⁷ However, it must be noted that this responsibility is an *international* obligation, governed directly by the general principles of public international law, as well as the specific terms of the United Nations Space Treaties.

The Liability Convention does not, of course, preclude the possibility of a non-governmental entity (or indeed a State) pursuing a claim¹⁸ within the national legal system of a launching State (as defined in that instrument).¹⁹ However, in such a situation, the ultimate legal responsibility will be governed by the launching State’s national legal system, as well as the terms of the relevant commercial launch services contract. The specific outcomes under different jurisdictions will vary from country to country,²⁰ and it is not proposed to deal with these in this paper. Rather, the focus here is on the commercial legal structures around launch services, and questions as to how liability

¹⁷ Emphasis added.

¹⁸ Article XI (2) of the Liability Convention. For a detailed discussion of the Liability Convention, see Steven Freeland, ‘There’s a Satellite in My Backyard – MIR and the Convention on International Liability for Damage Caused by Space Objects’ (2001) 24(2) *University of New South Wales Law Journal* 462-484.

¹⁹ Article I (c) of the Liability Convention defines a launching State as:

‘(i) A State which launches or procures the launching of a space object;
(ii) A State from whose territory or facility a space object is launched’.

²⁰ The 2008 French Act relating to space activities (Bill Nr. 2008-518 of June 3rd, 2008 relating to space operations) is a recent example of national space legislation that does seek to regulate the situation where a space activity causes damage to the environment. Article 1 (1) of that legislation defines ‘damage’ as including:

‘... damage to the environment caused directly by a space object as part of a space operation ...’

See also Bernhard Schmidt-Tedd and Isabelle Arnold, ‘The French Act relating to space activities: From international law idealism to national industrial pragmatism’ *European Space Policy Institute (ESPI) Perspectives* No. 11, August 2008.

‘... loss of life, personal injury or other impairment of health; or loss of or damage to property of States or of persons, natural or juridical, or property of international intergovernmental organizations’.

¹⁶ See Rescue Agreement, article 6; Liability Convention, articles XXII (1) and XXII (2); Registration Agreement, articles VII (1) and VII (2); Moon Agreement, article 16.

for the environmental consequences of launch activities is likely to be shared between the participants in launch activities.

In a Commercial Context, who Covers Third Party Losses arising from a Launch Failure?

The prospect of a catastrophic launch failure causing losses to third parties has, for many years, been uppermost in the minds of national legislators, commercial space lawyers and insurers. National legislation typically stipulates various conditions that are intended to limit the possibility of losses at the launch phase – for example, by providing for safety measures.²¹

Moreover, both international and national space laws appear to be aimed at ensuring that innocent third parties who suffer loss as a result of space activities receive some form of compensation, at least in theory.²²

It has long been assumed that in such an event, the launch provider, its insurers and its associated national government(s)²³ would be called upon to cover any losses suffered by third parties. Satellite owners who sign launch contracts rely on this combination of protections to cover them against liability, perhaps assuming that the tried and true language that has existed in the industry for decades, after countless reviews by insurers, could not be wrong.

But is this assumption correct, particularly in the case of environmental damage? Contracts, insurance policies and legislation that have never

been put to the test in real situations are like software that has never been installed on a computer – there is no way of knowing for certain whether they are going to work as intended when it really counts. In the event of a claim for environmental damage involving (potentially) billions of dollars, every entity that could possibly be called upon to cover the cost will be motivated to interpret its share of liability as narrowly as possible, perhaps resulting in unexpected gaps in coverage for the unwary satellite owner.

For this reason, governments, insurers and private companies that are associated with objects launched into space would be well advised to test their assumptions carefully by running through hypothetical scenarios. If the analysis exposes significant risks, the choice of the launch provider, the structure of the launch contract and the associated insurances may need to be reconsidered. The financial risks will be magnified if the potential for environmental damage is greater, for example where the launch takes place over land using fuel that is highly toxic to humans.

Any such analysis as to the level of risk is complex, because of the many technical and legal variables. Whilst a great deal of legislative effort has gone into the development of formulae for calculating the ‘maximum probable loss’ (using a ‘maximum probable loss methodology’)²⁴ arising from a launch failure, and there has been no shortage of discussion about potential legal liability amongst academics, at a commercial level there appears to have been relatively little attention paid to the likely legal outcomes when the cocktail of national and international laws, contracts and insurance policies is given a good stir.

Take for example, a hypothetical launch failure that results in destruction to property, injuries to persons, contamination of a large area of land and economic losses to individuals and businesses. It is to be hoped that, in the event of such a tragic accident, any corporation or government associated with the launch would respond in a humane fashion. Perhaps, because of considerations of humanity and also out of

²¹ See, for example, the Australian Space Activities Act 1998, which provides for the appointment of a Launch Safety Officer in relation to the operation of each licensed launch facility established under the legislation. The functions of the Launch Safety Officer include *inter alia*:

‘to ensure that no person or property is endangered by any launch conducted at the facility, until the space object is safely in Earth orbit or beyond’ (Section 51 (b)).

²² See, for example, preambular paragraph 4 of the Liability Convention, which recognizes ‘the need ... to ensure, in particular, the prompt payment ... of a full and equitable measure of compensation to victims of [damage] caused by space objects’.

²³ See the definition of ‘launching State’ set out in note 19 above.

²⁴ See, for example, Regulation 7.02 of the Australian Space Activities Regulations 2001.

concern for corporate brands and/or (inter)national reputations, the response would be swift and effective. Alternatively, depending on the culture and values of the States and corporations involved, the response may instead be to distance themselves from the tragedy as much as possible, pointing the finger of blame at other participants.

In either case, and quite apart from any consideration of the relevant *international* rules, behind the scenes, lawyers and insurers for all concerned will be working overtime to exclude, or at least to minimise actual legal liability as much as possible. At that point, regardless of any generosity of spirit that may have existed at the time of the initial transaction, experience teaches us that each party is likely to throw its resources behind the identification of loopholes in contracts, policies and legislation, in the hope of shifting some or all of the responsibility to another one of the participants. If there are flaws in the legal structure, they are likely to be unearthed through this process.

It is not the aim of this paper to discuss all of the theories of liability under which a private claim for damage to the environment may be made. However there are two obvious potential sources of liability for launch participants:

- (a) a claim by a State that has suffered loss against the launching State or States under the Liability Convention; or
- (b) a private individual or class action in negligence (or some such analogous cause of action) taken by injured parties in a national court.

With respect to the first of these scenarios, the enactment of national laws enables space-faring States to formalise domestic legal processes that would allow them to pass on financial responsibility to, and recover from their national non-governmental entities the amount of the damages for which the State may be liable at the international level. Of course, this does not remove the international obligation of liability of a launching State under the Liability Convention (or Outer Space Treaty). Rather, a domestic mechanism of this nature can transfer to non-governmental entities the financial 'risk'

associated with this potential international liability for third party claims, in effect resulting in a form of indemnity of the Government in the event of a claim against the State arising from the launch.²⁵

In the case of a private action, whether by an individual, a class of individuals or a company, it is likely that the litigants will cast the net as widely as possible, to cover any participant with financial resources who might have contributed to the accident. There are many factors that could theoretically lead to a launch failure, including faulty construction of the launch vehicle, errors in on board software, failures of ground equipment and anomalies in the behaviour of the satellite itself during launch. Accordingly, the launch provider, satellite owner and their suppliers are all among the potential targets of such litigation, depending on the cause of the accident.

Although any one or more of the participants could be blamed for a technical error causing the failure, arguably, the responsibility for ensuring that a launch failure does not result in harm to third parties lies with the launch provider and the Government(s) tasked with regulating the launch.²⁶ For this reason, the industry expectation is that the launch provider, as the party who is best placed to manage the risk of a launch failure, should be responsible to cover any third party losses, with the assistance of a reasonable level of insurance and backed up by its Government.

A satellite owner that becomes caught up in litigation following an accident would expect to be covered by this structure, which would normally be expressed in the form of lengthy insurance and indemnity provisions in the launch contract. The standard forms of these provisions have, for the most part, been in use for many years and are traditionally classified as 'non-negotiable'

²⁵ For example, the licensing regime established under the Australian Space Activities Act 1998 allows for the express inclusion of an indemnity to the Australian Government to be provided by recipients of an Overseas Launch Licence against third party claims arising from the launch.

²⁶ Article VI of the Outer Space Treaty obliges 'the appropriate State' to authorize and continually supervise the (space) activities of non-governmental entities.

by launch providers, due to the interwoven nature of insurances and contracts in the launch industry.

It is therefore important to note that there may be pitfalls in the system for those who launch space objects based upon the assumption that they are protected by this traditional structure. This is particularly the case where environmental damage is a high risk, depending on the choice of launch vehicle and the location of the launch site.

In this context, a number of key questions arise:

Will insurance cover environmental claims?

Returning to our hypothetical launch failure, in the event of a claim against the various launch participants, each of the defendants will look first to their insurance policies to protect themselves, as well as the insurance policy taken out by the launch provider. The owner of the satellite would usually ensure that it is named on the launch provider's policy and should therefore be protected against claims for property loss, death, personal injury and consequential losses up to the policy limit.

But does the concept of 'property loss' envisaged in an insurance policy extend to environmental claims? Where natural resources that are not regarded as personal property – and thus are the property of a State – have been damaged, there is a risk that such a policy will not be sufficient.²⁷ Furthermore, it is likely that claims of this nature would be expressly excluded from a standard third party launch liability policy. A prudent satellite owner would therefore be well advised to check the policies of the launch provider, to determine whether environmental losses are either excluded, are subject to a sub-limit or are dealt with in a separate policy, if at all.

This is particularly important in the case of technology such as that used in the Proton and Longmarch launch vehicles, which launch over

land and have used highly toxic fuel.²⁸ If the launch provider has taken out a separate policy to cover environmental losses, the owner of the satellite may want to ensure that it is comfortable with the level of cover and has also been named on that policy.

Will the launch provider cover environmental claims?

If the claim exceeds the limit of the insurance policy, or is not covered at all (which may be the case in the event of environmental damage), the owner of the satellite may have an expectation that the launch provider will take responsibility for the losses under the indemnities set out in the launch contract. Once again, an indemnity that requires that the launch provider take responsibility for loss of property, personal injury and death, may not cover the most potentially costly forms of environmental harm, for example where a toxic substance is spread over a wide area of land or sea.

Furthermore, depending on the specific drafting, the indemnity may not be triggered by the very situation in which it is needed; namely a claim in negligence against the owner of the satellite. If, for example, the indemnity is expressed to apply only when the failure is attributed to abnormal behaviour of the launch vehicle (based on the telemetry sent by the vehicle prior to or during the accident), the satellite owner may find itself facing the injured litigants alone, once the launch insurance policy is exhausted.

Indemnities of this nature are common in the launch industry and may, in the view of the authors of this paper, lead to an unexpected result for the satellite owner in some circumstances. This is because it is entirely possible for a failure to occur in circumstances where the telemetry received from the launch vehicle is perfect, either because the satellite suffered an anomaly, the

²⁷ This question is less problematic – although not completely uncontroversial – at the international level, given that Article 1 (a) of the Liability Convention defines damage as including 'loss of or damage to property of States or persons, natural or juridical....' (emphasis added).

²⁸ See note 14 above. See also Amelia Gentleman, 'Scandal of children poisoned by Russian space junk' *The Observer*, 10 December 2000; Michael Day, 'What Goes Up...' *New Scientist*, 11 October 1997; Peter J Brown, 'Kazakhstan at Crossroads in Space', *Moscow Times*, 3 August 2008; Jim Giles 'Study links Sickness to Russian Launch Site', Issue 433 *Nature* 95, 13 January 2005.

launch vehicle was struck by debris, or some other intervening cause.

It may even be possible for the launch vehicle to cause a failure in circumstances where the vehicle itself has not behaved abnormally. The potential for such fine technical distinctions to result in a different allocation of liability was illustrated recently, following the loss of a Russian satellite known as Express-AM-4, launched by a Proton M launch vehicle. On 19 August 2011, the day after the satellite was deposited into an incorrect orbit by the upper-stage rocket, a statement was issued on behalf of the launch vehicle's manufacturer, Khronichev, alleging that:

'the Proton M launch vehicle performed nominally, and the ascent unit, including the Briz M upper stage and the spacecraft, separated at the appropriate time'.²⁹

Yet, despite the apparently nominal telemetry from the launch vehicle, the satellite was irretrievably lost. An inter-agency investigation has subsequently concluded that the loss occurred as a result of an error on the Briz M's on-board computer.³⁰

If the protections set out in the launch contract can only be triggered by an anomaly that is disclosed by the telemetry of the launch vehicle,³¹ the launch provider may not be obliged to step up and protect its customer (the satellite owner) against third party claims in such a case. Fortunately, no third parties have, to date, suffered physical loss

²⁹ See ILS press release at <<http://www.ilslaunch.com/newsroom/news-releases/russian-federal-mission-express-am4-anomaly-investigation-underway>> (accessed 5 September 2011); 'Proton Places 300M Russian Telecom Satellite in Bad Orbit', SpaceNews.com.mht.

³⁰ Following an inter-agency launch investigation, Roscosmos has issued a statement to the effect that 'The satellite was placed in the wrong orbit because of the malfunction of the Briz-M upper-stage rocket' <http://www.spacedaily.com/reports/Express_AM4_Launch_Failure_Inter_Agency_Commission_Concludes_Investigations_999.html> (accessed 5 September 2011).

³¹ Of course, the drafting of the launch services agreement does not prevent unrelated third parties who suffer physical loss as a result of a launch failure from bringing a claim directly against the launch services provider.

as a result of the Express-AM-4 launch, although concerns have been expressed about the threat that a 'lost' 5.8 tonne satellite may pose to future space navigation.³²

Either way, the case illustrates the risks involved in assuming that the launch provider will cover third party claims in all circumstances. In the event of a failure that causes environmental or other physical damage, the technical cause of the anomaly may be a crucial element in determining who is ultimately responsible to pay for the loss.

Will the Government of the Launch Provider cover environmental claims?

The last port of call for a satellite owner faced with an environmental claim, following our hypothetical accident, may be the Government of the launch provider. The Governments of all of the major launch providers have legislation that provide for some form of compensation scheme in such a circumstance.³³ These schemes have presumably been put in place in response to international law,³⁴ and are also intended to provide satellite owners with the confidence to use the launch services offered by that country.

Yet, these national laws give rise to many (unanswered) questions. Which injured parties are able to make a claim under such a framework? Are the laws drafted broadly enough to encompass environmental claims? Can private individuals and companies claim, or only States? Can foreign nationals claim, or only nationals of that particular State?³⁵ Does the claims process give injured parties legal rights to compensation,

³² See http://www.spacedaily.com/reports/Lost_Russian_satellite_poses_threat_to_space_navigation_999.html (accessed 8 September 2011).

³³ See for example: United States 1984 *Commercial Space Launch Act*; Decree 5663-1, *Law of the Russian Federation about Space Activities*; 2008 *French Act Relating to Space Activities*

³⁴ See note 15 above.

³⁵ See Decree 5663-1, *Law of the Russian Federation about Space Activities*, Article 24.1: 'Clean-up of accidents while carrying out space activities shall consist of the restoration and reconstruction of the industrial and other plants that have suffered as a result of the accidents, necessary environmental measures and compensation for damage to relevant subjects of Russian Federation, organisations and citizens'

or only the right to apply for an *ex gratia* amount? Is further legislation or political action necessary before compensation is paid? Will the compensation be substantial or only token?

If the legislative claims process is uncertain, expensive, fraught with administrative barriers, or unwieldy, the potential litigants may choose to make their claim directly against the launch participants, either as an alternative, or in parallel. If this occurs, once again, the satellite owner should not simply assume that it will be indemnified. Rather, it would be prudent to make its own inquiries before entering into a launch contract. It may be the case, for example, that the launch provider will be reimbursed by its Government under the legislation, or pursuant to side arrangements. The satellite owner, on the other hand, who may not be a national of that State, may not have sufficient standing to make such a claim.

Questions about environmental responsibility become particularly pertinent in the case of launch vehicles which use more toxic forms of fuel. Whilst, for example, the Governments of Russia and Kazakhstan have reportedly argued between themselves for decades about the use of hydrazine-based propellants, as well as clean up procedures and compensation / land use payments to be made as a result of both successful and unsuccessful launches,³⁶ the risk of a claim against commercial launch participants remains a matter for consideration.

Conclusion

Despite a number of tragic incidents in the launch industry that have resulted in loss of life, property and environmental damage, this has not given rise to international or national claims under the Liability Convention, nor to extensive claims for environmental damage or other losses against launch participants. One might speculate that, regrettably, this may be because those who are most likely to suffer from direct physical damage or environmental degradation arising from launch activities are often persons in vulnerable

communities with little access to legal or financial resources, and few legal rights in their local / national jurisdictions.

However, those who launch objects into space have no reason to be complacent about this issue. From a legal perspective, the framework of national laws, insurances and commercial contracts that are commonly believed to protect launch participants may contain unexpected loopholes for the unwary. There is always a risk of a private action by classes of persons, corporations, or even affected States, not to mention damage to a corporation's brand or the international reputation of a country involved in a catastrophic launch failure.

With these considerations in mind, does the 'appearance' of legal protection make satellite owners more cavalier in their choice of launch vehicle than they otherwise should be? Should there be more consideration of human and environmental issues by those who launch space objects? Is the use of a launch vehicle with toxic fuel unconscionable, regardless of the legal framework protecting the participants?

Prevention of environmental damage in the first place is better than a legal cure. Thus it may be that the time has come for satellite owners (both Governmental and private) to make cleaner choices regarding the environmental aspects of their launch activities, rather than relying on largely untested legal protections, the terms of which may come to haunt them in the tragic event of a catastrophic launch failure giving rise to significant environmental damage.

³⁶ See, for example, <http://www.russodaily.com/reports/Kazakhstan_Wants_Russia_To_Pay_60_Million_Dollars_In_Damages_For_Proton_Crash_999.html> (accessed 5 September 2011).