

Legal Aspects of NEO Threat Response and Related Institutional Issues

Final Report

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The Research Project is undertaken by the University of Nebraska-Lincoln's Programme on Space and Telecommunications Law, sponsored by the Secure World Foundation and with the support of an International Advisory Board of eminent international space law experts from various states around the world, members of the International Institute of Space Law (IISL) and the International Academy of Astronautics (IAA).

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Executive Summary

With regard to potential threats to mankind and the earth posed by Near-Earth Objects (NEOs), three main conclusions can be drawn: (1) developments in space science and space technology have made it possible to predict with some accuracy (and sometimes decades in advance) whether a NEO may present a serious threat, (2) developments have also made it possible in many cases to undertake successful efforts to minimise the chance of actual collision with the earth, but (3) a, preferably international, framework for dealing with such issues is conspicuously missing, which may lead to unnecessary risks of NEO threats resulting in potentially catastrophic damage.

Regarding the third conclusion, the need for more comprehensive and in-depth analysis of the key legal and institutional issues involved in future international NEO threat mitigation, preferably prior to the first occasion of an actual serious NEO threat arising, has become clear. To address this need the University of Nebraska-Lincoln College of Law has, with the sponsorship of the Secure World Foundation and the support of an International Advisory Board of eminent international space law experts from various states around the world, members of the International Institute of Space Law (IISL) and the International Academy of Astronautics (IAA), taken the initiative for a Research Project on Legal Aspects of NEO Threat Response and Related Institutional Issues.

The Research Project has as its overriding goal ***to aid the international community of states and the relevant decision-makers in arriving at a proper, fair, transparent, comprehensive, workable, politically, institutionally and legally sound and feasible framework for international decision-making in the face of future NEO threats***, notably by analysing some of the key legal and institutional issues involved and by offering, where appropriate, recommendations on how to further develop the legal and institutional framework for NEO threat response.

Research, analysis and conclusions focused on the five following interlocking major clusters of legal/institutional issues: (1) general state responsibilities and obligations; (2) specific liabilities for damage; (3) the use of physical force, possibly even nuclear devices, in outer space; (4) the institutional structure; and (5) the proper role of commercial activities, in particular as undertaken by private enterprise.

In respect of each of the five clusters the Report analyses the current status of international law, taking into consideration as relevant general principles of national law; outlines where further research, analysis and/or discussion may be required; comes up with conclusions as to where gaps, overlaps, inconsistencies or lack of clarity exist; and offers some recommendations on how such flaws in the current legal framework could be addressed.

With regard to most of the aspects of legal issues analysed above, problems arise in terms of application of existing international law to solve the potentially dangerous and divisive, in worst cases catastrophic, threats NEOs could come to pose. In some cases, there exists no international law of much substance and at best some general principles that could be distilled from national law, such as on tort liability and the 'Good

Samaritan' principle – and even these principles are not completely uniform across the various national jurisdictions. In other cases, such international law has just started to develop and is still subject to considerable debate as to its precise ramifications; this is the case for instance with the 'responsibility to protect' and the ramifications of the International Charter on Space and Major Disasters in this specific context. In still other cases, moreover, there may perhaps not be such an absence of relevant international norms in general terms, but application thereof to the NEO threat response issue in particular may result in considerable, likely counter-productive complications, such as with the Liability Convention and (arguably) the use of nuclear force.

A first crucial step towards solving such issues in the most generic fashion would be to establish a proper international framework for decision-making. Such a framework would, firstly, where necessary, carve out from existing, more international and more general responsibilities and liabilities the specific context of NEO threat response actions and provide for adequate specific versions thereof. Secondly, alongside existing principles and customary law applicable to the subject it would result in – or at least provide a starting point for developing – customary international (and at a later stage perhaps treaty) law where no relevant international legal rules or principles exist, using as appropriate concepts and principles of national law. And thirdly, perhaps most important of all, it would underpin the development of a level of transparency and trust that would help to prevent divisive political tensions where the legal rules would not (yet) be clear.

Key to the success of such a framework would be a proper and workable balance between the interests and sovereign competencies of the (relatively few) states capable of actually undertaking successful NEO response missions and the rights and interests of all other states and humanity as a whole in being protected against threats posed by NEOs.

Under the current circumstances, a construction *mutatis mutandis* analogous to the roles of the UN Security Council, the UN General Assembly and individual sovereign states in the context of the UN role in preserving international peace and security, whether actually involving these UN bodies or not, provides the shortest and most effective route to such a balanced framework.

Under such a framework:

- any acknowledged responsibility to protect would be given a realistic chance of being complied with against a NEO threat by means of a balanced mandate on behalf of all states and mankind to be implemented according to certain guidelines and standards;
- liabilities for damage caused in spite of a mission taking place within the terms of the mandate concerned may be properly arranged, waived or otherwise dealt with as the case may be;
- the use of force, including even nuclear force as a measure of last resort, will not be prohibited if genuinely required in the defence of mankind – whilst allowing as little room for abuse as possible; and

- where necessary commercial interests, including those of private enterprise, can be harnessed for the cause by the states undertaking missions related to NEO threat responses, as long as remaining within the mandate.

The Report consequently offers the following seven key Recommendations to the international community.

#1. It is important to soon start discussions within the UN framework as to whether and how to develop an international decision-making framework along the lines sketched above within the present structure of the UN, notably as regards the roles of the UN Security Council and the UN General Assembly.

#2. A form of the ‘responsibility to protect’ should also be recognised in the NEO context as specifically requiring from states that have the capacity to generate relevant information and/or to respond to NEO threats to undertake such actions, after proper international coordination – preferably within a decision-making framework as recommended above in #1 – and without interfering with their sovereign powers to determine the details of any such mission.

#3. It should be recognised that if damage occurs in spite of a NEO response mission, or as a consequence of such mission being not (completely) successful, the state(s) responsible for such mission should not be held liable for such damage as long as the mission was undertaken within the parameters set by a proper mandate by the international community – preferably through a decision-making framework as recommended above in #1 – as well as by specific agreements with the state(s) responsible for such mission, as appropriate and applicable.

#4. In the international discussions on the use of force in outer space care should be taken that the result of such discussions will not unduly obstruct the use of force that might be required under some scenarios of NEO threats.

#5. As to the use of nuclear force in particular, this should be expressly recognised to be acceptable only as a last resort option, whilst ways should be explored to carve out very limited exceptions for NEO response purposes from the existing legal regime, which clearly prohibits any nuclear explosions in outer space, and which are consistent to the degree possible with the UN Principles on Nuclear Power Sources.

#6. A proper legal regime for handling possible commercial interests, including those of private enterprise, in exploitation of natural resources in outer space without threatening the clear-cut interests of all states and mankind at large in the proper conduct of such activities should be developed to ensure that any involvement in NEO response activities for commercial gain is only to be allowed if the overarching goal of such missions is not threatened or compromised thereby.

#7. A working group should be instituted by COPUOS, notably by the Legal Subcommittee in close consultation with the Scientific-Technical Subcommittee, to further investigate, discuss and develop the recommendations ##1-6 offered by the present Report, as well as the various options available in this regard.

1. Introduction

1.1. At its Annual Congress in 2005, the Association of Space Explorers (ASE) discussed the issue of potential threats to mankind and the earth posed by Near-Earth Objects (NEOs). The main conclusions can be summarised as: (1) developments in space science and space technology have made it possible to predict with some accuracy (and sometimes decades in advance) whether a NEO may present a serious threat, (2) developments have also made it possible in many cases to undertake successful efforts to minimise the chance of actual collision with the earth, but (3) a, preferably international, framework for dealing with such issues was conspicuously missing, resulting in unnecessary risks of NEO threats that may lead to potentially catastrophic damage.¹

1.2. These conclusions led the ASE to create a NEO Committee from amongst its members², further calling upon individual outside experts to form a Panel on NEO Threat Mitigation³. A series of workshops led to the presentation of the Report *Asteroid Threats: A Call for Global Response*⁴ in September 2008, providing recommendations for the international community to act. The Report will be discussed in the context of the 2010 sessions of the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS). The Report *inter alia* pointed out that the issue of NEO threat mitigation, in particular by means of creating a framework for decision-making, involved a number of important legal and institutional aspects requiring further analysis.

1.3. Other authoritative international bodies, such as the International Academy of Astronautics (IAA)⁵, the Planetary Society⁶, the B612 Foundation⁷, the Secure World Foundation (SWF)⁸ and the Space Generation Advisory Council (SGAC)⁹ have also conducted research in the area of NEOs, and have generally speaking come to the same or similar conclusions.

¹. See further Open Letter of the Association of Space Explorers, 19th Annual Congress, Salt Lake City, UT, 14 October 2005; see http://www.space-explorers.org/committees/NEO/docs/Open_Letter.pdf.

². The NEO Committee, previously chaired by Rusty Schweickart (USA), is currently chaired by Thomas Jones (USA) and further comprises Sergei Avdeev (Russia), Chris Hadfield (Canada), Edward Lu (USA), Dumitru Prunariu (Romania), Viktor Savinykh (Russia), and Franklin Chang-Diaz (USA/Costa Rica).

³. The Panel consisted of Adigun Ade Abiodun (Nigeria), Vallampadugai Arunachalam (India), Roger-Maurice Bonnet (Switzerland), Sergio Camacho-Lara (Mexico), James George (Canada), Tomifumi Godai (Japan), Peter Jankowitsch (Austria), Sergey Kapitza (Russia), Paul Kovacs (Canada), Walther Lichem (Austria), Gordon McBean (Canada), Lord Martin Rees (United Kingdom), Karlene Roberts (United States), Michael Simpson (United States), Sir Crispin Tickell (United Kingdom), Richard Tremayne-Smith (United Kingdom), Frans von der Dunk (Netherlands), and James Zimmerman (United States).

⁴. See <http://www.space-explorers.org/committees/NEO/docs/ATACGR.pdf>.

⁵.

See <http://iaaweb.org/iaa/Scientific%20Activity/Study%20Groups/SG%20Commission%203/sg35/sg35finaleport.pdf>.

⁶. See http://www.planetary.org/programs/projects/near_earth_objects/.

⁷. See <http://www.b612foundation.org/>.

⁸. See http://www.secureworldfoundation.org/index.php?id=16&page=Near_Earth_Objects.

⁹. See <http://www.spacegeneration.org/node/1138>.

1.4. As a result, in April 2009 the College of Law of the University of Nebraska-Lincoln (UNL) hosted an international *Conference on Near-Earth Objects: Risks, Responses and Opportunities – Legal Aspects*, providing for a broad discussion of those legal and institutional issues.¹⁰ The main conclusion arising from the discussions at the Lincoln conference was that some key legal and institutional issues should be resolved at an early stage; at the same time more research would be required in order to arrive at consolidated and feasible conclusions and recommendations.

¹⁰ For the programme, see http://spaceandtelecomlaw.unl.edu/c/document_library/get_file?folderId=152502&name=DLFE-7258.pdf. A report on the conference can be found in F.G. von der Dunk, Report on University of Nebraska-Lincoln Conference “Near-Earth Objects – Legal Aspects”, see <http://www.congrex.nl/09c04/programme.asp>; click through to download of papers.

2. The Research Project on Legal Aspects of NEO Threat Response and Related Institutional Issues

2.1. The need for more comprehensive and in-depth analysis of the key legal and institutional issues involved in future international activities of NEO threat mitigation, preferably prior to the first occasion of an actual serious NEO threat arising, had become clear. In order to address this need Prof. Frans von der Dunk of the UNL College of Law has, with the sponsorship of the Secure World Foundation, taken the initiative for a Research Project on Legal Aspects of NEO Threat Response and Related Institutional Issues.

2.2. To this end, an International Advisory Board has been constituted, consisting of eminent international space law experts from various corners of the world, members of the International Institute of Space Law (IISL) and the International Academy of Astronautics (IAA), as follows:

- Prof. Steven Freeland, University of Western Sydney, Australia;
- Prof. Joanne Gabrynowicz, Director, National Center for Remote Sensing, Air & Space Law, University of Mississippi, United States;
- Prof. Stephan Hobe, Director of the Institute of Air and Space Law, University of Cologne, Germany;
- Prof. Mahulena Hofmann, University Giessen;
- Prof. Ram Jakhu, Institute of Air and Space Law, McGill University, Montreal, Canada;
- Prof. Sergio Marchisio, University of Rome “La Sapienza”, Italy;
- Prof. Matthew Schaefer, University of Nebraska-Lincoln, United States; and
- Prof. Maureen Williams, University of Buenos Aires / Conicet, Argentina.

2.3. The Research Project has as its overriding goal ***to aid the international community of states and the relevant decision-makers in arriving at a proper, fair, transparent, comprehensive, workable, politically, institutionally and legally sound and feasible framework for international decision-making in the face of future NEO threats***, notably by analysing some of the key legal and institutional issues involved and by offering, where appropriate, recommendations on how to further develop the legal and institutional framework for NEO threat response.

2.4. It intends to achieve that goal by offering the present Report to the international community of states, as the constituency ultimately responsible for and capable of taking action in the event of a major NEO threat, notably for the purposes of discussion in UNCOPUOS as the most readily available international body in this context.

2.5. Research, analysis and conclusions focused on five interlocking major clusters of legal/institutional issues, which will each be dealt in separate chapters as follows:

1. General state responsibilities and obligations;
2. Specific liabilities for damage;
3. The use of physical force, possibly even nuclear devices, in outer space;
4. The institutional structure; and
5. The proper role of commercial interests, in particular those of private enterprise.

- 2.6. In respect of each of the five clusters the Report:
- Analyses the current status of international law, taking into consideration as relevant general principles of national law;
 - Outlines where further research, analysis and/or discussion may be required;
 - Comes up with conclusions as to where gaps, overlaps, inconsistencies or lack of clarity exist; and
 - Offers some recommendations on how such flaws in the current legal framework could be addressed.
- 2.7. Research, analysis and conclusions finally have, in addressing the subject matter of the research project, consistently used Article 38(1) of the Statute of the International Court of Justice (ICJ) as determining applicable international law.¹¹ Furthermore, in interpreting all relevant treaties the customary international law rules for interpretation as codified in Articles 31 and 32 of the Vienna Convention on the Law of Treaties have been consistently applied.¹²

¹¹. Art. 38(1), Statute of the International Court of Justice, San Francisco, done 26 June 1945, entered into force 24 October 1945; 156 UNTS 77; USTS 993; 59 Stat. 1031; UKTS 1946 No. 67; ATS 1945 No. 1; provides: "The Court, whose function is to decide in accordance with international law such disputes as are submitted to it, shall apply: a. international conventions, whether general or particular, establishing rules expressly recognized by the contesting states; b. international custom, as evidence of a general practice accepted as law; c. the general principles of law recognized by civilized nations; d. subject to the provisions of Article 59, judicial decisions and the teachings of the most highly qualified publicists of the various nations, as subsidiary means for the determination of rules of law."

¹². Art. 31 ("General rule of interpretation"), Vienna Convention on the Law of Treaties, Vienna, done 23 May 1969, entered into force 27 January 1980; 1155 UNTS 331; UKTS 1980 No. 58; Cmnd. 4818; ATS 1974 No. 2; 8 ILM 679 (1969); provides: "1. A treaty shall be interpreted in good faith in accordance with the ordinary meaning to be given to the terms of the treaty in their context and in the light of its object and purpose. 2. The context for the purpose of the interpretation of a treaty shall comprise, in addition to the text, including its preamble and annexes: (a) any agreement relating to the treaty which was made between all the parties in connection with the conclusion of the treaty; (b) any instrument which was made by one or more parties in connection with the conclusion of the treaty and accepted by the other parties as an instrument related to the treaty. 3. There shall be taken into account, together with the context: (a) any subsequent agreement between the parties regarding the interpretation of the treaty or the application of its provisions; (b) any subsequent practice in the application of the treaty which establishes the agreement of the parties regarding its interpretation; (c) any relevant rules of international law applicable in the relations between the parties. 4. A special meaning shall be given to a term if it is established that the parties so intended."

Furthermore, Art. 32 ("Supplementary means of interpretation") provides: "Recourse may be had to supplementary means of interpretation, including the preparatory work of the treaty and the circumstances of its conclusion, in order to confirm the meaning resulting from the application of article 31, or to determine the meaning when the interpretation according to article 31: (a) leaves the meaning ambiguous or obscure; or (b) leads to a result which is manifestly absurd or unreasonable."

3. General state responsibilities and obligations

The key question

3.1. The main question here is: to what extent is there, under current international law, including as relevant general principles of national law, a general responsibility of individual states, perhaps regional groupings of states (where mid-size Neo threat scenarios might only directly involve one or a few regions of the world), or alternatively the international community as a whole to address serious threats to mankind or major parts thereof, including natural disasters, which could apply in the specific context of NEO threats?

Introductory remarks

3.2. At the UNL Conference of April 2009 a general movement from purely intergovernmental processes to a 'global agenda' was noted, closely related to such concepts as the 'interest of mankind', 'international peace and security' and 'international cooperation, mutual assistance and understanding'. NEO response operations in outer space would have to be for all mankind, not for single-state purposes; information regarding relevant developments is thus to be shared internationally and international consultation is due.

3.3. In addition, the principles associated with the concept of the 'responsibility to protect', which is currently emerging under general international law¹³, may also be of relevance, especially once a NEO threat has been detected, and presumably agreed upon to be of sufficient severity (both in terms of likelihood of materialising, and in terms of potential damage resulting therefrom). This responsibility, more in particular, includes a 'responsibility to react', a 'responsibility to prevent' and a 'responsibility to rebuild'.¹⁴ It directs attention to the costs and results of action *versus* no action, and provides conceptual, normative and operational linkages between assistance, intervention and reconstruction.

3.4. However, several major issues with the possible application and applicability of a 'responsibility to protect' to the NEO threat issue have to be noted. As the 'responsibility to protect' doctrine was initially developed by a report in 2001 by the Canadian Government's International Commission on Intervention and State Sovereignty and then included in the 2005 World Summit Declaration, albeit as only a few small paragraphs in a much larger document, it has become the subject of much legal scholarship and also quite some diplomatic discussion as to its meaning and applicability.

3.5. Firstly, this Statement, in particular when addressed from the perspective of the legal value of such a statement by such a panel, begs the question whether *at this point* the 'responsibility to protect' can already be considered to 'have emerged' as customary international law, in other words: constitutes *lex lata*. The experts

¹³. In December 2004, the UN Secretary-General's High Level Panel on Threats, Challenges and Change recommended reforms to enhance the United Nations' capacity to carry out its collective security mandate. In this context, the Panel also strongly endorsed the emerging norm that there is an international responsibility to protect civilians in situations where governments are powerless or unwilling to do so; see M. Clough, *Darfur: Whose Responsibility to Protect?*, Human Rights Watch, Jan. 2005, <http://hrw.org/wr2k5/darfur/index.htm>.

¹⁴. See "The Responsibility to Protect", Report of the International Commission on Intervention and State Sovereignty (ICISS), December 2001, § 2.29; at <http://www.iciss.ca/pdf/Commission-Report.pdf>.

participating in the present Research Project generally perceive that such a stage has not yet been arrived at, and that the 'responsibility to protect' is essentially still *de lege ferenda*.

3.6. Secondly, the doctrine was formulated in a way that directed its applicability largely towards situations of gross violations of human rights (such as genocide, war crimes, ethnic cleansing and crimes against humanity). Even then, it was not overly clear precisely how and under which circumstances the taking of direct action by third states would become obligatory. Indeed, there is much uncertainty as to how, if at all, the formalisation of the principle adds something to the options for action available to states in cases of extreme peril to groups of people.

3.7. Thus, from the perspective of NEO threat mitigation there would be considerable problems in leaning too much on the 'responsibility to protect' principle. The contemporary discussion of the principle too often involves questions relating to state sovereignty – where the principle is effectively steered towards undertaking actions 'against' another state. It is worthwhile noting furthermore that the principle was raised at a diplomatic level when the people of Zimbabwe were facing starvation and cholera, and also (although less stridently) after the devastating storms/floods from various cyclones in Burma – yet, in the end, very little was done in a tangible way to address the threat that people were facing in those situations.

3.8. If the 'responsibility to protect' were to be used as a baseline for NEO threat mitigation, the absence (at least in principle) of any direct 'threat' to some state's sovereignty should be underlined. The starting point for such a responsibility to protect *vis-à-vis* NEOs would then be that under the Outer Space Treaty the basic freedom of exploration and use is subject *inter alia* to rules of general international law such as the UN Charter, in addition of course to the *lex specialis* of space law.¹⁵ To that extent, it may be argued that, as states already have a certain primary responsibility to protect fundamental human rights of their respective populations as enshrined in several international human rights conventions¹⁶, including the right to life, in case such a state would be unable to provide protection against a major impact of a NEO, the international community should be made to have a secondary obligation to do so.¹⁷

3.9. It is of crucial importance to realise that NEOs big enough to consider response missions may lead to massive killing and starvation of humans on earth, whilst a response to the threat of such an event at least in principle would not encounter the usual risks of interfering with state sovereignty.

¹⁵. See Artt. I, resp. III, Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (hereafter Outer Space Treaty), London/Moscow/Washington, done 27 January 1967, entered into force 10 October 1967; 610 UNTS 205; TIAS 6347; 18 UST 2410; UKTS 1968 No. 10; Cmnd. 3198; ATS 1967 No. 24; 6 ILM 386 (1967).

¹⁶. Cf. also "The Responsibility to Protect", §§ 1.3, 2.15, 2.21, on the related concept of 'human security'; "Human security means the security of people – their physical safety, their economic and social well-being, respect for their dignity and worth as human beings, and the protection of their human rights and fundamental freedoms".

¹⁷. Note that the UN GA 2005 World Summit Outcome, 15 September 2005, UN Doc. A/60/L.1, 71-72, already considers this to be the case presently. Cf. also e.g. E.R. Seamone, The Duty to "Expect the Unexpected": Mitigating Extreme Natural Threats to the Global Commons such as Asteroid and Comet Impacts with the Earth, 41 *Columbia Journal of Transnational Law* (2003), 735-91.

3.10. In the context of determining what constitutes an ‘attack’ against which a ‘responsibility to protect’ would come into play, it may be of interest to also take note that Article 7(b) of the ICC Statute (which, of course, deals with the criminal responsibility of individuals and has no jurisdiction in relation to the actions of states) defines a ‘crime against humanity’ as “any of the following acts when committed as part of a widespread (...) attack directed against any civilian population, with knowledge of the attack: (...) (b) Extermination”.

3.11. It should be noted, however, that the constituent elements of a ‘crime against humanity’ all need to be proven before it can be said that such a crime has been committed. Like all crimes, not only does this involve an action (*actus reus*), but also the requisite intention (*mens rea*) must be present – be it in the form of a *dolus specialis* or a *dolus generalis*. To prove that such a crime has been committed is thus difficult, with all elements to be present and the requisite thresholds to be crossed. On the other hand, there is much jurisprudence and expert opinion regarding the meaning of a ‘widespread attack’, which does not easily allow for the assertion that allowing large populations to be subjected to a serious risk of extermination by knowing of an imminent NEO ‘attack’ and not taking any response measures, would qualify as such, and hence should come to be defined as a ‘crime against humanity’. There is a complex, difficult and legalistic methodology for defining such crimes as well as for adding ‘new’ crimes – not to mention the very challenging political process and resistance involved.

The right to defend against a NEO threat

3.12. Firstly, the well-established *right* arises of a state to defend its citizens against, essentially, *any* threat as long as complying with relevant international obligations and not resulting in disproportionate harm to *other* states (and their citizens). The UN Charter recognises a core element of that right already in terms of an “inherent right of (...) self-defence” against “an armed attack”.¹⁸

3.13. The principle of ‘self-defence’ contained in the larger concept has also been used by states to undertake actions, including the use of force, to presumably protect or rescue their citizens. However, such usually unilateral interpretations of the concept, claiming a customary legal basis broader than the provision of the UN Charter itself in justification, have been subject to intense discussion as to their appropriateness, in view of the risk of being abused to provide a useful legal cover for less appropriate actions by the state concerned.

3.14. At the same time, the main underlying reason for resistance to such a broad and unilateral use of the principle of ‘self-defence’ lies in the fact that inexorably the use of force concerned will be directed against (an)other state(s). This applies also in cases of relevant acts essentially undertaken by non-state actors, where the ‘self-defence’ invoked is to be directed predominantly against (a) state(s) involved in and/or backing such non-state actors. Thus, a proper, just and justified balance between the justified interests of the first state in defending itself and those of (an)other state(s) not to be harmed by the use of force has to be established in every case.

¹⁸. See Art. 51, Charter of the United Nations (hereafter UN Charter), San Francisco, done 26 June 1945, entered into force 24 October 1945; USTS 993; 24 UST 2225; 59 Stat. 1031; 145 UKTS 805; UKTS 1946 No. 67; Cmd. 6666 & 6711; CTS 1945 No. 7; ATS 1945 No. 1.

3.15. What is at stake in the case of NEO threat mitigation, however, is a right of 'self-defence' (under whatever name) against a natural, even extraterrestrial phenomenon. 'Counter-attacking' such a phenomenon will *not* be automatically or even usually to the detriment of any other states. On the contrary, with few exceptions all other states would also benefit (at least from a *bona fide* and completely successful NEO mitigation effort).

3.16. If a state would be entitled to defend (an)other state(s) as a corollary to the right of self-defence (presuming the legal preconditions for exercise thereof by that other state would be fulfilled), *a fortiori* it would be entitled to defend (an)other state(s) against NEOs. It is to be noted here, that the UN Charter expressly allows for "collective self-defence"¹⁹; if states are entitled to use force against a perceived attacking state in the defence of a third state, *a fortiori* they would in principle be entitled to use force in defending a third state without such force being applied against any particular state.

The duty to defend against a NEO threat

3.17. As to whether such a right (either the general right of a state to defend itself, its citizens and/or other states and their citizens, or the specific right of self-defence, individual as well as collective) would also imply a *duty* for a state to act in order to protect its citizens, the legal situation is much more ambiguous.

3.18. The starting point here is the duty for a state to prevent the interests of *other states* from being harmed as a consequence of events happening on its own territory and under its control: every state is now under an "obligation not to allow knowingly its territory to be used for acts contrary to the rights of other states".²⁰ This principle, though originating from a bilateral dispute between Canada and the United States on environmental issues and decided by arbitration,²¹ has been broadened considerably to extend to all substantial harm that could be caused from the territory of one state to that of another, and at the same time, as such, has become part of customary international law.

3.19. However, it is one thing to assert a right – states would more often be prepared to support that a right exists (such as that of 'humanitarian intervention') – or a corollary duty *vis-à-vis* other states; it does not necessarily follow that states would accept that the existence of any such right to develop into an obligation to act. In the NEO context, this might apply even if merely conceived as a secondary option (namely when the state whose population is primarily at risk does not undertake appropriate steps to mitigate such risks). Clearly, states are far more resistant to assertions of obligations – and sadly, there have been many examples where states have failed to act even though large groups of people were facing serious peril.

3.20. On the national level, the sovereignty of states would create a default assumption that it would be entitled itself to determine to what extent it would *make*

¹⁹. Art. 51, UN Charter.

²⁰. Corfu Channel (United Kingdom v. Albania)(Merits), 1949 I.C.J. 4 (Apr. 9); at 22.

²¹. See Trail Smelter Arbitration (US v. Canada), 1941 R.I.A.A. No.3, at 1905; providing that "under the principles of international law, as well as the law of the United States, no state has the right to use or permit the use of its territory in such a manner as to cause injury by fumes in or to the territory of another or the properties or persons therein, when the case is of serious consequence and the injury is established by clear and convincing evidence."

use of its right to defend its citizen²², rather than *being forced* by an objective *international legal rule* to do so.

3.21. Only where human rights law has been developed of a character specifically enough in requiring respect for the supreme value of human life, either by treaty law or by customary law, would a state no longer have a choice, but would its rights have been turned into legal obligations. This, however, seems to be the case only in a limited number of instances, with respect to genocide²³, slavery²⁴, torture²⁵ and related international prohibitions (such as ethnic cleansing, crimes against humanity and war crimes).²⁶ Typically, even in those cases the obligations are not so much 'positive' obligations – to act to defend a certain human right – but largely formulated as 'negative' obligations – to abstain from acting in order not to infringe upon a certain human right.

3.22. Interestingly, in terms of space activities, the Rescue Agreement²⁷ does provide for a set of 'positive obligations' to come to the rescue of human beings in danger – albeit that these obligations are limited to a very small group of humans, to wit astronauts (including cosmonauts and taikonauts), that are actually in outer space or have been there, and are or have been confronted with dangers or accidents whilst there.²⁸ Still, the Rescue Agreement may present useful guidelines for the development of a legal regime requiring the active protection of mankind or substantial portions thereof in the context of a NEO threat once widespread agreement would develop on that principle, for example in balancing the rights and obligations of states whose individuals are at risk and those of the states able, entitled or obliged to act against a threat to those individuals.

3.23. On the global level, which is where NEO threat mitigation is most prominently at stake, the general obligation for a state to come to the rescue of *other* states and their citizens, whether cloaked as a responsibility to protect' or otherwise, which would be a distinctly 'positive' obligation, is only beginning to gain recognition in the international community.

3.24. Again, the UN Charter provides another rather limited example, where collective action may be required of states to encounter certain international threats to the peace and security, as ordained by legally binding UN Security Council

²². International Law and Non-Intervention: When Humanitarian Concerns Supersede Sovereignty, 17-2 *The Fletcher Forum of World Affairs* (Summer 1993), 199-200.

²³. Cf. Convention on the Prevention and Punishment of the Crime of Genocide, New York, done 9 December 1948, entered into force 12 January 1951; 78 UNTS (1951) 1021, vol. 78, p. 2771; <http://www.unhcr.org/refworld/docid/3ae6b3ac0.html>.

²⁴. Cf. Convention to Suppress the Slave Trade and Slavery, Geneva, done 25 September 1926 entered into force 9 March 1927; 60 LNTS 253, Registered No. 1414; <http://www.unhcr.org/refworld/docid/3ae6b36fb.html>.

²⁵. Cf. Convention against Torture and Other Cruel, Inhuman or Degrading Treatment or Punishment, New York, done 10 December 1984, entered into force 26 June 1987; UN Doc. A/RES/39/46; <http://www.unhcr.org/refworld/docid/3b00f2224.html>.

²⁶. See e.g. UN GA 2005 World Summit Outcome, 15 September 2005, UN Doc. A/60/L.1, 139.

²⁷. Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space (hereafter Rescue Agreement), London/Moscow/Washington, done 22 April 1968, entered into force 3 December 1968; 672 UNTS 119; TIAS 6599; 19 UST 7570; UKTS 1969 No. 56; Cmnd. 3786; ATS 1986 No. 8; 7 ILM 151 (1968).

²⁸. Cf. Art. 1-4, Rescue Agreement.

Resolutions constituting prior authorization.²⁹ If the Security Council rejects a proposal or fails to deal with it within a reasonable time, alternative options are consideration of the matter by the General Assembly in an Emergency Special Session under the 'Uniting for Peace' procedure³⁰ or action within the jurisdiction of regional or sub-regional organizations under Chapter VIII of the Charter, which would be allowed subject to seeking subsequent authorization from the Security Council. Such a 'secondary responsibility' of the General Assembly for the maintenance of international peace and security as well as related duties for member states to comply with these UN responsibilities has been recognised by several international awards.³¹

International cooperation in NEO threat mitigation and erga omnes obligations

3.25. It may be pointed out that, further to these responsibilities in a general context, also the Outer Space Treaty itself calls for "mutual assistance", for "conduct [by states of] their activities (...) with due regard to the corresponding interests of other states", and for space activities "to avoid (...) adverse changes in the environment of the Earth".³² The Outer Space Treaty also requires in general terms the exploration and use of outer space to "be carried out for the benefit and in the interests of all countries"³³. This requirement has been proclaimed to be not "a mere statement of the rights of States" but rather a guarantee "that the interests, not only of individual States, but of all countries and of the international Community as a whole, would be protected".³⁴

3.26. The Outer Space Treaty certainly being one of those treaties that is of a fundamental and broad nature, obligations under this treaty would be incumbent upon states towards the international community as a whole ('obligations *erga omnes*') as recognised by the International Court of Justice.³⁵ Thus, such clauses as

²⁹. Cf. Artt. 2(2), 2(5), 24, 25, 39-43, 48, UN Charter.

³⁰. See UN GA Res. 377(V), UN GAOR, 5th Sess., Supp. No. 20; A/RES/377(V)A-C, UN Doc. A/1775 (Nov. 3, 1950), at 10; stating "that if the Security Council, because of lack of unanimity of the permanent members, fails to exercise its primary responsibility for the maintenance of international peace and security in any case where there appears to be a threat to the peace, breach of the peace, or act of aggression, the General Assembly shall consider the matter immediately with a view to making appropriate recommendations to Members for collective measures, including in the case of a breach of the peace or act of aggression the use of armed force when necessary, to maintain or restore international peace and security".

³¹. Cf. most notably *Reparation for Injuries Suffered in the Service of the United Nations*, Advisory Opinion, International Court of Justice, 1949 I.C.J. Rep. 174 (Apr. 11); stating at pp. 8-9: "The Charter has not been content to make the Organization created by it merely a centre 'for harmonizing the actions of nations in the attainment of these common ends' (Article 1, para. 3). It has equipped that centre with organs, and has given it special tasks. It has defined the position of the Members in relation to the Organization by requiring them to give it every assistance in any action undertaken by it (Article 2, para. 5), and to accept and carry out the decisions of the Security Council; by authorizing the General Assembly to make recommendations to the Members (...) It must be added that the Organization is a political body, charged with political tasks of an important character, (...) namely, the maintenance of international peace and security".

³². Art. IX, Outer Space Treaty.

³³. Art. I, Outer Space Treaty.

³⁴. Statement by Soviet Delegate, UN GAOR, 21st Sess., 57th mtg. at 12, UN Doc. A/AC.105/C.2/SR.57, 20 October 1966.

³⁵. Cf. *Barcelona Traction, Light and Power Company, Limited (Belgium v. Spain)*, 1970 I.C.J. 3 (Feb. 5); *Case Concerning Military and Paramilitary Activities in and against Nicaragua (Nicaragua v. United*

quoted, if taken in combination, amount at least to a general responsibility to distribute information gained from space activities to states that could use such information to avert or limit the impact of natural disasters, as a customary international law obligation.³⁶

3.27. On the other hand, the broad and rather abstract nature of such a responsibility inevitably causes difficulties as regards its interpretation in a specific context such as that of NEO response activities – so much so, perhaps, as to disqualify it as a proper legal obligation. The absence of any further specific standards of appropriate behaviour means only a general standard of reasonableness can be used as a yardstick, leaving the door open to widely varying interpretations. For example, what constitutes a reasonable level of effort on the part of states possessing information to distribute it to those entities whose NEO response activities would actually benefit? Directly informing local evacuation authorities may both be practically impossible and politically counter-productive if the states possessing such information would be seen as interfering with the domestic sovereignty of victim states.

3.28. Here, the UN Principles on Remote Sensing may offer a starting point for developing a useful standard of reasonableness. The Principles require “States participating in remote sensing activities that have identified information in their possession that is capable of averting any phenomenon harmful to the Earth’s natural environment [to] disclose such information to States concerned”, as well as providing that “States (...) that have identified processed data and analysed information in their possession that may be useful to States affected by natural disasters, or likely to be affected by impending natural disasters, shall transmit such data and information to States concerned as promptly as possible”.³⁷ Such terms as ‘states participating in remote sensing activities’, ‘information in their possession’ and ‘states concerned’ already limit the scope of the relevant obligations to a certain extent.

3.29. Whilst these Principles may not be binding as treaty law, in view of the consensus with which they have been adopted and in the absence so far of authoritative jurisprudence on the matter most experts agree that they would constitute customary international law,³⁸ and there is no reason why the two Principles quoted would not be included in that evaluation. The Principles, of course, are formally narrowed in their scope of application to activities of remote sensing ‘of

States of America), 1986 I.C.J. 14 (June 27); see further R. Jakhu, Legal Issues Relating to the Global Public Interest in Outer Space, 32 *Journal of Space Law* (2006), 39.

³⁶. Cf. S. Marchisio, Legal Aspects of Disaster Management: European Efforts Including GMES, in *Space Law Symposium*, Vienna, April 3, 2006, 6; <http://esamultimedia.esa.int/docs/ECSL/symposium/sym-03.pdf>.

³⁷. Princ. X, resp. XI, Principles Relating to Remote Sensing of the Earth from Outer Space, UNGA Res. 41/65, of 3 December 1986; UN Doc. A/AC.105/572/Rev.1, at 43; 25 ILM 1334 (1986).

³⁸. See e.g. M. Williams, The UN Principles on Remote Sensing Today, *Proceedings of the Forty-Eighth Colloquium on the Law of Outer Space* (2006), 4; J. Gabrynowicz, Comments on the discussion paper Space and Remote Sensing Activities by Maureen Williams, *Proceedings of the UN/Brazil Workshop on “Disseminating and Developing International and National Space Law: The Latin American and Caribbean Prospective”* (2005), ST/Space 28, 143-4; F.G. von der Dunk, Legal Aspects of Geospatial Data-gathering in Space, in (19-8) *GIM International* (2005), 69-71, <http://www.gim-international.com/issues/articles/id528-Legal Aspects of Geospatial Datagathering in Space.html>.

the earth from outer space', but it is inherently logical to apply Principles X and XI to 'remote sensing' of natural phenomena in outer space for the purpose of protecting earth.³⁹

3.30. In addition, Principles X and XI are limited to the provision of data and information only, and do not include any 'obligation' to act upon such data or information other than to share and distribute them appropriately. However, also in the NEO context the issue of generating, sharing and distributing information should be separated from the issue of acting upon such information. This limitation therefore reinforces the appropriateness of applying these Principles to the NEO context, rather than advise against that.

The International Charter for Space and Major Disasters

3.31. Partly as a follow-up to the UN Principles on Remote Sensing, in 1999 the International Charter for Space and Major Disasters was drafted, by now underwritten by all major space agencies with substantial remote sensing and other capabilities relevant in the context of disaster prevention and mitigation.⁴⁰

3.32. The Charter provides for a set of semi-institutionalised procedures to serve its central purpose, stated as follows: "In promoting cooperation between space agencies and space system operators in the use of space facilities as a contribution to the management of crises arising from natural or technological disasters, the Charter seeks to pursue the following objectives: - supply during periods of crisis, to States or communities whose population, activities or property are exposed to an imminent risk, or are already victims, of natural or technological disasters, data providing a basis for critical information for the anticipation and management of potential crises; - participation, by means of this data and of the information and services resulting from the exploitation of space facilities, in the organisation of emergency assistance or reconstruction and subsequent operations."⁴¹

3.33. Though the Charter is not a legally binding document *per se*, its rather frequent invocation by states from all around the globe and in all stages of development, threatened by major disasters of many kinds, is notable.⁴² Furthermore: "The objective of the Charter (...) reflects the intent of principle XI of the UN Principles Related to Remote Sensing from outer Space."⁴³ If Principle XI of UN Principles is of an international customary law nature, then provisions of the Charter at least reflect that. Thus, it would seem to give rise to a rule of customary international law which requires the sharing of knowledge and information (whether derived from space activities or not) capable of averting or limiting international

³⁹. Indeed, recently satellites have been launched for precisely such remote sensing purposes; cf. e.g. NASA's "asteroid-hunting Wide-field Infrared Survey Explorer (WISE) space telescope", launched on a United Alliance Delta 2 rocket, on 14 December 2009; *Space News*, Vol. 21(3), p. 14.

⁴⁰. See Charter On Cooperation To Achieve The Coordinated Use Of Space Facilities In The Event Of Natural Or Technological Disasters; Rev.3 (25/4/2000).2; <http://www.disasterscharter.org/web/charter/charter>.

⁴¹. Art. II, International Charter on Space and Major Disasters.

⁴². The latest invocation of the Charter, on 14 January 2010, took place courtesy of the United Nations in response to the Haiti earthquake. See http://www.cdera.org/cunews/sitrep/haiti/article_2427.php.

⁴³. S. Ospina, SOS – Is Anyone Getting This Message, *Proceedings of the Forty-Ninth Colloquium on the Law of Outer Space* (2007), 82.

disasters with the states threatened thereby, if taking place within a semi-institutionalised environment such as the Charter provides.

3.34. Furthermore, whilst the overwhelming focus of the Charter is on its remote sensing aspects, it also addresses using navigations, communication, television, data, and other space and ground based applications as part of a response to a disaster.⁴⁴ This shows the intent that a disaster response ought to be as holistic and comprehensive as necessary, which also is a critical point for a NEO response.

3.35. Furthermore, while (as mentioned) the Charter may not be legally binding, its status could be evolving over time, and arguably, is already getting stronger.⁴⁵ Relevant factors for such an argument include “the frequency and number of activations and responses, their quality and effectiveness; additional standards of behaviour, if any, established by voluntary actions; the withdrawals, if any, of parties; and, the addition of any parties, associated bodies, and cooperating bodies. Perhaps the most important variable will be the number of automatic renewals it receives. Arguably, the more the Disasters Charter is renewed, the more it becomes a binding agreement. In addition to analyzing the use and interpretation of the Charter itself, its status will be determined by applying relevant general principles of law and assessing related activities. These include related treaties or agreements; decisions of national and international courts; national legislation; diplomatic correspondence; opinions of national legal advisers; and, the practice of international organizations.”⁴⁶

Conclusions

3.36. Beyond the very specific situations and contexts discussed above, recognition of a responsibility to protect generally speaking as of yet arises in a rather vague manner. This even applies to a certain extent to an obligation to share relevant information on NEO threats, as the necessary point of departure for any NEO response action. Thus, any application to the NEO context of that principle would require considerable elaboration in order to provide guidance on specific obligations to undertake, or contribute to, mitigation activities against NEO threats. Here, analogies with principles found elsewhere in general international law (like the ones referred to stemming from international human rights law, the UN Principles on Remote Sensing and the International Charter on Space and Major Disasters) may be used if some form of legal codification of an obligation to act in defence of the interests of other states and their citizens in the context of NEO threats would be undertaken in order to provide appropriate, generally acknowledged standards, for such obligations.

3.37. At present, the more appropriate and effective approach would be to develop the international decision-making framework called for *inter alia* by the ASE Report along the lines of the UN Charter’s construct for collective action referred to earlier. The powers of the UN Security Council under Chapters VI (on peaceful solution of disputes) and VII (on forceful action) of the UN Charter in principle are certainly

⁴⁴. See Art. IV.5, International Charter on Space and Major Disasters.

⁴⁵. In fact, the Charter has been revised and accepted three times, at least demonstrating its on-going acceptance in general terms by the relevant community.

⁴⁶. J.I. Gabrynowicz, Comments on the Discussion Paper, ‘Space Contribution for Disaster Management: Legal Framework’ with Specific Emphasis on the Disasters Charter, *Proceedings of The Space Law Conference 2006, Asian Cooperation in Space Activities – A Common Approach to Legal Matters*”, Institute and Center for Research of Air and Space Law, Mc Gill University.

broad enough to encompass such a NEO threat-related decision-making framework. That construct may have been developed in the context of the 'traditional' threats to international peace and security, where 'traditional' use of force against a state might be necessary to restore peace and security; it would be rather appropriate – and at the same time politically much less problematic – to extend its scope to threats to mankind's peace, safety and security presented by natural disasters not *ipso facto* harming (an)other state(s), in the present case as stemming from NEOs.⁴⁷

3.38. Establishment of the international decision-making framework along those lines might result in the combination of a legal *right*, even mandate, to act and a political and moral *obligation* to act. Such a combination should be sufficiently strong to guarantee one or more of the key states would indeed act if a relevant NEO threat arises, and, whilst itself currently much more realistic than any straightforward *legal* obligation to act, could also lead to such an obligation arising in the future as a matter of customary international law.

⁴⁷. See also T.R.Saechao, Natural Disasters and the Responsibility to Protect: From Chaos to Clarity, 32 *Brooklyn Journal of International Law* (2007), 663.

4. Specific liabilities for damage

The key question

4.1. The key issue here concerns the existence of specific liabilities for damage that would arise in the context of NEO response activities. Such damage could, in theory, follow from (1) the lack or refusal of distribution of relevant knowledge about asteroid threats (or on the contrary the distribution of incorrect or incomplete information), (2) the absence of appropriate action, (3) actions taken but not being entirely successful, or (4) actions inadvertently resulting in greater damage than would otherwise have been the case; whether such actions are those of individual states or undertaken jointly, perhaps even globally.

Introductory remarks

4.2. The 1972 Liability Convention, while offering a system for dealing with liability for activities in outer space, does not readily apply to the four scenarios outlined above. Firstly, it focuses on damage caused by ‘space objects’, man-made objects launched into outer space.⁴⁸ NEOs as such, clearly, are not ‘space objects’ in the above sense of the word⁴⁹; consequently the Liability Convention would only apply in case a NEO threat mitigation effort involves a space object, for example a ‘gravity tractor’ or ‘kinetic impactor’.⁵⁰ Thus, at most it would concern scenarios (3) and (4).

Liability in the context of information on NEO threats

4.3. For scenario (1) furthermore, a proper liability regime currently would not seem to exist at the international level.⁵¹ The claims by several foreign entities against the US National Oceanic and Atmospheric Administration (NOAA) for failing to issue warnings of the 2004 Indian Ocean tsunami are a case in point, as they failed to establish liability for damage that might have been averted by relevant warnings.⁵²

4.4. As discussed above, at best a basic responsibility in fairly vague and general terms only might exist, as emanating from several clauses in the Outer Space Treaty, the UN Principles on Remote Sensing and the International Charter for Space and Major Disasters as discussed above. It is only a slightly more focused version of the

⁴⁸. See Artt. I(c), II, III, Convention on International Liability for Damage Caused by Space Objects (hereafter Liability Convention), London/Moscow/Washington, done 29 March 1972, entered into force 1 September 1972; 961 UNTS 187; TIAS 7762; 24 UST 2389; UKTS 1974 No. 16; Cmnd. 5068; ATS 1975 No. 5; 10 ILM 965 (1971).

⁴⁹. Rather, they would qualify as ‘celestial bodies’ as that term is used in the space treaties; cf. e.g. Artt. I, II, Outer Space Treaty. See F.G. von der Dunk, Defining Subject Matter Under Space Law: Near Earth Objects Versus Space Objects, *Proceedings of the Fifty-First Colloquium on the Law of Outer Space* (2009); I.H.P. Diederiks-Verschoor & V. Kopal, *An Introduction to Space Law* (2008), 37, citing S. Gorove, *Studies in Space Law: its Challenges and Prospects* (1977), 105, and H.A. Baker, *Space Debris: Legal and Policy Implications* (1989), 62.

⁵⁰. See for more information on these options, e.g. “Near-Earth Object (NEO) Analysis of Transponder Tracking and Gravity Tractor Performance”, September 22, 2008, JPL Task Plan # 82-120022; <http://www.b612foundation.org/press/press.html>.

⁵¹. See e.g. F. Tronchetti, Space Treaties and Disaster Management, *Proceedings of the Fiftieth Colloquium on the Law of Outer Space* (2008), 679.

⁵². Cf. W.C. Nicholson, Legal Issues: Warning Systems, Public Entity Risk Institute (2005); https://www.riskinstitute.org/peri/component/option.com_bookmarks/Itemid,99999999/catid,-1/navstart,0/task_detail/mode,3/id,756/search,l/.

fundamental principle of law that he who is aware of a danger to someone else is basically, and within reasonableness, obliged to share his information with the latter as soon as possible.

4.5. As a general point, responsibility under international law does not automatically give rise to liability for damage: usually a specific international treaty or agreement is drafted specifically arranging for the required details (such as the Liability Convention for space activities). In the absence of such a specific treaty, it becomes very difficult to determine an appropriate standard of reasonableness in terms of how likely the danger is to materialise, how severe the consequences would be, and the lengths to which the one aware of the danger has to go to try and inform those possibly targeted. This is precisely where a specific treaty (on the international level) or law/act/statute (on the national level) has to determine the applicable standard of reasonableness.

4.6. In the case of NEO threats, it should be realised that on the one hand it might be very difficult to estimate the actual risk until very shortly before impact, and that on the other hand so many, partly or even exclusively foreign entities/persons might be threatened that it might be difficult for the one aware of the danger to get the message across to where it should end. That is of course why the focus of the International Charter on Space and Major Disasters has so far very much been on designating appropriate entities for requesting and receiving information, and for undertaking the required (satellite) activities. Consequently, also, in the case of the Indian tsunami the claims against NOAA for failure to warn appropriately did not carry through. For a final legal answer on this issues, however, in the absence of aforementioned international treaties or national laws/acts/statutes, unfortunately the wait might have to be until legal disputes on specific NEO threats would have to be decided upon by courts or tribunals.

4.7. At the same time, not in all cases is a specific treaty required to establish liability for damage in principle. Thus, Article 28 of the ILC Draft Principles on State Responsibility⁵³ states: “The international responsibility of a State which is entailed by an internationally wrongful act (...) involves legal consequences”. Similarly, Article 31(1) provides: “The responsible State is under an obligation to make full reparation for the injury caused by the internationally wrongful act.” Thus, a violation of an international obligation *does* give rise to obligations of *reparation* which often will *include* elements of compensation as a form of liability, unless the parties expressly provide otherwise in any relevant instrument. Finally, an internationally wrongful act, which may include obligations pertaining to liability, at least in the abstract does not have to emanate only from an international treaty.

4.8. Already the Chorzow Factory case-dictum provided that the violation of an international obligation should be repaired, such reparation usually taking the form of compensation in case material damage was suffered – which is essentially what the concept of ‘liability’ under international law refers to.⁵⁴ The *dictum* in this regard

⁵³. See International Law Commission, *Draft Articles on Responsibility of States for Internationally Wrongful Acts*, November 2001, Supplement No. 10 (A/56/10), chp. IV.E.1, at: <http://www.unhcr.org/refworld/docid/3ddb8f804.html>.

⁵⁴. See Case concerning the factory at Chorzów (Merits)(Germany v. Poland), Permanent Court of International Justice, 13 September 1928, P.C.I.J., Ser. A, No. 17. The key statements relevant for the present purpose provide that “it is a principle of international law, and even a greater conception of law, that any breach of an engagement involves an obligation to make reparation”, and that “reparation must,

referred to *restitutio in integrum* as the default standard of compensation, a principle reflected also in the Liability Convention.⁵⁵ On the basis of such general responsibilities, preferably after being specified and codified for the NEO threat response context, it should be possible ultimately also to develop a liability regime for dealing with cases where damage could possibly have been averted or minimised if appropriate sharing of information had taken place.

Liability for the absence of appropriate action

4.9. As for scenario (2), liability for damage that is the result of inaction even more than liability for damage caused by actions requires a precisely formulated and elaborate regime. The former has to provide (in addition to such 'standard' liability parameters as type of liability, burden of proof, level of compensation, exoneration clauses *et cetera*) for precise pointers regarding the extent to which certain actions would or could have been reasonably expected or obliged where these actions were *not* undertaken.

4.10. It does not seem that currently *any* such regime exists in international law, although further research may bring to light the existence of such regimes at least within certain national jurisdictions, and wherever appropriate may analyse them.

Liability in the context of NEO threat mitigation efforts

4.11. Turning back to scenarios (3) and (4), the Liability Convention was drafted with a view to damage caused *by* a space object, usually moreover interpreted as caused *by physical impact of* a space object.⁵⁶ Indirect damage such as effectively resulting from the (physical) damage caused by the primary incident is only addressed in as far as the primary incident concerns a collision between *two* space objects.⁵⁷

4.12. Thus, even for scenarios (3) and (4), presuming they involve space objects the Liability Convention might only apply through a contextual interpretation of the concept of 'damage caused by a space object'.

4.13. Firstly, it could be argued for such a purpose that the limitation, as generally perceived to exist, of that concept to *direct* damage⁵⁸ follows from the need to take into account the possibility of other factors contributing to a case of damage further

as far as possible, wipe out all the consequences of the illegal act and re-establish the situation which would, in all probability, have existed if that act had not occurred", pp. 29 resp. 47-8. See further e.g. M.N. Shaw, *International Law* (6th ed.)(2008), 800-8, esp. 801; I. Brownlie, *Principles of Public International Law* (7th ed.)(2008), 434-40, esp. 435;

⁵⁵. Cf. Art. XII, Liability Convention.

⁵⁶. Cf. Art. I, Liability Convention. See e.g. C.B. Bourne, 10 *Canadian Yearbook of International Law* (1972), 155; C.Q. Christol, International Liability for Damage Caused by Space Objects, 74 *American Journal of International Law* (1980), 355; extensively B.A. Hurwitz, *State Liability for Outer Space Activities* (1992), 12-9, arriving at the tentative conclusion there is no agreement amongst the experts on this at 15. So also P.L. Meredith & G.S. Robinson, *Space Law – A Case Study for the Practitioner* (1992), 62-4; R. Bender, *Space Transport Liability* (1995), 300-3; B. Cheng, International Liability for Damage caused by Space Objects, in N. Jasentuliyana & R.S.K. Lee (Eds.), *Manual on Space Law*, Vol. I (1979), 87, 97-8.

⁵⁷. Cf. Art. IV, Liability Convention; also Art. I(a), defining 'damage' for the purposes of the Convention. See further e.g. Diederiks-Verschoor & Kopal, 37.

⁵⁸. Art. I(a), Liability Convention, defines compensable damage as "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".

down the chain of causation, where other human or legal entities may be involved.⁵⁹ Whatever happens to a NEO or its fragments after being confronted with a NEO threat response mission, essentially still only the operators of that mission could be legally blamed for any damage potentially caused by such a NEO or its fragments; the line of causality is still singular and undiluted. Thus, it might be argued that in the case of a space object confronting a NEO and that NEO as a result causing damage to third states, such damage should still be viewed as 'damage caused by that space object', leading to liability of the launching state(s) of the NEO response mission.

4.14. Secondly, a relevant analogy would be offered by Article IV of the Liability Convention, as it deals with a collision in space between two space objects and damage caused as a consequence to a third party, whether on earth or in outer space. The clause itself stipulates that the fault for the primary collision in space also determines the relative liability of the launching states of the respective space objects for damage caused to such a third party.⁶⁰ Analogous interpretation of a collision between one space object and one NEO would lead to 'fault liability' of the space object for the primary collision (since obviously the NEO cannot be legally put at fault), hence the launching state(s) of the NEO response mission would become liable for the secondary damage caused on earth as well.

4.15. Whilst such arguments may seem to stretch the ordinary meaning of the clauses concerned considerably, the net result of such an 'ordinary meaning' currently is a level of uncertainty about possible application, applicability or invocation of the Liability Convention that is not conducive to transparent and efficient decision-making and action-taking in the case of a serious NEO threat materialising.

The Liability Convention and liability in the NEO threat mitigation context

4.16. Finally, as far as the Liability Convention is concerned, there is the overarching question of whether interpretations, which might result in liability for the party undertaking a NEO threat mitigation mission, would do justice to the general understanding that such mission would presumably be undertaken in an effort to save mankind (or parts thereof) from an impact. In other words, these clauses would no longer represent an effort to curb irresponsible behaviour in outer space but by contrast might punish a *bona fide* effort at responsible behaviour, which is obviously not intended by the Convention.

4.17. The gradual recognition of a 'responsibility to protect' as well as the general requirements under the Outer Space Treaty of mutual assistance and the avoidance of adverse changes to the earth's environment further underpin the conclusion that the Liability Convention should not apply, at least not as it currently stands, to such NEO-specific scenarios.

4.18. In sum, the Liability Convention currently falls considerably short of being able to handle all issues relevant in a NEO response context in an appropriate and fair manner – if at all. This conclusion leads to the desirability of investigating other potentially relevant liability regimes.

⁵⁹. E.g., Art. VI(1), Liability Convention, allows for exoneration from absolute liability for damage caused on earth to the extent the claimant state has acted in gross negligence or with the intent to cause damage.

⁶⁰. See Art. IV(1), (2), Liability Convention.

The International Charter and liability

4.19. In developing a proper regime for the NEO response context reference should therefore also be had to the International Charter for Space and Major Disasters and its handling of liability. Whilst the International Charter was developed with a view to disasters whose cause was essentially terrestrial, there is no reason whatsoever for excluding terrestrial disasters caused by extraterrestrial NEOs from its scope of application.

4.20. In terms of liability, the Charter provides on this issue that “associated bodies which, at the request of the country or countries affected by a disaster, call on the assistance of the parties undertake to (...) confirm that no legal action will be taken against the parties in the event of bodily injury, damage or financial loss arising from the execution or non-execution of activities, services or supplies arising out of the Charter”.⁶¹ ‘Associated bodies’ comprise the “rescue and civil protection, defence and security bodies or other services” which are to be called upon in cases of relevant emergencies or disasters and will in turn address the relevant space agencies for potentially helpful satellite data and information.⁶²

4.21. The general disclaimer of liability on the side of the parties providing the satellite data and information may serve as a baseline for dealing with liabilities in the context of NEO threat mitigation as well, extending such a ‘unilateral’ disclaimer relative to the provision of data and information to a general waiver in the latter context.

Tort liability and the ‘Good Samaritan’ principle

4.22. Considering that no other international liability regime would have any direct and comprehensive bearing upon the four scenarios outlined above (other than as discussed in the previous chapter as a consequence of general responsibilities to protect), this brings the analysis to the national level. In a number of cases, under domestic law limitations to tort liability and the ‘Good Samaritan’ principle could be invoked to solve similar issues of liability for damage as a consequence of unsuccessful mitigation of impending disasters.

4.23. Clearly more research and analysis would be necessary for a complete overview of the divergent ways in which within various national legal systems those principles have been given shape, although the general approach is clear. The key issue here is whether relevant national legal principles will have reached the level of “general principles of law recognised by civilised nations” under Article 38(1) of the Statute of the ICJ, so as to constitute international law. At the highest level of abstraction of tort liability, this would be true in that accountability for damage caused by one’s reckless or wilful misconduct, subject to certain standards of conduct and proof, in one form or another will be found in any developed legal system. This would also apply next to a general acceptability of the exclusion of a certain measure of otherwise applicable liability in case the liable person caused the harm at issue in a context of actually coming to the rescue of the person harmed.

⁶¹. Art. 5(4), International Charter for Space and Major Disasters.

⁶². Art. 1, International Charter for Space and Major Disasters; see further Artt. 3(4), 5.

4.24. Normally, in national jurisdictions ‘tort liability’ or similar concepts⁶³ are used to impose obligations to compensate damage to third parties which has resulted from the actions (or inaction where action would have been required) of a defendant.⁶⁴ The relevant domestic legal systems in each case determine the parameters of such liabilities; for example whether it is absolute, strict or fault-based, whether the compensation would be subject to certain limits, or what possibilities the defendant would have to be partially or wholly exonerated from its liability.

4.25. Since in principle this would also apply to cases where the defendant would have caused the damage whilst actually trying to prevent it or at least mitigate it, many domestic legal systems (along with some international arrangements⁶⁵) also allow for the application of a version of the ‘Good Samaritan’ principle.⁶⁶ The essence of this principle is that a person who injures another in imminent danger while attempting to aid him (as long as not under an obligation to do so) is not to be charged with contributory negligence and/or liabilities unless the rescue attempt is an unreasonable one or the rescuer acts unreasonably in performing the attempted rescue. Its purpose is to prevent people from being unduly reluctant to help a stranger in need, for fear of legal repercussions should they make some mistake in doing so.

4.26. The ‘Good Samaritan’ principle has been used widely in different jurisdictions throughout the world, albeit with major differences in implementation and application. In Canada and the United States for instance it is incorporated by means of specific acts, whilst in contrast to the US legal system there is no generally accepted concept of ‘gross negligence’ under Australian tort law. The principle is also reflected in different national laws of European states. If the rescuer has actually worsened the condition of the imperilled person many techniques are available to assess the rescuer’s conduct: from mitigation of damages in Dutch law to the presumption of a low standard of care in French and English law. Since the ‘Good Samaritan’ principle is incorporated into the domestic law of many states, in these broad general terms it should be considered to reflect customary international law as of now.

Conclusions

4.27. The considerable variety in application of tort liability-concepts and versions of the ‘Good Samaritan’ principle allowing for waivers of liability in appropriate cases, as set against the global character of most relevant NEO threats and the need to respond to them at a principally global level, however, would still make application of either concept at the international level rather complicated, if not impossible without further ado. In consequence, codification by means of some treaty-version of the principle for this purpose would be recommended.

⁶³ E.g., in many jurisdictions principles of ‘tort’ are referred to as ‘third-party liability’ or ‘non-contractual liability’.

⁶⁴ See e.g. K.P. Healy & G.T. Trotter, *Criminal law and procedure: cases and materials* (9th ed.), 299-315.

⁶⁵ See e.g. R.M.R.B., Nawinne, The Principles of State Responsibility and Humanitarian Assistance in the Context of Disaster Management, *Proceedings of the Fiftieth Colloquium on the Law of Outer Space* (2008), 742.

⁶⁶ Cf. e.g. Virginia, “Good Samaritan” Law, Chapter 493 Section 8.01-225, Code of Virginia, Approved April 9, 2000 (“Persons Rendering Emergency Care, Obstetrical Services Exempt From Liability”); <http://www.arlingtonva.us/Departments/EmergencyManagement/pdf/goodsam00.vaoems.pdf>.

4.28. To that end, further research might be able to provide a common denominator in those concepts. This might be particularly helpful in the context of drafting an alternative to the current regime of the Liability Convention as applicable under the most acceptable interpretation, even if by way of a protocol to the Liability Convention which would take into account the specific NEO threat mitigation context as described above, as one interesting possible solution on this issue.

4.29. Such a new liability framework specifically designed for dealing with NEO issues, where necessary and appropriate deviating from the default application of the Liability Convention, may make use to a certain extent of the International Charter as a model, for example regarding the way the latter deals with who would be authorised to activate a response. Also, it would logically take the approach of waiving international liability for damage caused by, or in the course of a *bona fide* effort at NEO threat mitigation along the lines of the 'Good Samaritan' principle.

4.30. Finally, development of such a regime should be given high priority in the context of the development of a global framework for decision-making in the context of NEO threats and required mitigation efforts. Liability issues are evidently amongst the most immediate concerns in any potentially risky undertaking.

5. The use of physical force, possibly even nuclear devices, in outer space

The key questions

5.1. There are specific legal issues involved when NEO response efforts would require the use of physical force in outer space (e.g. through ‘kinetic impactors’), in view of the general prohibition on the use of force under international law and the general impossibility of building a device which is *only* capable of exercising force against a NEO and *not* against another space object, or indeed against a target on earth. After all, “targeting an asteroid involves many of the same technical issues as targeting a satellite”.⁶⁷

5.2. A specific situation would furthermore arise where the possibility of the use of nuclear devices, an option in any event to be contemplated only as a last-resort measure where mankind is confronted with too short a time for action and too large a NEO for any other option, would be contemplated.

Introductory remarks

5.3. The starting point for any analysis of the current status of international law regarding the use of force in outer space, including the special case of nuclear force, would be the Outer Space Treaty, the UN Charter, the Test Ban Treaties and the Nuclear Power Source Principles.

5.4. The Outer Space Treaty only prohibits the orbiting and stationing of weapons of mass-destruction in outer space.⁶⁸ The concept of ‘weapons of mass-destruction’ is usually defined with reference to the general international law definition, as comprising nuclear, biological and chemical weapons, with radiological weapons occasionally included.⁶⁹ However, for example in US domestic law the concept of ‘weapons of mass destruction’ is generally interpreted much more broadly, as “(A) any destructive device as defined in section 921 of this title; (B) any weapon that is designed or intended to cause death or serious bodily injury through the release, dissemination, or impact of toxic or poisonous chemicals, or their precursors; (C) any weapon involving a biological agent, toxin, or vector (as those terms are defined in section 178 of this title); or (D) any weapon that is designed to release radiation or radioactivity at a level dangerous to human life”.⁷⁰

⁶⁷. J. Johnson-Freese, *The Viability Of U.S. Antisatellite Policy: Moving Toward Space Control*, USAF Academy, CO: USAF Institute for National Security Studies, January 2000, 21; see also J.C. Kunich, *Planetary Defense: The Legality of Global Survival*, 41 *Air Force Law Review* (1997), 119-60.

⁶⁸. See Art. IV, 1st para., Outer Space Treaty.

⁶⁹. See e.g. D.P. Fidler, *Weapons of Mass Destruction and International Law*, *ASIL Insights*, February 2003; <http://www.asil.org/insigh97.cfm>.

⁷⁰. 18 U.S.C. 2332a(2), where section 921 defines ‘destructive device’ equally broadly as “(A) any explosive, incendiary, or poison gas—(i) bomb, (ii) grenade, (iii) rocket having a propellant charge of more than four ounces, (iv) missile having an explosive or incendiary charge of more than one-quarter ounce, (v) mine, or (vi) device similar to any of the devices described in the preceding clauses; (B) any type of weapon (other than a shotgun or a shotgun shell which the Attorney General finds is generally recognized as particularly suitable for sporting purposes) by whatever name known which will, or which may be readily converted to, expel a projectile by the action of an explosive or other propellant, and which has any barrel with a bore of more than one-half inch in diameter; and (C) any combination of parts either designed or intended for use in converting any device into any destructive device described

The right to use conventional force against NEOs

5.5. By inference from the clauses of Article IV of the Outer Space Treaty the mere stationing of a non-nuclear device *capable* of using force against a NEO as much as against a satellite or a target on earth is not prohibited under that treaty.

5.6. That right, obviously helpful in the context of any scenarios to deploy kinetic impactors against NEOs, at the same time does not imply the right to *use* such devices at will. For example, the use thereof against the sovereignty or territorial integrity of another state would normally be in violation of the baseline obligation to refrain from the use of force against other states.⁷¹

5.7. On the other hand, apart from the fact that even on earth (read against another state) the use of force may be sanctioned as self-defence or even called for in limited cases as for example mandated by the United Nations, the use of force against NEOs would in principle be outside of this general prohibition. Consequently, there does not seem to be any principled legal obstacle to using physical force against a threatening NEO (unless the action could be argued to aim at using the NEO itself to threaten in turn another state, which however technically and operationally speaking would be a very unrealistic scenario).

5.8. It should be noted, however, that current proposals for treaties banning conventional weapons from outer space might pose a serious barrier to such a possibility. The general difficulties to distinguish, in a technical and operational sense, between, on the one hand, space 'weapons' "specially produced or converted to eliminate, damage or disrupt normal function of objects in outer space, on the Earth or in its air, as well as to eliminate population, components of biosphere critical to human existence or inflict damage to them"⁷² and capable of being used against 'terrestrial' targets and, on the other hand, space devices to be used against NEOs may lead to an outcome effectively prohibiting such devices, or at least their stationing or orbiting, in outer space. Operational threat control concepts other than that of 'weapons' might need to be explored in the light of the above developments, if necessary to preclude such a potentially stifling effect.

The prohibitions on the use of 'weapons of mass-destruction'

5.9. As regards nuclear devices the legal situation is more complicated. As stated, Article IV effectively prohibits the orbiting or stationing in outer space of any nuclear weapons. Noting that it would likely be impossible to distinguish between a nuclear *weapon* and a nuclear *device* able to *only* counter a NEO threat, this would still leave the door open to *launching* a nuclear weapon into outer space the moment a threat materialises.

5.10. However, in such cases the Test Ban Treaties come into play, as both the Partial and the Comprehensive Test Ban Treaty in principle ban *any* nuclear explosion in outer space.⁷³ At the same time, arguments could be put forward that

in subparagraph (A) or (B) and from which a destructive device may be readily assembled" (18 U.S.C. 921(4)).

⁷¹. Cf. already Art. 2(4), UN Charter.

⁷². Art. I(c), Draft Treaty on the Prevention of the Placement of Weapons in Outer Space, the Threat or Use of Force Against Outer Space Objects; presented 12 February 2008 to the Conference on Disarmament; e.g. <http://www.reachingcriticalwill.org/legal/paros/parosindex.html>.

⁷³. See Art. I(1.a), Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water (hereafter Partial Test Ban Treaty), Moscow, done 5 August 1963, entered into force 10 October

both treaties, clearly not intended to preclude any state from using nuclear weapons if really and unequivocally necessary in the defence of mankind, should not be interpreted in such a fashion, as that would lead “to a result which is manifestly absurd or unreasonable”.⁷⁴

5.11. Furthermore, it should be noted that both treaties allow for relevant states to withdraw from the treaty in case of supreme interests of national security being at issue.⁷⁵ Such withdrawal does require a period of three respectively six months before legally taking effect, which does not make it directly useful in the present context since presumably the use of a nuclear explosion to counter a NEO threat is a last-minute resort, hence decided at best weeks if not days in advance of the action itself.

5.12. Yet, following the argument of the ‘manifest absurdity’ of sticking to a literal interpretation of the obligation if the aim of the nuclear explosion is to save mankind, it could be argued that a temporary withdrawal on immediate notice only for such a purpose should be allowed. If this is not to be achieved by means of a liberal interpretation, as possibly inviting abuse, then it should be effectuated by means of an additional clear-cut provision or ‘common understanding’ in order to take away any potential doubt on the side of a state contemplating nuclear action against a NEO.

5.13. Furthermore, reference should be made to the Legality of the Threat or Use of Nuclear Weapons Advisory Opinion of 1996, when the ICJ responded to a question by the UN General Assembly – “Is the threat or use of nuclear weapons in any circumstances permitted under international law?” – with a split decision. On the one hand: “There is in neither customary nor conventional international law any comprehensive and universal prohibition of the threat or use of nuclear weapons as such”, but on the other hand “the threat or use of nuclear weapons would generally be contrary to the rules of international law applicable in armed conflict, and in particular the principles and rules of humanitarian law. However, in view of the current state of international law, and of the elements of fact at its disposal, the Court cannot conclude definitively whether the threat or use of nuclear weapons would be lawful or unlawful in an extreme circumstance of self-defense, in which the very survival of a State would be at stake”.⁷⁶

5.14. Whilst it may be debated whether that *dictum* would also have been handed down had the Advisory Opinion been requested today, this has so far never been put to the test. Therefore, noting the special character of the use of a nuclear device against a NEO threat as lacking the principled threat against *another* state’s survival that would result in a non-NEO context (and on the contrary, perhaps *contributing* to

1963; 480 UNTS 43; TIAS 5433; 14 UST 1313; UKTS 1964 No. 3; ATS 1963 No. 26; resp. Art. I(1), Comprehensive Test Ban Treaty, New York, done 24 September 1996, not yet entered into force. See further e.g. D.S. Jonas, The Comprehensive Nuclear Test Ban Treaty: Current Legal Status in the United States and the Implications of a Nuclear Test Explosion, 39 *Journal of International Law and Politics* (2007), esp. 1008-19, 1029-40.

⁷⁴. Means of interpretation of a treaty clause which are supplementary to terms, object, purpose and context of the treaty are allowed in case application of the latter leads “to a result which is manifestly absurd or unreasonable”; Art. 32, Vienna Convention on the Law of Treaties.

⁷⁵. See Art. IV, Partial Test Ban Treaty; resp. Art. IX, Comprehensive Test Ban Treaty.

⁷⁶. See Legality of the Threat or Use of Nuclear Weapons, Advisory Opinion, I.C.J. Reports 1996, p. 226 (July 8).

such survival!), seems to offer an argument for the basic legality of using nuclear force in case of a relevant NEO threat arising.

5.15. Finally, guidance might arise from the perspective of the Nuclear Power Source (NPS) Principles, dealing with the use of NPSs in space for non-propulsive purposes.⁷⁷ As the Principles address launching NPSs from earth, they may not be exactly on point, but they are the most detailed of all UN Declarations of Principles. For example, they address the relationship between the degree of accident probability and required action. Also, the Principles were in part the result of an actual event – the Cosmos 954 fragmentation and dispersal over Canada in 1978 – and thus may offer clues worthy of further research with a view to handling nuclear explosions in outer space.

Conclusions

5.16. In sum: in light of the above, whilst existing international rules on these issues implicitly or explicitly allow for the use of conventional force as part of a relevant NEO response action, further parameters should be developed for such use of force. This is certainly the case for the use of *nuclear* force, not permitted as such under international law – at least under standard textual interpretations. If such use of nuclear force is to be permitted, in a last-resort effort to save mankind and the earth, it is adamant that at the very least a proper international decision-making framework providing for a set of fundamental parameters be developed.

⁷⁷. Principles Relevant to the Use of Nuclear Power Sources in Outer Space, UNGA Res. 47/68, of 14 December 1992; UN Doc. A/AC.105/572/Rev.1, at 47.

6. The institutional structure

The key question

6.1. Whilst it is not part of the remit of the Research Project to discuss in all relevant details the possibilities for and ramifications of an international framework for decision-making in the case of a NEO threat, a key question to be tackled concerns the extent to which an institutional structure ultimately established could limit or distribute the responsibilities and liabilities of individual states.

6.2. It might be rather illustrative here to take note of international efforts to address other major 'threats' – for example, the threats posed by climate change. In that context, the world is attempting to put into place a workable and efficient institutional structure and attendant rules to deal with the problems at stake. Of course, it is not clear whether or not this will ultimately be successful (or even if the underlying framework will meet with the agreement of states) – yet it would be interesting to at least gauge what lessons the NEO threat mitigation approach discussion could learn from those other international efforts and why (or why not) those examples might be useful 'models' to follow in the case of threats posed by NEOs.

The UN decision-making framework in general terms

6.3. The construct of the United Nations, where the Security Council is mandated by the international community as a whole (as also and in particular comprising the General Assembly) to take action against aggressors,⁷⁸ may be very illustrative here. In case the Security Council has concluded that a threat to or major breach of international peace and security exists, under the UN Charter it is entitled to mandate its member states, and arguably even impose a general duty upon them, to act to counter such threat or breach.⁷⁹

6.4. Though no reference is made by the Charter to issues concerning the possible damage that would be caused by any such actions, it is to be presumed that at the very least the damage inflicted upon the state(s) against whom the actions are mandated could not give rise to liability claims by the latter against the former, at least as long as the actions remain within the terms of the relevant UN mandate.⁸⁰

6.5. The Security Council itself, though only comprising fifteen of the almost two hundred UN member states, is generally operating in such capacity on behalf of all member states, as codified by the Charter itself as well as further implementation guidelines. In many cases, moreover, a first impetus to Security Council discussion and action is given by UN General Assembly action,⁸¹ the General Assembly indeed comprising all UN member states.

⁷⁸. See e.g. UN GA 2005 World Summit Outcome, 15 September 2005, UN Doc. A/60/L.1, 79-80.

⁷⁹. Cf. again Artt. 2(2), 2(5), 24, 25, 39-43, 48, UN Charter; also UNSC Res. 1373 (2001), of 28 September 2001; UN Doc. S/RES/1373 (2001); <http://www.unhcr.org/refworld/docid/3c4e94552a.html>.

⁸⁰. Art. 43, UN Charter, makes reference to special agreements to be concluded in case of mandated or mandatory use of armed force in the context of threats to or breaches of international peace and security; such agreements might well include a reference to liability issues. Validation of that assumption, however, would require further research.

⁸¹. See e.g. Artt. 10-11, UN Charter, under which the General Assembly may call the attention of the Security Council to situations which are likely to endanger international peace and security.

6.6. In one particular case, as discussed before the General Assembly may even represent a venue alternative to the Security Council for taking action, namely after the latter fails to act: here, a “possible alternative, is to seek support for military action from the General Assembly meeting in an Emergency Special Session under the established “Uniting for Peace” procedures. These were developed in 1950 specifically to address the situation where the Security Council, because of lack of unanimity of the permanent members, fails to exercise its primary responsibility for the maintenance of international peace and security. Since speed will often be of the essence, it is provided that an Emergency Special Session must not only be convened within 24 hours of the request being made, but must also, under Rule of Procedure 65 of the General Assembly, ‘convene in plenary session only and proceed directly to consider the item proposed for consideration in the request for the holding of the session, without previous reference to the General Committee or to any other Committee.’”⁸²

The UN framework as blueprint for global NEO threat mitigation efforts

6.7. If an international framework for decision-making in the case of a generally recognised need to take action to respond to a NEO threat should be established, this UN construct might provide an interesting pointer. The mandate given to the Security Council to act, often strengthened and/or detailed by political action in the General Assembly, means that a handful of states, including in particular the veto-holders, effectively will decide on the action against the state(s) responsible for a threat to or breach of international peace and security. In practice, moreover, the result will be individual or multilateral action by sovereign states acting within the confines of the mandate but otherwise making their own decisions as to how to apply force. Clear-cut cases are offered by the military actions of the US-led coalitions against Iraq after its invasion of Kuwait and against Afghanistan after the 9/11 attacks.

6.8. Likewise in the case of NEOs, reality dictates that only a handful of states would actually be able to undertake activities in response to a NEO threat with a major chance of success (and in case of nuclear response, the group is even smaller). These states might resent detailed interference with an actual mitigation campaign, and more likely still might not accept being ordered to act by an international body, even if it would be a Security Council of which they themselves might be members. There is a clear tension here between general juridico-political realities requiring arriving at binding solutions by majority voting and practical-political realities dictating respect for the individual sovereignty of states capable of mitigation campaigns, which could be solved using the UN construct, either as such or as a model.

6.9. In addition, it might be clarified that, *if* such a mitigation campaign is not completely undertaken at a state’s own sovereign discretion but within a mandate established by a concurrence of General Assembly and Security Council actions, certain arrangements to be developed would enter into force on sharing the cost of the campaign with other member states as well as on waiving any liability for damage which might (still) result as a consequence of, or in spite of, the mitigation effort. (One additional option would be to establish at some time in the further future an

⁸². “The Responsibility to Protect”, § 6.29.

international NEO damage and mitigation fund to deal with relevant cases of damage.)

6.10. If by contrast a state undertakes a NEO mitigation campaign on its own volition and/or not in conformity with such a mandate from the global community, under such a regime to be developed it would be held fully liable for any damage that results as a consequence of its mitigation effort.

6.11. Finally, an institutional framework for such purposes might also, along the lines of the International Charter for Space and Major Disasters, appoint or point out a 'stand-alone response entity' within relevant states empowered to respond in the event of an objectively, in accordance with predetermined criteria, defined NEO threat existence.

6.12. Such clarifications might go a long way in ensuring that those states capable of undertaking a campaign would be willing to act if called upon by international mandate and in acting remain within the parameters of such a mandate, *and* that the other states would be willing to accept the inherent measure of discretion in the conduct of specific NEO threat mitigation missions.

6.13. The main – but very important – *caveat* to be made with regard to the above analysis is that the actual composition of the UN Security Council does not properly reflect the situation in terms of space capabilities. The states capable of launching NEO response missions (even if perhaps only some categories of response missions), are not identical to the member states, or even the permanent member states, of the Security Council. Thus, in the last resort an entity somehow similar to the Security Council in role and relationship towards the other member states as represented in the General Assembly, but composed of those NEO-response capable states (which moreover should likely include the European Space Agency (ESA)) might have to be established to fully allow the UN model to work in this particular environment.

Conclusions

6.14. Without prejudicing the outcome of any international discussions on the establishment of an international framework for decision-making, it seems that both the UN General Assembly and the UN Security Council would have to play a role in this context, generally comparable to their respective roles in the context of threats against international peace and security in the classical sense. At the same time, the specifics of space activity and NEO response in particular should, at least ultimately, lead to a Security Council-like body much more congruent with the community of the main spacefaring nations, which should probably consult and cooperate with the Security Council on all aspects which may threaten international peace and security in a more classical vein, and could well refer to the General Assembly as the main representative of those states without mature NEO response capabilities.

6.15. Ideally, therefore, the general parameters for such decision-making should be outlined by a UN General Assembly Resolution, basing itself fundamentally on the contributions of UNCOPUOS on this issue and learning the lessons from the climate change process up to what many have described as a failure in Copenhagen, whilst specific NEO threats might then be subject to more detailed and focused Resolutions by a Security Council-like body providing for the necessary mandate and guidance for the NEO response efforts themselves in a particular NEO threat-related event.

6.16. Such a baseline approach should both allow for long-term planning and coordination and for (sometimes urgent) action in case of a concrete case. It would also allow coordination with other UN agencies which may need to be involved in global disasters, such as the UNCHR.

6.17. In case the United Nations is *not* to be charged with such a role in the NEO threat mitigation context, the structure to be chosen, elaborated or established should at least in general terms mirror the UN construct, in particular as regards the relationship between the Security Council and the General Assembly with reference to tackling threats to international peace and security, whilst keeping in mind the different constituency of the Security Council respectively the NEO-response capable community.

7. The proper role of commercial, including private, activities

The key question

7.1. The last cluster of legal issues to be analysed here concerns the proper role of commercial activities in such endeavours, and the legal parameters for and consequences of such a role.⁸³ Under no circumstance should commercial interests, whether private, governmental, or of yet another nature, be allowed to lead to deviations from the main goals of NEO threat response actions. In particular with commercial activities conducted by private entities, this raises key issues such as state responsibility and state liability for those activities which should be guiding the development of any legal framework on the issue.

7.2. At a second level, therefore, the legal differences between public and private parties should be taken into consideration. For example, sovereign immunity issues could affect the former but not the latter. Any role of private enterprise in particular should be limited by the understanding that NEO response actions should be first and foremost a public, (inter)governmental affair. Thus, much will depend upon the role that a commercial and/or private entity will play, leading to different legal ramifications: as subcontractor to a state manufacturing hardware or providing a service, as partner in a public-private partnership, or as a stand-alone profit-generating venture.

7.3. Cost being a major aspect of any space activity including NEO mitigation campaigns, interesting opportunities may exist to draw commercial interests into contributing to NEO threat mitigation in all cases short of a nuclear explosion (which should explicitly be considered a last-resort option in any event). Such opportunities might arise if missions using technologies like a 'gravity tractor' or 'kinetic impactor' would yield valuable mineral or energy resources.

7.4. If such an approach of trying to defray costs by getting commercial interests to join relevant efforts is to be effective, obviously the *bona fide* interests of private operators as the most common type of commercial players have to be taken into consideration, if not indeed positively supported and underpinned by legal arrangements as much as necessary and possible.

Towards a legal regime for commercial exploitation of outer space?

7.5. In particular in this context of mineral and energy resources, international space law has now started to grapple with the ongoing entry into outer space of commercial actors including in particular private ones.⁸⁴ Whilst in general terms

⁸³. It should be pointed out that this report uses the term 'commercial' as referring to 'activities by governments, private entities or entities of any other nature that are intended to generate revenue, whether for profit, cost recovery, or any other purpose'. For some states likely participating in NEO response activities, 'commercial' includes government, as well as private, activities. Hence, the application of this term is not limited strictly to private entities, even if those are the ones most commonly involved in commercial activities, as well as raising the most specific issues from the perspective of international law in view of state responsibility and state liability for their activities. See e.g. F.G. von der Dunk, *The Moon Agreement and the Prospect of Commercial Exploitation of Lunar Resources*, 32 *Annals of Air and Space Law* (2007), 93.

⁸⁴. See e.g. D.J. O'Donnell, *A New Institution is Proposed to Manage Space Resources: The Metanation in Space*, *Proceedings of the Forty-First Colloquium on the Law of Outer Space* (1999), 28-9; J. Clayton-Townsend, *Property Rights and Future Space Commercialization*, *Proceedings of the Forty-Second Colloquium on the Law of Outer Space* (2000), 159.

especially private involvement is to be regulated by means of national space laws and licensing systems properly fitting private actors and their activities into the international framework,⁸⁵ in the context of such celestial bodies as NEOs a more specific issue has arisen already on the international level.

7.6. This concerns the so-called possibility to obtain private ownership or property rights over (parts of) celestial bodies, which is asserted by some private parties to be a necessary prerequisite for providing them with the legal certainty allowing them to make the investments necessary to go to such celestial bodies and start their exploitation activities.⁸⁶ It should be clear, that at least under the current legal regime, in particular as provided by Article II of the Outer Space Treaty, such private appropriation is not possible.⁸⁷ It is suggested by some that allowing private appropriation would be the largest single legal factor able to draw private investments into outer space, including cases of NEO investigation, determination and exploitation as possibly contributing to taking away any danger such a NEO may pose.

7.7. If, however, the rationale for governments to engage non-governmental commercial entities is to defray costs for governments, such a rationale has yet to be demonstrated in the existing space industry. Around the world, an overwhelming part of the space industry is heavily dependent upon government subsidies in some form or other. The speculative, dangerous, and difficult prospect of NEO exploitation seems to be an even lesser attractive investment sector for private enterprise, unless private expertise, capital, flexibility and innovation would be directly harnessed by governments which remain fully responsible for, as well as in full control of the actual NEO missions.

7.8. Whatever the merits might be of enticing any entities for commercial motives to join a NEO response-related activity, it should be clear that any NEO response will be a fundamentally humanitarian act rescuing humanity from a catastrophic disaster, and it has to be pointed out that, so far, no humanitarian rescue scenario has ever involved private claims even to *in situ* resources. In the long legal history of rescue in a global commons, there is nothing analogous. The execution of a rescue on the high seas renders no property right in the *in situ* water, fish, or other resources at the rescue site. The execution of a rescue pursuant to the Rescue Agreement renders no property right in the *in situ* space resources at the rescue site, and applying such a

⁸⁵. Essentially further to Art. VI, Outer Space Treaty: "States (...) shall bear international responsibility for national activities in outer space", and "activities of non-governmental entities (...) shall require authorization and continuing supervision by the appropriate State Party". See further e.g. M. Gerhard, Article VI, in S. Hobe, B. Schmidt-Tedd & K.U. Schrogl (Eds.), *Cologne Commentary on Space Law – Vol. I: Outer Space Treaty* (2009), 114, 117-22; E. Back-Impallomeni, Article VI of the Outer Space Treaty, in *United Nations Treaties on Outer Space: Actions at the National Level, Proceedings United Nations/Republic of Korea Workshop on Space Law* (2004), 75; F.G. von der Dunk, *Private Enterprise and Public Interest in the European 'Spaceescape'* (1998), 17-22, 48-51.

⁸⁶. See e.g. H.R. Hertzfeld & F.G. von der Dunk, Bringing Space Law into the Commercial World: Property Rights without Sovereignty, 6 *Chicago Journal of International Law* (2005), 81-99.

⁸⁷. Art. II, Outer Space Treaty, prohibits "national appropriation" by any means; this can only lead to the conclusion that also private appropriation under international law is not possible; see Statement of the Board of Directors of the International Institute of Space Law (IISL), of 22 March 2009, at http://www.iislweb.org/html/20090322_news.html; also F.G. von der Dunk, E. Back-Impallomeni, S. Hobe & R.M. Ramirez de Arellano, Surreal estate: addressing the issue of 'Immovable Property Rights on the Moon', 20 *Space Policy* (2004), 149-56.

concept to NEO response would be a legal novelty at least to be further studied thoroughly before allowing it to become international law.

7.9. Yet, by way of a futuristic example, the opportunities to use ‘intercept-orbit’ missions both for deflection and for ‘consumption’ purposes were discussed at the UNL Conference of April 2009. For such scenarios, a baseline approach to liability issues might be developed where lack of a capability to intercept would imply lack of liability, whereas a capability to do so would imply liabilities for any damage that would result, setting off collateral damage as a consequence of action against damage as a consequence of inaction in case of proven capabilities. Under such an approach, it might even be appropriate in some cases to pay entrepreneurs to eliminate a NEO threat, whilst monitoring such activities in order to make sure the overriding purpose of eliminating or minimising the threat posed by the NEO is not interfered with.

7.10. Such an approach, if adopted, again reverts back to the possibility to offer commercial entities interesting incentives and opportunities with regard to the resources certain NEOs may hold. If ownership of complete celestial bodies as of yet is legally out of the question, in the case of small NEOs ownership of resources after, at the very least, a transponder has been delivered nearby, for purposes of generating wealth by ‘destroying’ at the same time the NEO properly speaking, might present an option in this respect.

7.11. It is interesting to note from this perspective, that the Moon Agreement, drafted essentially to allow exploitation of natural resources of the moon and other celestial bodies only within the framework of a regime under a heading of ‘common heritage of mankind’, “does not apply to extraterrestrial *materials* which reach the surface of the earth by natural means”.⁸⁸ This phrase suggests both that celestial bodies below a certain size would qualify merely as ‘materials’ rather than as full-blown ‘celestial bodies’, and that the provisions regarding the ‘common heritage of mankind’, often perceived to considerably constrain or even completely rule out private commercial exploitation, are not applicable to such small-size celestial bodies.

7.12. In any case, missions to NEOs for the purpose of, for example, exploration, investigation, determination or even response as long as not resulting in the total destruction of the NEO at issue, will start to be undertaken, even if presumably for the short and mid-term on a purely governmental basis. Once that happens, it seems inevitable that, expensive as such missions are, the potential commercial value of the targeted NEO will raise the fundamental need for a regime allowing commercial exploitation within clearly demarcated parameters.

Conclusions

7.13. To the extent that – and *only* to the extent that – commercial interests, in particular those of private enterprise, may play a beneficial and contributory role to NEO threat mitigation activities, their proper interests and rights, likely focused on the exploitation of resources of NEOs, should be at the least taken into account and

⁸⁸. Art. 1(3), Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (hereafter Moon Agreement), New York, done 18 December 1979, entered into force 11 July 1984; 1363 UNTS 3; ATS 1986 No. 14; 18 ILM 1434 (1979); emphasis added. See further Preamble, Artt. 11, 14.

perhaps formally be incorporated in the legal/institutional framework for decision-making to be established.

7.14. While it is perhaps too early to speculate on the precise form and extent of such commercial exploitation interests, and in particular on any role of private parties in that context, as the ongoing discussions on these issues tend to show the desirability for a proper and fair regime for exploitation, including commercial exploitation, of celestial bodies, including NEOs, and their resources is difficult to deny. They should, from the perspective of NEO response, ensure that any involvement of entities in NEO response activities for commercial gain (whether private or public) is only to be allowed if the overarching goal of such missions is not threatened or compromised thereby.

8. Concluding remarks

8.1. With regard to most of the aspects of legal issues analysed above, problems arise in terms of application of existing international law to solve the potentially dangerous and divisive, in worst cases catastrophic, threats NEOs could come to pose. In some cases, there exists no international law of much substance and at best some general principles that could be distilled from national law, such as on tort liability and the 'Good Samaritan' principle – and even these principles are not completely uniform across the various national jurisdictions. In other cases, such international law has just started to develop and is still subject to considerable debate as to its precise ramifications; this is the case for instance with the 'responsibility to protect' and the ramifications of the International Charter on Space and Major Disasters in this specific context. In still other cases, moreover, there may perhaps not be such an absence of relevant international norms in general terms, but application thereof to the NEO threat response issue in particular may result in considerable, likely counter-productive complications, such as with the Liability Convention and (arguably) the use of nuclear force.

8.2. A first crucial step towards solving such issues in the most generic fashion would be to establish a proper international framework for decision-making. Such a framework would, firstly, where necessary, carve out from existing, more international and more general responsibilities and liabilities the specific context of NEO threat response actions and provide for adequate specific versions thereof. Secondly, alongside existing principles and customary law applicable to the subject it would result in – or at least provide a starting point for developing – customary international (and at a later stage perhaps treaty) law where no relevant international legal rules or principles exist, using as appropriate concepts and principles of national law. And thirdly, perhaps most important of all, it would underpin the development of a level of transparency and trust that would help to prevent divisive political tensions where the legal rules would not (yet) be clear.

8.3. ***Key to the success of such a framework would be a proper and workable balance between the interests and sovereign competencies of the (relatively few) states capable of actually undertaking successful NEO response missions and the rights and interests of all other states and humanity as a whole in being protected against threats posed by NEOs.*** Here, of necessity the challenge must be met of defining the various interests and rights at play in each particular case; if a full-fledged legal/institutional framework would not be feasible, a code of conduct to be developed in the early stages would already be of great benefit – if not indeed necessary.

8.4. Under the current circumstances, it is submitted that a construction *mutatis mutandis* analogously to the roles of the UN Security Council, the UN General Assembly and individual sovereign states in the context of the UN role in preserving international peace and security, whether actually involving these UN bodies or not, as a clear example of progressive development of international law provides the shortest and most effective route to such a balanced framework.

8.5. Under such a framework:

- any acknowledged responsibility to protect would be given a realistic chance of being complied with against a NEO threat by means of a balanced

mandate on behalf of all states and mankind to be implemented according to certain guidelines and standards;

- liabilities for damage caused in spite of a mission taking place within the terms of the mandate concerned may be properly arranged, waived or otherwise dealt with as the case may be;
- the use of force, including even nuclear force as a measure of last resort, will not be prohibited if genuinely required in the defence of mankind – whilst allowing as little room for abuse as possible (taking into consideration that it is always more difficult to determine this in the abstract sense as generally applicable than in a specific case); and
- where necessary commercial interests, including those of private enterprise, can be harnessed for the cause by the states undertaking missions related to NEO threat responses, as long as remaining within the mandate.

9. Recommendations

The most important overarching Recommendation that arises from the research and analysis undertaken for this report is the following:

#1. It is important to soon start discussions within the UN framework as to whether and how to develop an international decision-making framework along the lines sketched above within the present structure of the UN, notably as regards the roles of the UN Security Council and the UN General Assembly.

More specific Recommendations would arise in the above context as follows:

#2. A form of the ‘responsibility to protect’ should also be recognised in the NEO context as specifically requiring from states that have the capacity to generate relevant information and/or to respond to NEO threats to undertake such actions, after proper international coordination – preferably within a decision-making framework as recommended above in #1 – and without interfering with their sovereign powers to determine the details of any such mission.

Taking the relevant clauses of the Outer Space Treaty, the UN Principles on Remote Sensing and the International Charter for Space and Major Disasters into consideration, it might further be recommended in this context to consider drafting a UN Resolution establishing the above-mentioned specific applicability of the ‘responsibility to protect’ to the case of NEO threats and threat responses.

#3. It should be recognised that if damage occurs in spite of a NEO response mission, or as a consequence of such mission being not (completely) successful, the state(s) responsible for such mission should not be held liable for such damage as long as the mission was undertaken within the parameters set by a proper mandate by the international community – preferably through a decision-making framework as recommended above in #1 – as well as by specific agreements with the state(s) responsible for such mission, as appropriate and applicable.

It might further be considered in this context to draft a UN Resolution that provides for the application of a general version of the ‘Good Samaritan’ concept to damage caused in the context of NEO response actions, further clarifying that the Liability Convention is not currently the proper legal document to handle to issues.

#4. In the international discussions on the use of force in outer space care should be taken that the result of such discussions will not unduly obstruct the use of force that might be required under some scenarios of NEO threats.

In this case a decision-making framework as recommended above in #1 would be rather helpful to ensure political tensions would remain at a minimum level. Generally speaking, establishment of the recommended decision-making framework should suffice under the current legal situation to allow the proper and balanced use of such force.

#5. As to the use of nuclear force in particular, this should be expressly recognised to be acceptable only as a last resort option, whilst ways should be explored to carve out very limited exceptions for NEO response purposes from the existing legal regime, which clearly prohibits any nuclear explosions in outer space, and which are consistent to the degree possible with the UN Principles on Nuclear Power Sources.

In this case a decision-making framework as recommended above in #1 may well be indispensable to ensure political tensions would remain at a minimum level, as nuclear power sources, even if exclusively for peaceful purposes, carry with them important elements of concern. Furthermore, in particular the existing Test Ban Treaties should be further dealt with from this perspective.

#6. A proper legal regime for handling possible commercial interests, including those of private enterprise, in exploitation of natural resources in outer space without threatening the clear-cut interests of all states and mankind at large in the proper conduct of such activities should be developed to ensure that any involvement in NEO response activities for commercial gain is only to be allowed if the overarching goal of such missions is not threatened or compromised thereby.

To the extent that commercial interests, and in particular those of private enterprise, may play a beneficial and contributory role to NEO threat mitigation activities, their proper interests and rights, likely focused on the exploitation of resources of NEOs, should be at the least taken into account and perhaps formally be incorporated in the legal/institutional framework for decision-making to be established. This calls for development of a coherent regime for (commercial) exploitation of outer space in the longer term inevitable also with a view to practical considerations emanating from NEO response actions.

#7. A working group should be instituted by COPUOS, notably by the Legal Subcommittee in close consultation with the Scientific-Technical Subcommittee, to further investigate, discuss and develop the recommendations ##1-6 offered by the present Report, as well as the various options available in this regard.

Such a working group would furthermore be recommended to consult closely with the various space agencies and non-governmental expert bodies involved to ensure input will come from all relevant perspectives. It should work fundamentally in an interdisciplinary mode, since the precise facts need to be known and understood as much as possible in order to elaborate realistic proposals.