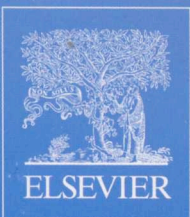
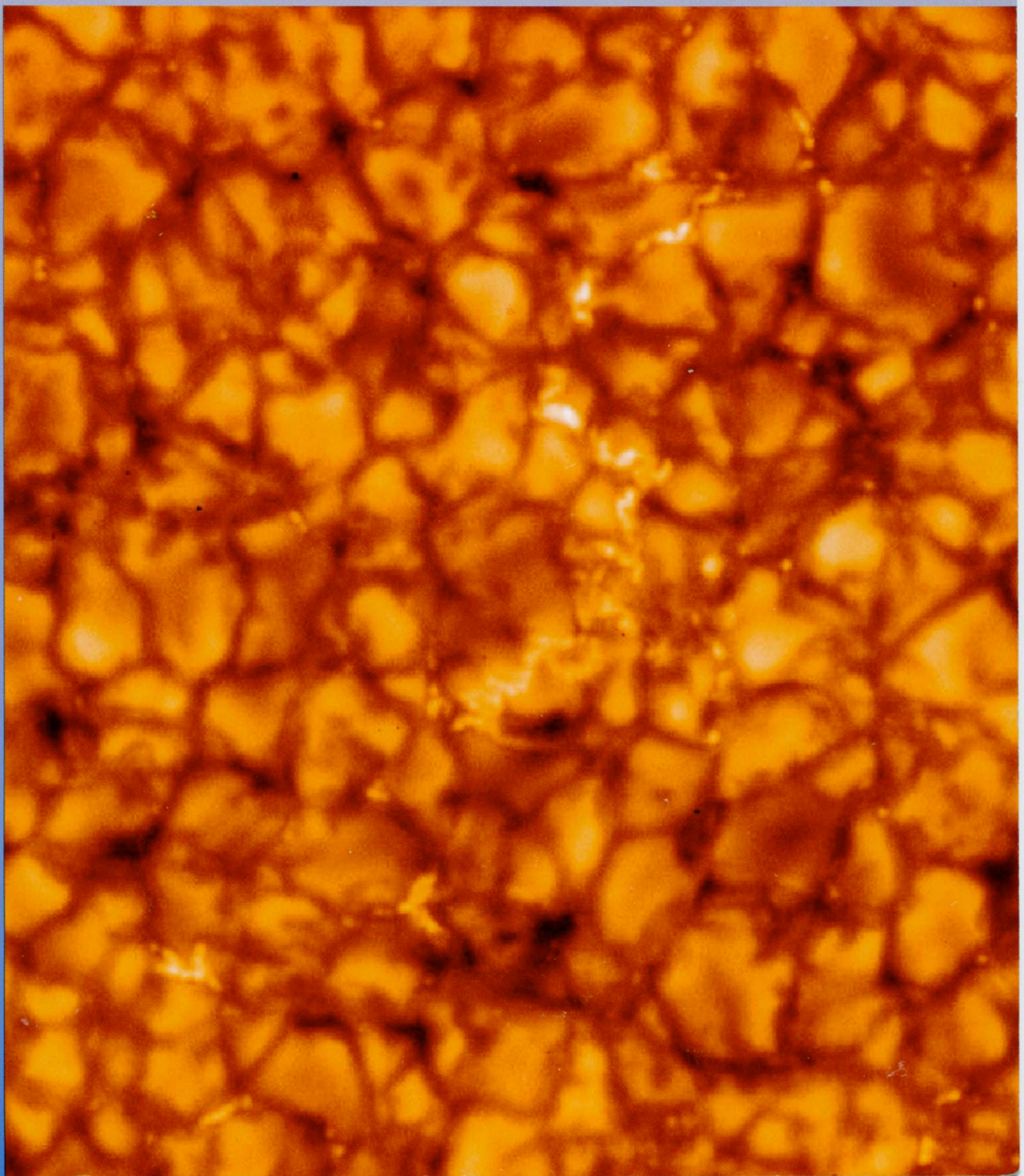




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SPACE RESEARCH TODAY



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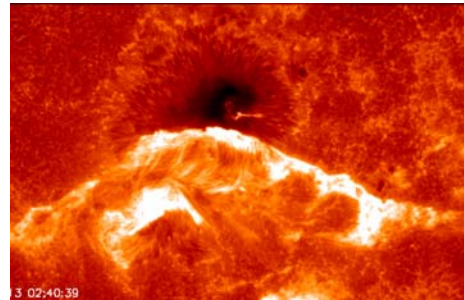
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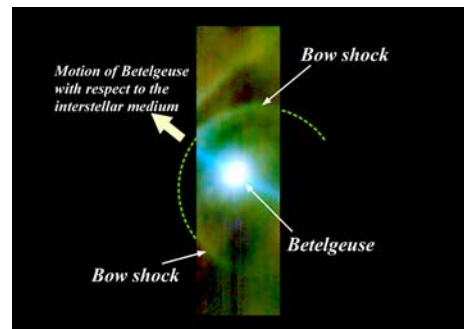
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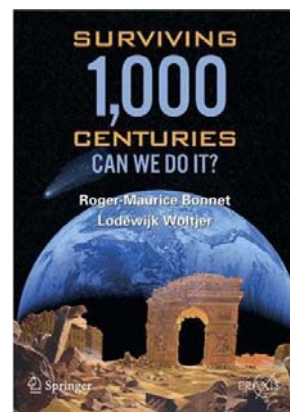
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comprising Dr Pete Hays (Associate Director, Eisenhower Center for Space and Defense Studies, USAF Academy), Major General James Armor (Ret. USAF) and British visiting professor Dr John Sheldon (of the Maxwell Air Force Base in Alabama). The Panel members discussed how space assets are helping modernize the US Army and agreed on the potential of these assets to act as a driver of economic growth. One example is the 'Future Combat Systems' (FCS), the principal modernization programme for the US Army. According to Dr Hays, the aim of the FCS is to integrate the Armed Forces's manned and unmanned assets, requiring seamless connectivity *via* satellite capabilities. These systems, the speakers maintained, are not being pushed by manufacturers, but pulled by consumer demand.

Another recurring theme identified by the Panel was that space pre-eminence is essential to being a great power, and that other nations recognized this. The panellists asserted that space-related activity is the foundation of a robust industrial base and technological leadership that fosters innovation and promotes a healthy science, technology, engineering and mathematics workforce. To this end, Major General Armor recommended the establishment of institutes in the fields of space law, space medicine, propulsion and cheap access to orbit. The key to achieving these goals, he said, lies in unleashing commercial industry, and presidential leadership.

With regard to national security specifically, the total 'blackout' of satellite systems is unlikely but not impossible, and the Panel emphasized that space is not being taken as seriously as it ought to be by policymakers. The Panellists explained how satellites enable most, if not all, facets of US diplomatic, economic and military activities, as well as those of its allies: they are part of the physical backbone of the globalized economy. According to them, members of the government and armed forces understand the importance of space in many areas, but – to a great extent – view space

with a general sense of complacency; the Panellists considered that the space arena did not seem to be able to command a high enough priority. Other space-faring nations, they claimed, are beginning to raise the stature of space in their policymaking.

Panel members also agreed that the US President needs to demonstrate more leadership in space. Both Panels concurred on the need to reinstate the US National Space Council in the Executive Office of the President, which provided policy oversight for US space activities to President George H.W. Bush from 1989 to 1993. It has not been funded or staffed since that time. In a paper released by Barack Obama during his campaign for the US Presidency, he called for the reinstatement of this council. However, no definitive action has been taken as yet.

[*The Space Studies Board is the US National Committee for COSPAR.]

Space Law and the Satellite Collision of 10 February 2009

[By Tanja Masson-Zwaan (President, International Institute of Space Law; Deputy Director, International Institute of Air and Space Law, University of Leiden)]

Most readers of *Space Research Today* have a scientific or technical background but, possibly, know little about 'space law'. In a recent talk with COSPAR President, Roger-Maurice Bonnet, the idea came up of writing a brief article about space law, in order to introduce a field that is gaining more momentum in the eyes of the scientific/technical community. Indeed, the idea is to do this on a regular basis and, as President of the International Institute of Space Law (IISL), the honour was bestowed on me to start this new means of cooperation between

two established institutions in the field of space activity¹.

Rationale

More and more frequently these days, non-lawyers find they want to learn about space law. This was hardly the case even a decade ago, bar a few exceptions². Aerospace engineering students from the Technical University of Delft regularly follow an introductory course in air and space law at the University of Leiden, and they prove to have good analytical minds and come up with logical and refreshing questions and solutions. In our fields of space science and technology and space law, interaction is highly essential: one cannot make a good law without understanding the technological aspects involved. Likewise, it is no good making scientific innovations without information on the regulatory framework that may influence them.

In this context, this article sets out to explain why there is no official definition of 'outer space', then provides a summary overview of some of the main principles involved and, finally, highlights some of the initial legal implications of the satellite collision that occurred on 10 February 2009.

Defining Outer Space

Perhaps the first question that arises after finding out that there is something called 'space law' is where outer space actually begins. This is an understandable question. However – as lawyers often (have to) say – there is no firm answer. The topic has been debated in the UN for several decades, but no agreement has been reached so far. Various approaches and many theories exist, but I will not go into those, except to say that with the advent of space tourism, the time may soon come when we will be in real need of a boundary between air space and outer space. There is a fundamental difference in the regimes governing air space and outer space, as the first is subject to sovereignty of the underlying state, whereas in outer space a regime of 'freedom' exists (be it with certain limitations, of course...), and no state is allowed to claim sovereignty over outer space or any celestial bodies.

Some states (e.g., Australia) have recently enacted legislation proclaiming a boundary at 100 km and this may evolve into an example that other states follow, although some states (e.g., the USA) remain convinced that no boundary is necessary.

UNCOPUOS and Some Major Principles

The 'space race' started around 1957 between the two 'super powers', the USA and the then USSR, as the major 'players' in the space arena – a situation similarly reflected in the early days of space law making. The UN Committee on the Peaceful Uses of Outer Space (UNCOPUOS), established in 1958, first as an *ad hoc* and later as a permanent committee of the United Nations, initially had around twenty member states, which enabled the Committee to reach consensus relatively easily. This resulted in the adoption of as many as five UN Treaties between 1967 and 1979³.

¹This first footnote serves to promise that, contrary to many legal papers, not many footnotes will be included in this brief introduction in order better to serve its aim, namely to present space law in a comprehensible manner to non-lawyers. If readers are interested in more sources and background information, please contact president@iislweb.org.

²Dr Lubos Perek (Czech Academy of Sciences) has been a member of the Board of the IISL for many years and has always played the important role of explaining complex technical issues to lawyers, as well as making scientists aware that there are rules governing activities in outer space. He plays a very important 'liaison' role and, it is to be hoped, that others will follow his example of combining both technical and legal skills.

³They are: (1) The Outer Space Treaty (1967), the 'Constitution' of space law; (2) the Rescue

Since then, the membership has grown to some seventy states, including many more space ‘haves’, but also numerous space ‘have-nots’, and it has become exponentially more difficult to reach a consensus, with the result that no more treaties have been adopted since 1979⁴.

It is noteworthy that, right from the start of the space era, COPUOS recognized the need to work both in the scientific and technical field as well as in the legal field: it therefore created two subsidiary bodies, the Scientific and Technical Subcommittee and the Legal Subcommittee. These both report on the results of their meetings, in February and March/April respectively, to the full Committee which meets each year in June.

The first and, therefore possibly, the most important principle of space law is contained in paragraph 1 of Article I of the Outer Space Treaty. It provides that “the exploration and use of outer space [...] shall be carried out for the benefit and in the

interests of all countries [...] and shall be the province of all mankind”. Of course, the concepts are not clearly defined and can be subject to varying interpretations, but the general idea is clear: the use of space should somehow benefit all mankind. However, the second part of Article I contains an important counterpart to this provision by declaring that outer space is free for exploration and use by all states, without discrimination and on a basis of equality.

The second most important principle of space law is – no surprise – contained in Article II, which declares that outer space and celestial bodies cannot be subject to appropriation by any means. There is no ‘territorial jurisdiction’ in outer space. This implies that it is forbidden to claim ownership of any part of outer space; this applies not only to states but also to private entities, contrary to what is sometimes argued, because there is no sovereign authority that has competence to confer titles of ownership⁵.

Some other keywords in the Treaty are, in a nutshell: peaceful uses; cooperation and mutual assistance; state responsibility (also for activities by private enterprises and individuals, which must be authorised and supervised by a state); state liability (again, also for private entities, which is a unique feature in international law); jurisdiction and control by the registration state; applicability of international law and the UN Charter, and special regard for the interests of developing countries.

Lastly, in the context of this paper, it is necessary to mention Article IX of the Outer Space Treaty, which says that states must avoid harmful contamination of celestial bodies and adverse changes to the Earth. It also contains a duty for consultation.

Agreement (1968), dealing mainly with the legal status of astronauts in case of an accident; (3) the Liability Convention (1972), addressing the question of liability in case of damage caused by a space object; (4) the Registration Convention (1975), creating an obligation to register objects launched into space both with the UN and at the national level; and (5) the Moon Agreement (1979), addressing the legal status of celestial bodies and, specifically, the exploration and exploitation of natural resources of celestial bodies. The first three treaties were ratified by close to ninety states, the fourth by around fifty and the last by only thirteen states. Since the 1980s, several sets of ‘Principles’ in the form of non-binding UN Resolutions have been adopted on several topics. All texts, official titles and sources can be consulted on the useful website of the Office for Outer Space Affairs in Vienna, the UN office supporting the work of COPUOS. See <http://www.oosa.unvienna.org>.

⁴This does not mean that COPUOS has lost its relevance; on the contrary. It has been able to adapt to the changing political climate and has recently made some important reforms allowing it to continue making important contributions to the further development of space law, albeit in a different form than previously.

⁵The IISL issued a ‘Statement’ on this topic in 2004 and is finalizing a second Statement. Shrewd businessmen are selling ‘lunar deeds’, others claim that the existence of private property rights is a prerequisite for exploitation of lunar resources, but these claims do not have any legal foundation.

The Satellite Collision of 10 February 2009

This article is being written about a week after a historic event took place that may turn out to be catastrophic in various aspects: the first ever collision between two intact satellites in outer space. On 10 February 2009, the American *Iridium-33* and the ‘dead’ Russian *Cosmos 2251* collided at approximately 790 km above Siberia⁶. Of course, earlier collisions have taken place in outer space, e.g., the French *Cerise* which collided with a piece of debris from an Ariane launcher in 1996, but the mass of *Cerise* was just 50 kg, while *Iridium* weighed ten and *Cosmos* twenty times as much; the other difference is that *Cerise* continued to function. The present collision was unprecedented in the amount of debris it created. The exact count is still being established, but already amounts to some six hundred pieces of various sizes. It has even been reckoned that the amount of debris is triple the quantity created by the Chinese ASAT test in January 2007, which has been said to account for 20% of the debris population before the 2009 collision⁷.

There are many experts in the COSPAR community who are much better placed than I am to comment on the technical details of this event, so I will just mention a few of the legal implications. Both states involved, the USA and Russia, are parties to the 1967 Outer Space Treaty, the 1972 Liability Convention and the 1975 Registration Convention. Several aspects come into play. First, of course, the question that comes to mind is “who’s to blame” among the parties involved and should compensate for the lost satellite (the so-called ‘second-party’ liability). Secondly, and more important, what would happen if

any ‘third party’ besides the two involved parties had suffered damage in space, in the air or on the ground (third-party liability)? And third, what are the implications for ‘humankind’ in terms of the environmental impact in outer space and what can be done to avoid similar accidents in the future? These scenarios will be addressed in turn. I will not go into the procedural details as set out in the Liability Convention (e.g., the establishment of a claims commission), but will focus on the substantive questions raised by the collision.

Second-party Liability

Article III of the 1972 Liability Convention determines that, when damage is caused ‘elsewhere than on the surface of the Earth’ by a ‘space object’ of one ‘launching state’ to a ‘space object’ of another ‘launching state’, the first state is liable only if the damage is due to its ‘fault’ or the fault of persons for whom it is responsible. This means that ‘fault’ must be established for liability to arise, and hence for a claim for compensation to be made.

Thus, it must first be established who were the ‘launching states’ of the objects involved. The term ‘launching state’ is defined in Article I as a state that launches or procures the launching of a space object, or a state from whose territory or facility a space object is launched. In the present case, the *Iridium* satellite belonged to a private US company, Iridium Inc., headquartered in Bethesda, MD, USA. Interestingly, *Iridium-33* was launched by a Proton rocket from Baikonur in Kazakhstan. This launch facility is leased by the Kazakh government to Russia and is managed by the Russian Federal Space Agency. This means that at least two states could be considered the launching state of *Iridium-33*: the USA, as the state ‘procuring’ the launch in view of the incorporation of the Iridium company on its territory, and Russia as the state from whose facility the launch took place. The *Cosmos 2251* was a Russian telecommunications satellite launched from Russian

⁶There are numerous sources on the internet reporting on the collision and its possible consequences; a good start is http://en.wikipedia.org/wiki/2009_satellite_collision

⁷See: <http://www.newscientist.com/article/dn16604-satellite-collision-more-powerful-than-chinas-asat-test.html>

territory by a Kosmos 3M carrier rocket. Here, clearly only Russia would qualify as the launching state.

It also needs to be established whether the damage that occurred falls under the definition of ‘damage’ covered in the Convention. Damage is defined in Article I as “[...] loss of property of states or of persons, natural or juridical [...]”. It is obvious that Iridium has suffered damage with the loss of one satellite of its 66-satellite constellation. It is less obvious whether any economic losses could fall under this definition, should they occur (which apparently is not the case, according to their own reporting⁸). Has Russia also suffered damage? Probably not, since *Cosmos 2251* ceased to function in 1995, just two years after its launch, and was therefore no longer of any use to the launching state. But note that Article VIII of the Outer Space Treaty states that ownership of objects launched into outer space is not affected by their presence in space – thus, despite the fact that it was not an active satellite, it still was Russian property and has been destroyed.

The next question is whether the damage that Iridium suffered was indeed caused by a ‘space object’. The term is – again – not clearly defined; Article I tells us only that it ‘includes component parts of a space object as well as its launch vehicle and parts thereof’. Obviously the *Iridium* satellite would fall under this definition. But the case for the Russian satellite might not be so clear-cut. It has indeed been argued in the past that ‘dead’ satellites might no longer qualify as ‘space objects’ for which a state can be held responsible and liable, since it has no means of controlling it⁹. Probably the

Russian satellite could not be controlled or manoeuvred anymore, but I find it hard to accept that for that reason it would no longer fall under the responsibility and liability of the launching state. Russia still is the state of registry, and the state of registry has jurisdiction and control according to Article VII of the Outer Space Treaty, which moreover confirms that the defunct satellite remains in the ownership of Russia. I do not see any valid reason for arguing that liability would cease to attach to an object when it goes out of control. I would rather adhere to the view “once a space object, always a space object”, but clearly this is one of the concepts in space law that needs to be clarified.

Then, ‘fault’ must be established, as well as a causal link between the damage and the fault. This is, possibly, the most challenging part, and one that may well take years to resolve – if it ever comes to that. It will be necessary to prove that one of the launching states has not fulfilled its obligations under international law and that this has caused the damage to occur. I will not go into the technicalities of this, but suffice it to say that many elements can be brought into the picture to weaken the causal link, including the availability of information, the duty to inform and to consult, and the question whether any outside party (such as an agency monitoring objects) might have been negligent in warning Iridium of the imminent collision. It might also be established that one of the parties has somehow contributed to the damage by not adequately monitoring collision risks, thus reducing the extent of ‘fault’ by the other party. Furthermore, a state may be exonerated from absolute liability if ‘gross negligence’ or ‘intent’ can be demonstrated.

Finally, it is important to note that, if one of the parties believes that it has a case and wishes to present a claim under the

difficulty or impossibility of identification of a small piece of debris as belonging to a certain space object.

⁸See: <http://iridium.com> under ‘breaking news’.

⁹The same applies to pieces of debris – if it can be established at all that a certain piece of debris belonged to a certain space object, can the launching state of that initial object still be held responsible and liable for the piece of debris? The concepts of ‘abandonment’ and ‘salvage’ come into play here and parallels with the law of the sea can be made. Of course, there may be

Liability Convention, the Convention only binds states: private entities cannot present a claim on their own. Thus, if Iridium wishes to present a claim, its 'launching state' would have to do so on its behalf – i.e., the US or, improbably, Russia. If Russia wishes to present a claim, it would likewise not approach Iridium, but the US Government. The US Government could, if found liable, have a right of recourse against its private entity Iridium, presumably under the terms of its license.

Despite all this, it must not be forgotten that, in the end, political circumstances and considerations might well prevent a government from presenting a claim to another government to obtain compensation for damage it, or one of its private entities, has suffered.¹⁰

If the satellites were insured, the insurers would settle the case among each other, but apparently neither of the two satellites were insured, or were no longer insured. It is currently becoming more common to extend the initial launch policy also to cover a satellite's life-in-orbit, but it is not (yet) common practice to continue coverage beyond the useful life of a satellite, nor does this seem probable.

Third-party Liability

Regarding the liability for damage to third parties caused by a collision of two space objects, two possibilities exist and are addressed in Article IV of the Liability Convention. Note that the same considerations as above exist as regards the definitions of 'damage', 'launching state', 'fault' and 'space object'.

If debris resulting from the collision damages a space object of a third state in outer space, the liability of the states of the satellites involved in the collision is based on the fault of either of them (or of persons for whom they are responsible). The risk that this might happen is real, because the orbit where the collision occurred is heavily used by communications satellites and also because of the large number of debris that might even cause a chain of collisions because of the physical characteristics of outer space. Luckily, the risks for the *ISS* or the *Hubble* space telescope are very low, but there are many other potential objects, mainly satellites, that could become victims of a collision – and give rise to lawsuits. In the longer term, we can think also of missions involving humans (astronauts or cosmonauts on board a Shuttle, for instance, or tourists on board *SpaceShipTwo* or similar vehicles), where a collision would have a much deeper impact as it could cause loss of life. On the other hand, if the damage to a third state comprises a piece of debris hitting an aircraft in flight or persons or property on the Earth, the liability is absolute (no need to prove fault). In both (or all these) cases, the states involved in the collision are 'jointly and severally liable' This means that the third state may present a claim to either of them for the entire amount of the damage, and it is up to the other states to settle the amount to be paid by each (in case of fault liability, damage in principle to be apportioned according to the extent of the fault).

Interestingly, the FAA issued a NOTAM (Notice to Airmen) on 14 February to warn pilots to be on the lookout for

¹⁰This is also what happened when *Cosmos-954* crashed on Canadian territory in 1978; the USSR paid a certain sum to Canada, but this was not done by recognizing liability under the Liability Convention; rather, it was settled 'out of court' via diplomatic channels. See, for the text, http://www.oosa.unvienna.org/oosa/SpaceLaw/multi_bi/can_ussr_001.html.

possible ‘re-entry of satellite debris’¹¹. However, it did not mention the collision as its source, despite widespread panic in Texas after the sighting of fireballs which turned out to be a meteor. But, of course, large pieces resulting from the collision could eventually re-enter the atmosphere and pose a serious threat to aircraft in flight and to third parties on the ground.

The increased risk that the 10 February collision may entail may well lead to a review of insurance policies and quite possibly an increase in insurance premiums¹².

Future Avoidance

Of course, everyone agrees that a collision like this must never happen again. However, with the ever increasing use of space (for now, it seems that the space industry hardly suffers from the economic downturn), it is clear that more accidents will happen and put satellites, large structures like the *ISS*, humans and even the nascent space tourism industry at great risk¹³. In addition, it cannot be excluded that the environment of outer space as such could

be seriously affected by repeated collisions and an increasing debris population. It remains to be seen, however, who should or could present a claim on its behalf or on behalf of humankind.

As indicated earlier, the UN COPUOS has not adopted a new treaty for three decades. However, it took an important step forward when it adopted the UN Space Debris Mitigation Guidelines in 2007, on the basis of guidelines adopted earlier by the IADC¹⁴. The UN General Assembly endorsed the UN Space Debris Mitigation Guidelines in January 2008¹⁵. The Scientific and Technical Subcommittee agreed that “Member States, in particular space-faring countries, should pay more attention to the problem of collisions of space objects, including those with nuclear power sources (NPS) on board, with space debris and to other aspects of space debris, as well as its re-entry into the atmosphere”.

There are seven guidelines, each of which has its own recommended practices and rationale/justification: (1) Limit debris released during normal operations; (2) Minimize the potential for break-ups during operational phases; (3) Limit the probability of accidental collision in orbit; (4) Avoid intentional destruction and other harmful activities; (5) Minimize the potential for post-mission break-ups resulting from stored energy; (6) Limit the long-term presence of spacecraft and launch vehicle orbital stages in LEO after the end of the mission; and (7) Limit the long-term interference of spacecraft and launch vehicle orbital stages within the GEO region after the end of the mission.

¹¹See: http://spaceflightnow.com/news/_n0902/15debris/. It quotes: “FDC 9/5902 FDC... Special notice... Effective immediately until further notice. Aircraft are advised that a potential hazard may occur due to re-entry of satellite debris into the earth’s atmosphere. Further NOTAMs will be issued if more information becomes available. In the interest of flight safety, it is critical that all pilots/flight crew members report any observed falling space debris to the appropriate ATC facility to include position, altitude, time, and direction of debris observed”.

¹²See: <http://www.space.com/news/090217-satellite-crash-future.html>, quoting an insurance source as saying: “Until a few days ago, this was seen by the insurance industry as a non-issue. Now everyone’s taking a hard look at this”.

¹³Remember that 90% of all objects in outer space are debris, and this will only increase as long as we do not act urgently to decrease the amount of debris currently present and to prevent future debris from occurring.

¹⁴Interagency Space Debris Coordinating Committee, see <http://www.iadc-online.org/>. For the COPUOS guidelines, see the Report of the Scientific and Technical Subcommittee of 2007, UN Doc. A/AC.105/890, Chapter V and Annex IV. Note that a European Code of Conduct for Space Debris Mitigation has been adopted by ASI, BNSC, CNES, DLR and ESA, version 2.0 of 14/9/2007.

¹⁵A/RES/62/217, accessible via <http://www.un.org/ga/62/resolutions.shtml>.

The Director of the Office for Outer Space Affairs issued a press release on 13 February 2009, reiterating the call by COPUOS to all Member States and international organizations to take measures voluntarily to ensure that the Guidelines are fully implemented. Ms Mazlan Othman stressed that “the prompt implementation of appropriate space debris mitigation measures is in humanity’s common interest, particularly if we are to preserve the outer space environment for future generations”¹⁶. The Scientific and Technical Subcommittee is discussing the issue of space debris at the time of writing, and the Legal Subcommittee had decided in 2008 to include “General exchange of information on national mechanisms relating to space debris mitigation measures” as a new single issue/item on the agenda of the Subcommittee at its 48th session in 2009.

Possibly the collision will give a new boost to the international space community, convincing them of the need for further rules in this field, *binding* rules, rather than ‘mere’ guidelines. Who knows, a new treaty may be feasible after all. But even if that does not happen, ‘guidelines’ can be a useful tool of ‘soft law’ to move forward. Although they are voluntary, their adoption by consensus and the adherence by many states can contribute to such rules eventually developing into rules of customary law binding on all parties benefiting from the use of outer space.

In addition, there have been proposals recently to agree on a system for ‘space traffic management’¹⁷. The concepts of ‘space security’ and ‘space situational awareness’ are also closely related to the

issues discussed in this paper¹⁸ which, although they cannot be addressed within the limited scope of this paper, certainly merit our attention.

Conclusion

The general legal framework for space activities under public international law as contained in the UN treaties is in place, and is sufficiently general and flexible to enable and encourage states to carry out space activities in an orderly manner. It contains the basic provisions that allow parties to address the legal implications of a collision like the one that occurred on 10 February 2009. But it is also clear that the time has come for the international community to agree on the further development of these general principles, starting perhaps with space debris and space traffic management. However, other imminent ‘new’ uses of space such as space tourism will also require further elaboration of legal principles. And let us not forget that ‘age-old’ issues such as the ‘militarization’ (‘weaponisation’) of outer space will continue to require our attention and vigilance; perhaps, some of these could be addressed in a future paper by a space lawyer in this newsletter!

¹⁶See: http://www.unis.unvienna.org/unis/press_rels/2009/unisos376.html.

¹⁷See: the IAA *Cosmic Study on Space Traffic Management*, published in 2006, at <http://iaaweb.org/content/view/229/356/>. See also: *Space Traffic Management, Final Report*, ISU 2007, http://www.isunet.edu/index.php?option=com_content&task=view&id=374&Itemid=251

¹⁸See: the Space Securities Index reports since 2004, at <http://www.spacesecurity.org>. The Secure World Foundation must also be mentioned in this context: see <http://www.secureworldfoundation.org/>