All of these numbers might not strike as overwhelmingly shocking, however, the rate of space debris will increase rapidly due to natural processes of collision in orbit as there are already estimated 29,000 debris objects in orbit, which are sized larger than 10cm.[56]

The proposed market based approach seeks to limit the active and intentional emission of space debris annually.[57] This approach, on the one hand, sets the allowed cap for the numbers of debris emitted during launch activities and, and on the other hand, also sets a limit for the number of inactive payloads in orbit. The emission of space debris is categorized, depending on the kind of debris – i.e. operational debris and inactive payloads. On a national level there would be a cap limiting debris emission from both private industry and national agencies, and on an international level there will be a cap limiting debris emission globally.

In effect, this system would be divided into three or more phases, following the EU ETS model. Phase One is a three to five year pilot phase where, in the absence of reliable debris data, caps are set on the basis of best estimates. A suggestion for the cap for launch debris would be at seven categorized objects per launch, which is near the number of objects averagely emitted per launch. Regarding inactive payloads, all newly launched payloads have to have the capacity to be de-orbited and, at the end of their life-span have to be actually de-orbited. In phase two, the cap for launch debris will be decreased to a suggested 3-4 objects, depending on the state of technology. Additionally, a cap for inactive payloads in orbit is introduced, depending on the number of existing inactive satellites per member state. The proposed cap could be introduced at 2/3 of the existing payload debris per country.

In phase three, contingent upon success of the prior phases, the state of technology and the compliance of the Member States, these caps will be marginally increased.

---

[56] ESA, How many Space Debris Objects are currently in orbit? http://www.esa.int/Our_Activities/Space_Engineering_Technology/Clean_Space/How_many_space_debris_objects_are_currently_in_orbit (last visited July 13, 2016)

[57] DAVE BAIOCCHI & WILLIAM WELSER IV, CONFRONTING SPACE DEBRIS: STRATEGIES AND WARNINGS FROM COMPARABLE EXAMPLES INCLUDING DEEPWATER HORIZON 42 (2010).

2. Tradable Permits

Space debris permits (or allowances) would work in such a way that they would make the producers of debris pay for the emissions they cause in outer space. After agreeing on the socially acceptable global cap and respective national caps of the space faring nations, permits would be issued in correspondence to these numbers. Modelled after existing schemes, permits can be issued for free in a primary transition period and auctioned in later periods. The total number of allowances has to be limited in order to ensure their value.[58] Over time, the global and national caps will be reduced in total so that a reduction in the annual debris output can be reached.

Space agencies, companies and private individuals that wish to pursue space activity which will create debris must hold permits corresponding to their pollution quotes.[59] Consequently, they will choose their contractors and subcontractors depending on the "sustainability" of their products in space. This encourages all space actors and the space industry to be more efficient when they are creating and launching space objects or parts of them. Furthermore, space actors will try to avoid fines, which would be substantial.

As a result, cleaner agencies and private actors benefit more. Not only do they save money and are able to invest in new technologies but also they save their reputation, which plays a big role when it comes to tenders and contractors. This creates an additional pressure for companies if they want to maintain their competitiveness.[60]

Therefore, as mentioned earlier, this approach gives the necessary economic incentives and triggers behavioral changes[61] in order to minimize the creation of non-functional objects in space.

---

[58] European Commission, The EU Emissions Trading System (EU ETS), http://ec.europa.eu/clima/policies/ets/index_en.htm (last visited July 3, 2016).

[59] Thierry Senechal, *Orbital Debris: Drafting, Negotiating, Implementing a Convention*, masters thesis, Massachusetts Institute of Technology, at 66 (June 2007) available at http://web.mit.edu/stgs/pdfs/Orbital%20Debris%20Convention%20Thierry%20Senechal%2011%20May%202007.pdf.

[60] Senechal, *supra* note 60,, 66; W. David Montgomery, *Markets in Licenses and Efficient Pollution Control Programs*, 5 J. ECON. THEORY 395–418 (1972).

[61] Montgomery, *supra* note 61, 395–418.

3. Penalty System

Enforcement is the most significant aspect since without an affective enforcing system the value of allowances is forfeited.[62]

In order to enforce a sanction, one has to once again consider the overall limit. The first cap is determined on a global level, however national legislation regulates caps and allowances within domestic systems. Therefore, the penalty system has two levels. First, the national level, where the State has to make sure that their respective national space agencies and private actors stay within the cap. In cases where a private entity has not fulfilled its obligations, a State must levy a sanction upon the entity. Sanctions are enforced by domestic law and can be either of administrative or judicial, civil or criminal nature.[63] For example, substantial penalty payments or deductions from future (e.g. next year's) allowances can be imposed.[64] These two measures can also be combined.[65] In case of the national agencies, cuts in budget and other means can be used to ensure compliance.

Second, at the international level, the whole emissions of a state are measured which consequently also observes the performance of the national space agencies and impedes preferential treatment of state-owned actors. States must follow the globally accepted cap, otherwise the state will suffer a penalty for overstepping the cap, which can again be monetary or a reduction in future allowances[66]. The (in an optimal situation legally binding) interna-

---

[62] Ott, *supra* note 16.

[63] T. H. Tietenberg, EMISSIONS TRADING, PRINCIPLES AND PRACTICE (SECOND EDITION), 170 (2010)

[64] UNFCCC, An Introduction to the Kyoto Protocol Compliance Mechanism, http://unfccc.int/kyoto_protocol/compliance/items/3024.php (last visited July 13, 2016), UN Framework Convention on Climate Change, *Bodies*, https://unfccc.int/bodies/items/6241.php (last visited July 3, 2016) and International Carbon Action Partnership, Linking https://icapcarbonaction.com/en/about-emissions-trading/linking (last visited July 27, 2016)

[65] International Carbon Action Partnership, Linking https://icapcarbonaction.com/en/about-emissions-trading/linking (last visited July 27, 2016)

[66] UNFCCC, An Introduction to the Kyoto Protocol Compliance Mechanism, http://unfccc.int/kyoto_protocol/compliance/items/3024.php (last visited July 13, 2016)

tional agreement on which the cap and trade system would be established, the rules of international relations and reciprocity, and public annual reports would additionally ensure compliance[67].

4. Compliance System

In order to implement and monitor the mitigation of space debris pursuant to the present approach, a two-stage compliance system is proposed, which involves reporting at both, the national and international levels.

Private space actors and operators are required to have an approved monitoring plan, according to which they monitor and report their emission of space debris during the year to the national organ in charge. The monitoring and the reports must follow a certain style and guidelines, in order to simplify inspections. In the style of the EU ETS, a 'compliance circle' could be installed, which includes in addition to the monitoring plan and the reporting system, an annual verification of the submitted numbers by an accredited verifier.[68]

The annual total of the debris emissions of private space actors and national space agencies of each participating state is then forwarded to an international monitoring organ, which processes and catalogues the numbers. One possibility would be to consign the Secretary-General of the United Nations with this position, as it also maintains the registry for space objects.[69]

5. Investment in Innovative Technologies

According to the "Kessler Syndrome"[70], the current extent of space debris in orbit may already render LEO impassable.[71] Even if no more debris objects are emitted, dysfunctional objects could

---

[67] T. H. Tietenberg, EMISSIONS TRADING, PRINCIPLES AND PRACTICE (SECOND EDITION), 170 (2010)

[68] European Commission, *Monitoring, Reporting and Verification of EU ETS Emissions*, http://ec.europa.eu/clima/policies/ets/monitoring/index_en.htm (last visited July 3, 2016).

[69] Convention on the Registration of Objects Launched into Outer Space, *opened for signature* Jan. 14, 1975, 28 U.S.T. 695, 1023 U.N.T.S. 15, Art III.

[70] Donald J. Kessler and Burton G. Cour-Palais, *Collision Frequency of Artificial Satellites: The Creation of a Debris Belt*. JOURNAL OF GEOPHYSICAL RESEARCH **83**: 2637–2646 ((1978)..

[71] Tkatchova, *supra* note 3, 213.

multiply in a cascading effect through collisions and break-ups.[72] According to Prof. Klinkrad, head of ESA's Debris Office, "only the active removal of five to 10 large objects per year can reverse the debris growth".[73] Therefore, revenues and collected penalties from the cap and trade system would be used to promote scientific research and funding for innovative projects for active space debris removal. Monetary penalties would be paid into a compliance fund to be used for remediation, for example with the creation of a "Clean Space Fund," depending on how the cap and trade System will be legally implemented.

Similarly, the system has a remedial effect on the national level as the private Space operators will be able to use their revenues from selling emission permits as investments into "greener technologies," i.e. debris-neutral launches, the use of material which prevents the creation of minute particles or bigger break-ups in orbit, and de-orbiting capacities for all the launched payloads.

III. CONCLUSION

The market-based approach of a cap and trade system in Space is the most cost-effective solution for long-term sustainability. It provides economic incentives for decreasing the emission of space debris and in the contrary to existing cap and trade systems it doesn't offer an easy "buy-out" as there would also be an obligation to invest. This is made possible as the resulting profits from saved allowances are to be used for investment in new technologies which will substantially improve mitigation efforts. This system enables to set a clear time frame for the targeted level of reduction. A global cap and trade system for space debris is thus warranted and would benefit the society as a whole.

---

[72] Tkatchova, *supra* note 3, 213.

[73] Jonathan Amos, *'Urgent Need' to Remove Space Debris*, BBC NEWS, Apr. 25, 2013, http://www.bbc.com/news/science-environment-22299403.

EFFECTIVE EXERCISE OF 'IN-SPACE JURISDICTION': THE US APPROACH AND THE PROBLEMS IT IS FACING

*Frans G. von der Dunk**

I. INTRODUCTION

As mankind moves closer to the fiftieth anniversary of the conclusion of the Outer Space Treaty[1], the framework international treaty laying down the baseline regime for space activities, it may be considered a major achievement that the treaty, as well as some of its off-spring – notably the Rescue Agreement[2], the Liability Convention[3] and the Registration Convention[4] – seem to be as relevant as ever. This is a major feat in an international era of many fundamental changes in the geopolitical, economic and social context.

Nevertheless, the increasing involvement of private entities in many fields of space activity, beyond the (by now) more 'traditional' ones of satellite communications and to lesser extents launching and satellite remote sensing, has given rise to many new legal issues, even questions about the continuing validity and appropriate-

---

* Frans G. von der Dunk is Harvey & Susan Perlman Alumni/Othmer Professor of Space Law at the University of Nebraska-Lincoln. This paper is an adapted version of a White Paper "Towards the Effective Exercise of 'In-Space' Jurisdiction on US registered spacecraft? Possible US Approaches', prepared for the 7th Annual University of Nebraska-Lincoln's Washington Conference on Space Law, 3

[1] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies London/Moscow/Washington, *opened for signature* Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205 [hereafter Outer Space Treaty].

[2] Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space, *opened for signature* Apr. 22, 1968, 19 U.S.T. 7570, 672 U.N.T.S. 119 [hereinafter Rescue and Return Agreement].

[3] Convention on International Liability for Damage Caused by Space Objects, *opened for signature* Mar. 29, 1972, 24 U.S.T. 2389, 961 U.N.T.S. 187 [hereafter Liability Convention].

[4] Convention on Registration of Objects Launched into Outer Space, *Opened for signature* Jan. 14, 1975, 28 U.S.T. 695, 1023 U.N.T.S. 15 [hereafter Registration Convention].

ness of the broad regime resulting from the abovementioned treaties. Nowhere is this probably more true than in the case of the United States, the world's leading spacefaring nation in particular also in the context of extended private participation in activities in outer space.

In the United States, various serious commercial enterprises are eying the possibilities of exploiting the mineral resources of asteroids or other celestial bodies. Also in the United States, the various companies that are close to selling tickets to outer space to the rich, famous, and a few others are converging – even if Richard Branson's Virgin Galactic originally was a British company, and SXC, planning to launch from the Dutch Caribbean island of Curacao, was a Dutch company before its merger with XCOR. Except for satellite communications and a few isolated examples in launching and remote sensing operations, all private operators with advanced plans for, or actually ongoing, space operations are US or US-led companies.

This also means that the development of legal tools within the United States to properly handle such new private endeavours should be of great interest to the rest of the world as well. Indeed, various non-US countries and other interested parties in this realm are closely following the developments within the United States in this regard.

One important aspect thereof concerns the use of national legislative and regulatory instruments to address international responsibility and liability of the United States under the treaties for the activities of such private entities in outer space or in an outer-space-context, further to Articles VI and VII of the Outer Space Treaty.[5]

---

[5] Art. VI, Outer Space Treaty, *supra* note 1, provides for "international responsibility for national activities in outer space, including" where "such activities are carried on (…) by non-governmental entities." Art. VII provides: "Each State Party to the Treaty that launches or procures the launching of an object into outer space (…) and each State Party from whose territory or facility an object is launched, is internationally liable for damage" caused by that space object. *See generally* F.G. von der Dunk, *Private Enterprise and Public Interest in the European 'Spacescape': Towards Harmonized National Space Legislation for Private Space Activities in Europe* 17-26 (1998) (unpublished Ph.D. dissertation, International Institute of Air and Space Law, Faculty of Law, Leiden University) and J. Nagvanshi & A. Sharma, *Jurisdiction in Outer Space: Challenges of Private Individuals in Space* in CURRENT DEVELOPMENTS IN AIR AND SPACE LAW 324-39 (eds. R. Singh, S.D. Rao & S. Kaul 2012).

At the same time, the United States turns out to present a rather unusual picture from the perspective of domestic implementation of international obligations under the space treaties and domestically specifying the agencies exercising jurisdiction for the purpose. It does not have a single national framework space act from which all further detailed regulations follow (which is essentially what all other countries with dedicated national space laws have availed themselves of), but a set of separate, to some extent even disparate national acts handling different aspects and elements. While historically understandable, and so far not having raised major legal problems, this is rapidly changing now under the pressure of such new developments as sketched above.

For that reason, the present article addresses the US approach to handling its international obligations under the space treaties specifically *vis-à-vis* private actors, the issues arising from that approach and the discussions currently gearing up to try and handle those issues more profoundly, comprehensively and, in a sense, logically. In short: how does and should, the United States arrange for the exercise of domestic jurisdiction over any relevant space or space-related operations by private actors, in line with applicable international law and, more precisely, in line with relevant clauses of the Outer Space Treaty and the Registration Convention.

II. THE NEED FOR EFFECTIVE EXERCISE OF US 'IN-SPACE' JURISDICTION: THE PRIVATE 'SPACESCAPE'

The size and importance of the US private commercial space industry not just for the United States but also from a global perspective is beyond question. It requires both appropriate levels of control and regulation by the US government, for purposes of national policy and compliance with relevant international obligations of the United States, and, to the extent compliant with international law, appropriate stimulation equally to be reflected in legislation and regulation.

From this perspective, within the broader sector of the private commercial space sector, *prima facie* roughly seven categories of private commercial space activities warrant special attention, running the gamut from already being operational to being in the general stage of preliminary mission consideration. All fundamentally

raise the issue of the exercise of US jurisdiction over private activities conducted in or with respect to outer space.

The first four categories of these roughly fall within the sub-sector of private human spaceflight, whereas the fifth and sixth category deal with the sub-sector of private robotic on-orbit operations and the seventh with private exploitation of celestial bodies' resources, which for the time being is envisaged to be undertaken by way of unmanned missions (although this may change at a later stage). It is these three sub-sectors which consequently will be addressed by the present contribution.

A. Private Human Spaceflight

'Private human spaceflight' should be defined as "flights of humans intended to enter outer space (a) at their own expense or that of another private person or private entity, (b) conducted by private entities, or (c) both."[6] As said, currently this means there are four types of private human spaceflight at issue in the US context (or indeed, generally speaking, globally).

First, there are the impending 'space tourism' flights of a sub-orbital nature. Following the conquest of the X-Prize in October 2004 especially US companies Virgin Galactic and XCOR seem to be getting close to launching the first commercial short-duration flights with paying passengers into a 'sub-orbital' trajectory, aiming for an apogee in the range of 100 to 120 km above the Earth's surface.[7]

---

[6] This double criterion is formulated to exclude scenarios where governments or intergovernmental organizations pay for the flight of a particular human *and* undertake the actual flight operations, in which case the flight is legally speaking still comprehensively 'public' in nature. Flights such as carried out by private operators on behalf of NASA however are still included by virtue of criterion (b), whereas flights such as those of Mr. Dennis Tito to the *ISS* remain included by virtue of criterion (a). See for further analysis Frans G. von der Dunk, *Legal Aspects of Private Manned Spaceflight*, in HANDBOOK OF SPACE LAW 266-67 (ed. Frans G. von der Dunk 2015); *cf.* E. Walter, *The Privatisation and Commercialisation of Outer Space*, in OUTER SPACE IN SOCIETY, POLITICS AND LAW 496-500 (eds. C. Brünner & A. Soucek 2011); M. Gerhard, *Article VI* in COLOGNE COMMENTARY ON SPACE LAW, VOL. I 110-4 (eds. S. Hobe, B. Schmidt-Tedd & K.U. Schrogl 2009); and P. Atrey, Space Tourism – Future Industry, in in CURRENT DEVELOPMENTS IN AIR AND SPACE LAW 417-29 (eds. R. Singh, S.D. Rao & S. Kaul 2012).

[7] Currently, both companies provisionally plan for such first flights to take place in the course of 2017 or soon thereafter. *See* Virgin Galactic http://www.virgingalactic.com (last visited July 4, 2016) and XCOR Aerospace, http://www.xcor.com (last visited July 4, 2016).

Second, several US companies are currently involved in NASA's Commercial Crew Development (CCDev) program in preliminary work for manned space transportation[8] and the follow-on Commercial Crew & Cargo Program (C3PO) to have privately-developed and privately-operated spacecraft transporting astronauts to and from the International Space Station, presumably as from 2017 onwards.[9] Recently, Space-X, Boeing and Sierra Nevada Corporation have been awarded commercial crew funding through Space Act Agreements. While Orbital Sciences, now Orbital ATK, was unable to obtain NASA funding at this stage, it continues to develop plans for similar spaceflight projects. While the focus is on transporting NASA and guest astronauts to the *International Space Station* (*ISS*), once the technology would be proven there would be little doubt those companies would in principle also be interested in offering such orbital transportation flights to other destinations and/or for other customers than NASA, such as Bigelow Aerospace. Such operations would then raise essentially the same legal questions as sub-orbital space tourism, at least as for the outer space-elements thereof.

Third, the year 2001 witnessed the beginning of 'orbital space tourism' with the visit of Dennis Tito to the *ISS*. However, the orbital space tourist trips from there on were, and likely will remain for the foreseeable future, one-off occasions never resulting for instance in two tourists being on board the *ISS* at the same time. Thus, whilst falling within the definition of private human spaceflight quoted above, this category of private human spaceflight for the time being would not seem to require further analysis from the

---

[8] On the COTS and CCDev programmes see FED. AVIATION ADMIN, 2011 US COMMERCIAL SPACE TRANSPORTATION DEVELOPMENTS AND CONCEPTS: VEHICLES, TECHNOLOGIES, AND SPACEPORTS 38-45 (Jan. 2011) *available at* https://www.faa.gov/about/office_org/headquarters_offices/ast/media/2011%20DevCon%20Report.pdf; FED. AVIATION ADMIN.,THE ANNUAL COMPENDIUM OF COMMERCIAL SPACE TRANSPORTATION: 2012 60-1 (Feb. 2013) *available at* http://www.faa.gov/about/office_org/headquarters_offices/ast/media/Annual_Compendium_of_Commercial_Space_Transportation_2012_February_2013.pdf; S. Chaddha, *US Commercial Space Sector: Matured and Successful*, 36 J. SPACE L. 29-30 (2010); and T. Brannen, *Private Commercial Space Transportation's Dependence on Space Tourism and NASA's Responsibility to Both*, 75 J. AIR L. & COMM. 667 (2010).

[9] On the C3PO programme see Fed. Aviation Admin., ANNUAL COMPENDIUM, *supra* note 8, 60 (as consisting of 'CCDev2' and 'CCiCap'); Chaddha, *supra* note 8, 30-1; and A. Lele, *Security Connotations of Space Tourism*, 11 ASTROPOLITICS 219-20 (2013).

perspective of the issue of 'in-space jurisdiction'. Moreover, the governmental nature of both the spacecraft flying orbital space tourists to their destination and back, and that destination itself – so far exclusively the *ISS* – means that the potential issues requiring the proper exercise of US jurisdiction in outer space over their activities have basically been taken care of within the legal framework pertaining to the *ISS* and NASA's leadership role in that respect.[10]

Fourth, Bigelow Aerospace intends to offer 'in-orbit' hotel and other space station capacity within a few years from now.[11] The major difference between this category of private orbital tourism and that of orbital tourism on board the *ISS* concerns the private character of the former facility, which would again raise the issue of the appropriate exercise of – presumably – US jurisdiction on board as differently from that already taken care of by NASA.

In general furthermore, the operators currently developing vehicles for sub-orbital space tourism and orbital service flights are partly viewing their respective projects as precursors to full-fledged sub-orbital point-to-point transportation much along the lines of (international) air transportation. Such long-haul flights would again raise issues of jurisdiction, in particular as long as the vehicles concerned would not be squarely defined as 'aircraft,'[12] so as to make national and international air law applicable to their operations. In the context of any such operations, the "range of in-space activity" conducted on board of the spacecraft would not anymore be, more or less, "pre-ordained" and/or remain closely related to the actual operation of the vehicles, but may now encompass many ordinary activities humans are conducting on earth all the time – and humans "make mistakes, commit violence, develop afflictions, and so on," and may well "behave in ways that regulators have not contemplated beforehand."[13]

Thus, each of these various impending spaceflight activities requires a substantive level of US regulatory control over them, both to comply with international obligations of the United States under international law and to ensure a proper and balanced legal

---

[10] See further *infra*, § IV.A.

[11] *See generally* Bigelow Aerospace, *Genesis I & II*, http://bigelowaerospace.com/genesis (last visited July 5, 2016).

[12] Note the standard definition of aircraft discussed in greater detail *infra*, at § III.C.

[13] B. Perlman, *Grounding US Commercial Space Regulation in the Constitution*, 100 GEORGETOWN L. J. 940, 941 (2012).

and regulatory framework allowing this particular sector of private activities to prosper. Whilst a considerable body of US national law does in principle exist to address commercial spaceflight in general, under the strain of these new and rapid developments certain cracks, gaps and loopholes now start to become evident and call for a more fundamentally coherent approach.

B. Private Robotic On-orbit Operations

So far, two closely related categories comprise the sub-sector of private unmanned orbital operations: the activities of on-orbit servicing and active debris removal. Both these two activities, for economic reasons, for the time being seem to be beyond the capability of the private sector in terms of both technologies and financial incentives. Even the major space-faring nations seem to stand only at the beginning of developing such operations in any detailed and structured fashion. However, on-orbit servicing proposals are currently being floated with increasing frequency and urgency, and developments could move faster than anticipated – as well as require substantial lead-times for complementary legal and regulatory tools to be developed. This would consequently still warrant taking them into consideration at this point in time in the discussions on jurisdictional issues.

Certainly such activities would raise a number of salient and thorny political and additional international legal issues which would need to be solved before they would become feasible, notably the issues of international responsibility and liability, and dual-use technology export controls in addition to more specifically legal issues such as the definition of 'space debris', the possibilities to legally 'abandon' a space object and to involve insurance in the context of 'salvage'-like operations.[14]

Moreover, once private operators would become involved in those operations, in addition essentially the same overarching issue of 'in-space' jurisdiction arises as is discussed in more detail in the present contribution for the areas of private human spaceflight and

---

[14] *Cf.* M.P. Schaefer, *Analogues Between Space Law And Law Of The Sea/International Maritime Law: Can Space Law Usefully Borrow Or Adapt Rules From These Other Areas Of Public International Law?*, in 2012 PROCEEDINGS OF THE INTERNATIONAL INSTITUTE OF SPACE LAW 316-30 (ed. Corinne Jorgenson 2013) and F. LYALL & P.B. LARSEN, SPACE LAW – A TREATISE 309-10 (2009).

private exploitation of celestial bodies' resources. For that reason, from the perspective of aiming for the most comprehensive approach to the exercise of relevant US jurisdiction, on-orbit servicing and active debris removal should also be taken summarily into account in the present analysis.

C. Private Exploitation of Celestial Bodies' Resources

Looking also into the future and for the time being not foreseeing manned missions, various serious projects have been announced to undertake mining missions to asteroids, most notably those being planned by Planetary Resources and Deep Space Industries, two US companies with major funding and expertise behind them. Both the former, originally founded November 2010, and the latter, founded January 2013, intend to follow-up reconnoitring missions to asteroids rich in water and other mineral resources with actual effort to harvest, process, and manufacture those.[15]

Whilst the actual harvesting and further commercial exploitation are deemed to be at least one or two decades away, in view of the major upfront investments in the current timeframe needed if these ventures are to succeed at all relatively soon more legal certainty should be offered to operators such as these two as regards the legal parameters, rights, and obligations which would pertain to their harvesting and exploitation activities once actually taking off.[16]

Since the two leading contenders in this venture are both US companies, this is of primary concern for the United States within the broader international legal framework applicable to space activities and its responsibility for private activities in that context. The exercise of US jurisdiction should thus ensure that such harvesting and exploitation will take place both taking into consideration the international obligations of the United States in this context and the interests in allowing such private companies to benefit

---

[15] *See generally* Planetary Resources, http://www.planetaryresources.com (last visited July 5, 2016) and Deep Space Industries, http://deepspaceindustries.com (last visited July 5, 2016).

[16] *Cf.* F. TRONCHETTI, THE EXPLOITATION OF NATURAL RESOURCES OF THE MOON AND OTHER CELESTIAL BODIES (2010), 1-3; Lyall & Larsen, *supra* note 14, 190-7 and S. Hobe, P. Stubbe & F. Tronchetti, *The 1979 Agreement Governing the Activities of States on the Moon and Other Celestial Bodies*, in COLOGNE COMMENTARY ON SPACE LAW, VOL. II 338-41 (eds. S. Hobe, B. Schmidt-Tedd & K.U. Schrogl 2013).

as much as possible and appropriate from their entrepreneurial activities.

Indeed, the US legislative branch has undertaken the first steps in this particular direction by enunciating the U.S. Commercial Space Launch Competitiveness Act.[17] Title IV of the Act addresses 'Space Resource Exploration and Utilization', adding a Chapter 513 to Title 51 of the United States Code. In terms of jurisdiction, it its careful to apply personal jurisdiction only, addressing "United States citizens" as defined and thus not claiming any US territorial sovereignty over celestial bodies or their resources.[18]

III. THE EXERCISE OF JURISDICTION IN OUTER SPACE SO FAR: THE LEGAL STATUS QUO AND THE GENERIC OPTIONS

A. Exercising Jurisdiction in Outer Space: The General Framework

'Jurisdiction' of a state as a key notion of public international law has been defined as "its lawful power to act and hence (…) its power to decide whether, and if so, how to act, whether by legislative, executive or judicial means"; it refers "primarily, but not exclusively, [to] the lawful power to make and enforce rules."[19] It thereby constitutes one of the fundamental legal hallmarks of a sovereign state, as opposed to non-governmental or international organizations. It is the baseline legal instrument for states also to exercise legal control for the sake of meeting responsibilities and liabilities in international law.

In view of the complexities of today's societies, moreover, such jurisdiction and its exercise is in reality usually rather fragmented and distributed across a multiplicity of government agencies, in particular where it concerns the monitoring, implementation and

---

[17] U.S. Commercial Space Launch Competitiveness Act; Public Law 114-90, 114th Congress, 25 November 2015; Ch. 513, 51 U.S.C.

[18] Sec. 51302. Note that Title IV or also explicitly refers to "accordance with the international obligations of the United States", referring among others to Art. II, Outer Space Treaty.

[19] B.H. Oxman, *Jurisdiction of States*, in THE MAX PLANCK ENCYCLOPEDIA OF PUBLIC INTERNATIONAL LAW, vol. VI 546 (Ed. R. Wolfrum 2012). *See also* B. Schmidt-Tedd & S. Mick, *Article VIII*, in COLOGNE COMMENTARY ON SPACE LAW, VOL. I 156-60 (eds. S. Hobe, B. Schmidt-Tedd & K.U. Schrogl 2009), 156-60; Nagvanshi & Sharma, *supra* note 5, 325-6; and A.J. YOUNG, LAW AND POLICY IN THE SPACE STATIONS' ERA 152-53 (1989).

enforcement of laws and regulations once properly enunciated. Thus, national jurisdiction from that perspective can very well turn out be effectively exercised by a distinct subordinate body, organ, or even agency of the government at large, entrusted with such day-to-day monitoring, implementation and enforcement.

This is no different in principle for space law, even as territorial jurisdiction cannot extend to outer space on a territorial basis.[20] While international space law does provide for some legal distinctions between the 'void' of outer space itself and celestial bodies orbiting therein, this does not extend to the application of jurisdiction in a generic manner.[21] Also, celestial bodies cannot be appropriated by any particular state, hence also their national laws cannot extend to such celestial bodies as if they were outlying parts of national territory.[22]

Consequently, territorial jurisdiction only applies indirectly to outer space activities to the extent it can be asserted over anyone conducting space activities from the territory of a particular state. On the other hand, personal jurisdiction of a state over its citizens (natural or legal) continues to apply as well – even if those persons would happen to be, and be active, in outer space.

In addition, Article VIII of the Outer Space Treaty provides states with the opportunity to exercise, through registration of spacecraft, jurisdiction on a quasi-territorial basis on board of such spacecraft and even over personnel thereof if out on EVAs.[23] No further clues are offered regarding the extent or form that the exercise

---

[20] *Cf.* Outer Space Treaty, *supra* note 1, Art. II.

[21] Effectively, this distinction is mainly relevant in the context of military usages of outer space. *Cf. Id.* at Art. IV, Art. XII.

[22] From this perspective, also, the various offers to 'buy' plots on the Moon or other celestial bodies are legally speaking hoaxes, as private ownership rights over real estate crucially depends on national law which only applies to national territory, whereas celestial bodies could never become part of national territory. *See* Statement by the Board of Directors of the International Institute of Space Law (IISL) On Claims to Property Rights Regarding the Moon and Other Celestial Bodies, http://www.iislweb.org/docs/IISL_Outer_Space_Treaty_Statement.pdf (2004) and Statement of the Board of Directors of the International Institute of Space Law (IISL). http://www.iislweb.org/docs/Statement%20BoD.pdf (2009). *See also* F.G. von der Dunk et al., *Surreal estate: addressing the issue of 'Immovable Property Rights on the Moon'*, 20 SPACE POLICY 151-56 (2004).

[23] Art. VIII of the Outer Space Treaty provides: "A State Party to the Treaty on whose registry an object launched into outer space is carried shall retain jurisdiction and control over such object, and over any personnel thereof, while in outer space or on a

of such jurisdiction should take. Thus, the clause should be read as allowing individual states maximum leeway in exercising such jurisdiction as long as taking place within the (broad) boundaries of general public international law, including those pertaining to a state's individual responsibility and liability. This also results from the precise formulation of Article VIII, which refers to the right "to *retain* jurisdiction,"[24] in other words to extend existing types of jurisdiction as appropriate, not to create or establish a new type of jurisdiction.

The application of such registration-based jurisdiction is not so much triggered by entry into outer space as such, but by the involvement of a 'space object,' which in turn, due to the rather summary and partly circular definition contained in the Registration Convention, is usually considered to refer to man-made objects intended to be launched into outer space.[25] This does bring back the issue of delimitation of outer space, even if, as it were, through the backdoor – without defining the altitude which a certain object is intended to reach, it remains to that extent uncertain whether that object qualifies as a space object. Moreover, the applicability of the Registration Convention is generally considered to be further premised on such objects actually going into "Earth orbit or beyond."[26]

Following the Registration Convention's regime as well as more generally the need to take care of international responsibility and liability under Articles VI and VII of the Outer Space Treaty and the Liability Convention, various states having sent or about to send space objects into outer space have asserted such jurisdiction in outer space by specific, legislative means. For example, the United States by way of its Patents in Outer Space Act[27] extended

---

celestial body." Arts. I and II of the Registration Convention further clarify how such jurisdiction is to be applied.

[24] Emphasis added.

[25] *See* Registration Convention, *supra* note 4, Art. I(b). *See also* M. LACHS, THE LAW OF OUTER SPACE 68-9 (1972); B. Cheng, *Convention on International Liability for Damage Caused by Space Objects*, in MANUAL ON SPACE LAW, VOL. I 116-17 (eds. N. Jasentuliyana & R.S.K. Lee 1979); and G. ZHUKOV & Y. KOLOSOV, INTERNATIONAL SPACE LAW 85-86 (1984).

[26] *Cf.* Registration Convention, *supra* note 4, Art. II(1) on the national registry to be developed. As for the purpose of the international registery under Articles III and IV, the information to be provided should include "basic orbital parameters" (Art. IV(1)(d)).

[27] Patents in Outer Space Act, Pub. L. No. 101-580; 104 Stat. 2863 (1990).

the scope of application of existing US patent legislation to inventions made on board of US-registered space objects. Following the conclusion of the Intergovernmental Agreement on the *ISS* and the build-up and operation of that station, Germany and Italy have similarly extended the scope of their national intellectual property right laws to – in this case – inventions made on board the European module of the *ISS*.[28]

Finally, Article VI of the Outer Space Treaty effectively calls for the exercise of at least some level of jurisdiction when it comes to private space activities, as it states that "[t]he activities of non-governmental entities in outer space, including the Moon and other celestial bodies, shall require *authorization and continuing supervision* by the appropriate State Party to the Treaty."[29] In view of the close correlation to the concept of international responsibility as this is posited by Article VI, such authorization and continuing supervision should at least suffice for the state at issue to reasonably assure other states that the activities at stake would be "carried out in conformity with the provisions set forth in the present Treaty," in other words: to assure no violations of international space law occur.[30] Thus, also the requirement of 'continuing supervision' should be read in this light as a fairly general and broad

---

[28] Agreement among the Government of Canada, Governments of Member States of the European Space Agency, the Government of Japan, the Government of the Russian Federation, and the Government of the United States of America concerning Cooperation on the Civil International Space Station (hereafter Intergovernmental Agreement), art. 21(2), Jan. 29 1998, T.I.A.S. No. 12927. *See also* A.M. Balsano & J. Wheeler, *The IGA and ESA: Protecting Intellectual Property Rights in the Context of ISS Activities*, in THE INTERNATIONAL SPACE STATION 67 (eds. F.G. von der Dunk & M.M.T.A. Brus 2006).

[29] Outer Space Treaty, *supra* note 1, Art. VI (emphasis added). Though strictly speaking 'authorization and continuing supervision' could be exercised through other means than the formal exercise of jurisdiction. *See* A. Kerrest de Rozavel & F.G. von der Dunk, *Liability and Insurance in the Context of National Authorisation*, in NATIONAL SPACE LEGISLATION IN EUROPE 150-5 (ed. F.G. von der Dunk 2011) on the example of France until the enunciation in 2008 of the Loi n° 2008-518 du 3 juin 2008 relative aux opérations spatiales [Law on Space Operations], unofficial English translation in 34 J. SPACE L. 453 (2008). It is widely recognized that establishment of a national licensing system and appropriate form of national space legislation would offer the most comprehensive, transparent and effective tool for ensuring such authorization and continuing supervision. *See also* Gerhard, *supra* note 6, 117-22 and J. HERMIDA, LEGAL BASIS FOR A NATIONAL SPACE LEGISLATION 28-60 (2004).

[30] Outer Space Treaty, *supra* note 1, Art. VI. The reference to 'the provisions set forth in the present Treaty' is generally perceived to refer to *all* of international law applicable

provision; not as automatically requiring a level of intensive supervision that would fundamentally hinder any relevant activity in outer space.

This represents the core of Article VI-responsibility: the focus is on compliance with international law, offering a structural tool for states to ensure such compliance also when private entities are involved in the space activities at issue. As the current substance of obligations under international space law is relatively limited in size and scope, in particular as regards the specifics of private activities and their rights and interests, the requirement resting upon states to actually and effectively exercise and implement jurisdiction could still result in a rather 'light' version thereof.

In many respects it thus amounts more to a requirement to establish general regulatory authority in outer space than to a requirement to establish detailed legislation – in the end, namely, this essentially is a matter of sovereign discretion, as the outer space treaties make clear that the states concerned are going to be held responsible *in any event* for any violation of international space law and liable for any damage caused by space objects launched with their involvement, that is in first instance regardless of whether they exercised this jurisdiction to any substantial extent.

B. The Benefits of Exercising US Jurisdiction in Outer Space: General Aspects

The exercise of US jurisdiction (or any national jurisdiction for that matter) from this perspective would also have a mirror-side to it which is easily overlooked in the usual anxiety of the business sector that the net result of the exercise of US jurisdiction would be the continuing establishment of new legislation stifling economic and private commercial development of space activities, including the exploitation of space resources.

First, in view of the current absence of much international space law specifically targeting private space endeavours, developing the legal instruments to exercise of US jurisdiction over space activities and in outer space in a balanced manner might well set a world-wide precedent and example for an international regime and

---

to outer space activities in the light of the fundamental character of the Outer Space Treaty and its reference to general international law as per Art. III.

the substance thereof. This is, of course, precisely why the current analysis should also be of interest to other spacefaring nations than the United States to the extent that private participation in relevant space activities presently is a fact or at least envisaged fairly soon.

In 1945 the Truman Declaration establishing the concept of the Continental Shelf[31] as endowing coastal states with the entitlement to exercise jurisdiction over economic exploitation of the mineral resources in the area at issue including the right to license private operators within its jurisdiction in that context quickly evolved into an international rule of customary law ultimately also enshrined in international treaties. Similarly, a profound and balanced effort at establishing a detailed level of control over private entities and their space operations might evolve into the international standard and beyond that into proper international law. In such a manner any risk that an international regime adopted by other states could arise which might be contrary to the rights and interests of both the United States and US private enterprise would at least largely be pre-empted.

Currently, for example, the envisaged activities of extraterrestrial mineral resource exploitation operators such as Deep Space Industries and Planetary Resources would, though under present international space law not prohibited as such, meet with too many legal uncertainties for a reasonably secure investment climate.[32] Such uncertainties concern, among others, their rights to operate in certain areas of outer space or celestial bodies exclusively (that is with an accompanying right to keep others out of such areas

---

[31] Proclamation No. 2667, Policy of the United States With Respect to the Natural Resources of the Subsoil and Sea Bed of the Continental Shelf (Sept. 28, 1945), http://www.presidency.ucsb.edu/ws/?pid=12332. *See also* P.T. Stoll, *Continental Shelf*, in THE MAX PLANCK ENCYCLOPEDIA OF PUBLIC INTERNATIONAL LAW, VOL. II 720 (ed. R. Wolfrum 2012) and M.D. Evans, *The Law of the Sea*, in INTERNATIONAL LAW 642 (ed. M.D. Evans 2003).

[32] The 'global commons' status of outer space and the fundamental freedom of space activities, including notably exploration and use of outer space, as per Arts. I and II of the Outer Space Treaty, are currently perceived by most countries and experts to legitimize any exploitation for commercial purposes as long as other parameters and obligations of international (space) law are complied with, but in view of the absence of any specific rules on this and the opposition of a still-sizeable portion of world community and authors alike to such legitimacy, any actual exploitative operations might continue to give rise to considerable international controversy, essentially at a political level but likely spilling over soon into the legal domain.

and/or under what conditions) and the extent to which their ownership of extracted minerals would be contested by other countries or their entities, not only politically but also legally. A rudimentary legal framework addressing such issues is therefore needed at the international level, and US efforts to achieve such a framework at least nationally might well lead the way here.

Once again, an example from the law of the sea would be elucidating. The 1982 United Nations Convention on the Law of the Sea had provided for application of a 'common heritage of mankind' regime to the ocean floor and the mineral resources to be discovered thereon, including notably technology-transfer and benefit-sharing commitments.[33] Those clauses were considered by the United States and other leading Western countries to stifle commercial exploitation initiatives in that area, and by that token inacceptable. These states by and large refused to ratify the Convention, and instead in some cases developed national ocean floor mining licensing regimes to be applied unilaterally to any relevant private party so interested.[34]

When a 1994 *de facto* amendment of the 1982 Convention however resulted in considerable mitigation of the disputed clauses, most of those countries became parties to the 1982 Convention as per that 1994 Agreement, which had meanwhile entered into force and was enjoying continuously increasing partisanship.[35] More and

---

[33] *See* United Nations Convention on the Law of the Sea, Montego Bay, Arts. 133-191, esp. Arts. 136-137, 144, 150-153, 170, Dec. 10 1982, 1833 U.N.T.S. 3 [hereinafter UNCLOS]. *See also* L. VIIKARI, FROM MANGANESE NODULES TO LUNAR REGOLITH 52*ff* (2002).

[34] This notably concerned the 1980 US Deep Sea Bed Hard Mineral Resources Act, 30 U.S.C. Secs. 1401 *et seq.* (2016); 1981 West German Act on the Interim Regulation of Deep Sea Bed Mining, 20 I.L.M. 393 (1981); 1981 UK Deep Sea Bed Mining (Temporary Provisions) Act, Ch. 53, 20 I.L.M. 1219 (1981); 1982 French Deep Seabed Mineral Resources Exploration and Mining Law, *Loi no. 81-1135*, 21 I.L.M. 808 (1982); 1982 Japanese Law on Interim Measures for Deep Seabed Mining, 22 I.L.M. 102 (1983) and Italian Law No. 41 of 1985, 24 I.L.M. 983 (1985). *See also* Tronchetti, *supra* note 16, 104-13 and Viikari, *supra* note 32, Ch. 4.

[35] This concerned the Agreement Relating to the Implementation of Part XI of the United Nations Convention on the Law of the Sea of 10 December 1982 New York, July 28, 1994, 1836 U.N.T.S. 3 [hereafter New York Agreement]. The New York Agreement amounted to an understanding to interpret and apply the disputed Part XI-clauses of the 1982 Convention in a much more private enterprise-friendly way. *See* Viikari, *supra* note 32, 73-8 and Tronchetti, *supra* note 16, 113-8.

more, the United States came to stand alone in refusing to ratify the Convention and formally adhere to the resulting legal regime.

Any US private company favouring the very-pro-private-enterprise regime that the United States continued to apply domestically, might therefore perhaps legally-technically speaking have been at liberty to ignore the international licensing regime now in existence under the revised regime, and (just) apply for a US license. Nevertheless, once Lockheed Martin was quite far advanced in actually initiating ocean floor harvesting activities, rather than take that route, it established a UK subsidiary, UK Seabed Resources specifically to apply for a *UK* license.[36] The United Kingdom meanwhile having become a party to the 1982 Convention as per the 1994 Agreement, such a license would be subject to the international legal parameters and boundaries established by the latter. The benefit of a license enjoying almost world-wide recognition and respect obviously outweighed any licensing and operating requirements that would be more burdensome on the US operator than those that would have applied under a national US license.

Thus, while a unilateral national regime is exactly what Title IV of the U.S. Commercial Space Launch Competitiveness Act is trying to achieve, if such a regime ultimately is to be found at fundamental odds with any emerging global regime outside the United States, its value might become intrinsically marginalized or at least subject to serious repercussions, if not legal than political. This is also why the Act makes reference to the obligation of the US President to "(1) facilitate commercial exploration for and commercial recovery of space resources by United States citizens; (2) discourage government barriers to the development in the United States of economically viable, safe, and stable industries for commercial exploration for and commercial recovery of space resources in manners consistent with the international obligations of the United States; and (3) promote the right of United States citizens to engage in commercial exploration for and commercial recovery of space resources

---

[36] *See* UK Government sponsors Lockheed Martin, Lockheed Martin UK subsidiary for licence to harvest Polymetallic Nodules, Mar. 14, 2013, http://www.lockheedmartin.com/uk/news/press-releases/2013-press-releases/uk-government-sponsors-lockheed-martin-uk-subsidiary-for-licence.html.

free from harmful interference, in accordance with the international obligations of the United States and subject to authorization and continuing supervision by the Federal Government.□"[37]

The Act effectively guarantees the protection of legitimate ownership rights in resources once extracted, as well as judicial means to solve disputes concerning conflicting exploitation activities, as long as in conformity with US obligations under international space law.[38] Whether the balance between such conformity with international obligations and providing private operators with sufficient legal guarantees is actually appropriately achieved, however, as indicated is already subject to debate, evidencing the existence of the current legal gaps.[39]

Second, the establishment and exercise of US jurisdiction in outer space and/or over private space activities also means that the United States as a sovereign power squarely endorses activities allowed following the exercise of such jurisdiction, and would be legally entitled under general public international law to exercise so-called diplomatic protection with regard to the interests of US entities if legally challenged by other countries or their entities. Further to such exercise, for example specific protection zones and property rights can be established which could be upheld against such foreign claims, since they can be defended as a logical – and so far really the only – elaboration of the rather general principles pertaining to safety zones and suchlike.[40] This presumes developments such as have taken place with regard to the ocean floor regime would not take place with regard to outer space or its celestial bodies – in other words: where a domestic US regime to be developed would come to lack any international recognition, it might actually backfire.

---

[37] Sec. 51302.

[38] See Sec. 51303.

[39] *Cf. e.g.* F. Tronchetti, *Private property rights on asteroid resources: Assessing the legality of the ASTEROIDS Act*, 30 SPACE POL'Y 193-6 (2014).

[40] *Cf.* Outer Space Treaty, *supra* note 1, Art. XII requiring "reasonable advance notice of a projected visit" to "stations, installations, equipment and space vehicles on the Moon and other celestial bodies."

C. Exercising Jurisdiction Specifically vis-á-vis Human Spaceflight

So far in the context of human spaceflight, jurisdictional issues in a broad sense have remained confined to the relatively few instances of public human spaceflight, where the capacity of the astronauts and cosmonauts as employees of governmental space agencies basically guaranteed the appropriate level of exercise of jurisdiction over their behaviour, largely already by way of their employment contracts. Thus, even in the context of the *ISS*, the most pronounced legal environment for human space operations in view of the multi-national construction, it generally sufficed for each partner to register its own modules per Article 5 of the Intergovernmental Agreement. Apart from the specific issue of intellectual property rights referred to above only the issue of possible exercise of criminal jurisdiction needed to be more specifically addressed, which was effectuated by means of Article 22.[41]

With the impending likely arrival on the scene of private 'space tourism' flights however, this picture will change profoundly. For the time being, the flights contemplated by those operators perhaps will remain little more than sub-orbital hops, barely entering into outer space before starting to re-enter, but for the further future they intend to aim for longer flights, from sub-orbital transportation between various continents to semi-orbital or orbital transportation to 'space hotels' such as Bigelow is in the process of developing. Essentially, spaceflight participants who have no employment contract with a space agency but fly on their own account and out of their own interest – and whose selection and training, even if not negligible, will be far less extensive than those of professional astronauts and cosmonauts – will enter outer space in a purely private context.

From the perspective of current space law, the first issue which then arises in the context of the jurisdictional questions is the aforementioned fact that the Registration Convention, providing the default instrument to establish and exercise jurisdiction over spacecraft, only formally addresses space objects "launched

---

[41] Intergovernmental Agreement, *supra* note 27, Art. 22 addresses this issue by in first instance allowing individual states to exercise active personal jurisdiction over personnel for criminal law purposes, adding a certain fallback option for other duly affected states to exercise criminal jurisdiction.

into Earth orbit or beyond."[42] This has usually been taken to mean that sub-orbital flights like the ones envisaged by Virgin Galactic and XCOR would not be subject to the Convention's regime. However, the phrasing 'Earth orbit or beyond' would seem to refer to a certain *area* being (intended to be) reached by the space object at issue for the Convention to apply. So a sub-orbital space object which would achieve an altitude 'beyond' an 'Earth orbit' – in other words, in outer space as it is most commonly defined with reference to the lowest-orbit approach – could well fall within the ambit of the Convention.[43]

In addition, Article VIII of the Outer Space Treaty, which allows states to retain jurisdiction over space objects launched into outer space, does not limit such retention of jurisdiction to space objects 'launched into Earth orbit or beyond'. As soon as a space object is intended to reach an area called 'outer space,' the state registering it may exercise its jurisdiction over and on board of that space object. To the extent therefore these two phrases – of 'Earth orbit or beyond' and 'outer space' – would *not* be seen as referring to the same geographical area, it is the 'outer space' label of the two which prevails in determining, for example, whether an object triggers the application most notably of the Liability Convention, since that is the term used by that Convention.[44]

In other words: the national jurisdiction of a registration state of a space object, as provided for and regulated by Article VIII of the Outer Space Treaty and the Registration Convention, principally allows exercise of such jurisdiction over that object in outer space regardless of whether any orbit(al velocity) has been or will be achieved – or was even aimed for.

In the absence of a well-established and generally-acknowledged lower boundary of outer space, however, in particular within the United States, the question as to whether the sub-orbital vehicles now giving rise to the discussion regarding 'on-orbit jurisdiction' would (intend to) enter into outer space can not be definitively answered. This also means that the question whether they are

---

[42] Registration Convention, *supra* note 4, Art. II(1).

[43] See for a very extended analysis and argument F.G. von der Dunk, *Beyond What? Beyond Earth orbit?...! The Applicability of the Registration Convention to Private Commercial Manned Sub-Orbital Spaceflight"*, 43 CAL. W. INT'L L. J. 269-341 (2013).

[44] *See* Liability Convention, *supra* note 3, Arts. I-V.

'space objects' in the sense of the space treaties cannot be finally answered – at least not authoritatively as for the United States.[45]

At the same time, in view of their technologies and intended trajectories and activities, the only reasonable alternative to qualifying those vehicles as 'space objects' would be to qualify them as 'aircraft.' 'Aircraft' have been defined as "any machine that can derive support in the atmosphere from the reactions of the air other than the reactions of the air against the earth's surface."[46] The International Civil Aviation Organization (ICAO), though acknowledging the applicability of the general definition of 'aircraft' to most of the vehicles currently being designed for private sub-orbital flight, decided to desist so far from developing Standards and Recommended Practices (SARPs) for such sub-orbital vehicles or the operations conducted with them.[47] On the other hand, at this point in time ICAO seems to be reconsidering such an approach once more.[48]

In the last resort however, this would not make a principled difference. Also a qualification of the vehicles at issue as 'aircraft' would still give rise to the full-fledged possibility for the state concerned to exercise jurisdiction on board of that vehicle, as "[a]ircraft

---

[45] It may be noted however that outside the United States a growing convergence of opinion on an altitude of 100 km (62.5 miles) as the legal boundary between airspace and outer space can be discerned. Also, within the United States, that particular altitude has already popped up in the context of (non-legal) federal agency documents, state legislation discussions, and – of course – the private operators touting their incumbent sub-orbital flights as entering into outer space; see further F.G. von der Dunk, *International Space Law*, in HANDBOOK OF SPACE LAW 64-72 (ed. F.G. von der Dunk 2015).

[46] *See* Convention on Civil Aviation, Dec. 7, 1944, 15 U.N.T.S. 295 [hereinafter Chicago Convention]; Annex 7, Aircraft Nationality and Registration Marks, at definitions (5th ed. 2003) *available at* http://www.icao.int/safety/airnavigation/
NationalityMarks/annexes_booklet_en.pdf; Annex 8, Airworthiness of aircraft, at definitions (10th ed., April 2005) *available at* http://www.icao.int/safety/airnavigation/NationalityMarks/
annexes_booklet_en.pdf. See also V.J. Vissepó, *Legal Aspects of Reusable Launch Vehicles*, 31 J. SPACE L. 185-9 (2005).

[47] See Working Paper on Concept of Suborbital Flights, ICAO Council, 175th Session, C-WP/12436 (May 30, 2005. *See generally* T.R. Hughes & E. Rosenberg, *Space Travel Law (and Politics): The Evolution of the Commercial Space Launch Amendments Act of 2004*, 31 J. SPACE L. 76-77 (2005) and Vissepó, *supra* note 43, 179-85. SARPs are the detailed elaborations of general obligations and requirements under the regime created by the Chicago Convention.

[48] *Cf.* Reuters: A. Lampert, *UN Aviation body to mull space safety as space taxis ready for flight*, REUTERS, Sept 19, 2014, http://uk.reuters.com/article/
2014/09/19/aerospace-space-icao-idUKL1N0RK2LS20140919.

have the nationality of the State in which they are registered,"[49] and such nationality *ipso facto* allows the state of nationality to exercise its national jurisdiction on board.

In other words, it would even be possible for the United States to start addressing the issue of fundamental and comprehensive jurisdiction on board of US-registered sub-orbital, orbital or beyond-orbital vehicles for the time being *without* having to address the question of where outer space should be deemed to begin. After all, this jurisdiction would focus on the registration of vehicles and the resulting right to exercise jurisdiction in first instance regardless of whether the registered vehicles would be registered as aircraft, as space objects or even as both at the same time.[50]

D. Exercising Jurisdiction Specifically vis-á-vis Resource Exploitation

In the absence of specific possibilities for states to regulate the exploitation of mineral resources on celestial bodies on a 'traditional' basis due to the legal impossibility to exercise territorial jurisdiction on such celestial bodies, basically only two theoretical approaches would be available to establish a certain level of legal certainty regarding the applicable rights and obligations for potential private exploitation missions.

The one option concerns the development of an international regime somehow allowing private entities to be licensed to undertake exploitation activities on celestial bodies within a set of rules further specified by an international instrument. Noting that also the high seas constitute an area outside of any individual state's territorial jurisdiction, this approach was originally used in the context of deep seabed mining, where the United Nations Convention on the Law of the Sea[51] provided for a complicated system of exploitation licenses under an international regime. As discussed, only after a considerable restructuring of the original approach, bending

---

[49] Chicago Convention, *supra* note 43, Art. 17.

[50] It should be noted that analyses of these issues so far largely ignore the possibility for (component parts of) a vehicle *ab initio* to be registered as both an aircraft and a space object, and assume for instance that registration as an aircraft automatically and comprehensively excludes the possibility of concurrent registration as a space object.

[51] See UNCLOS, *supra* note 32.

the regime to make it considerably more market-friendly, did this regime start to achieve world-wide credibility and acceptance.[52]

For similar reasons, the approach taken by the Moon Agreement,[53] which also applies to other celestial bodies in the solar system, did not go very far. While it is in force, it is in force only for sixteen non-major-spacefaring nations, thus strictly speaking would not constitute an obstacle for *inter alia* the United States to take a different approach. At the same time, the Moon Agreement's lack of credibility and widespread adherence also means there is essentially *no* internationally-agreed legal regime of appreciable detail applicable to any prospective mining operations, allowing major uncertainties to remain as the Outer Space Treaty continues to apply but does not provide much helpful specifics.

The other option follows a unilateral bottom-up approach, whereby individual states license national operators under national regimes, basically on the basis of personal jurisdiction, to proceed with such exploitation activities. Even if such national licenses would be granted in full deference to existing international law on the subject, the risks of unenforceability of licensee rights under such national licensing regimes against third states and their entities, and of competing claims to particular areas considered of interest would present a major level of legal uncertainty, which might well make celestial bodies resource exploitation an already legally speaking very risky venture.[54]

At the same time, as long as the number of countries potentially capable of undertaking (or allowing their private operators to undertake) such activities would remain fairly small, such a national approach may well be the starting point from various perspectives. It would co-determine the international regime which would ultimately have to arise for full-fledged global acceptability of a particular national system, such as by requiring 'due care' for

---

[52] As discussed, this was achieved mainly by way of the New York Agreement, *supra* note 34.

[53] Agreement Governing the Activities of States on the Moon and Other Celestial Bodies New York, Dec. 18, 1979, 1363 U.N.T.S. 3 [hereafter Moon Agreement].

[54] *Cf.* the discussion *supra* at § II.B.

other states' activities for example under Article IX of the Outer Space Treaty.[55]

IV. THE EXERCISE OF JURISDICTION OVER SPACE OBJECTS IN THE US CONTEXT

Other countries have so far established a single coherent piece of national space legislation to ensure the desired level of exercise of national jurisdiction over duly registered space objects,[56] which also testifies to the fundamental interest in such exercise being both comprehensive and coherent. By contrast, however, the situation in the US context has developed into a complicated one by the existence of a number of acts and statutes addressing specific aspects or elements of space operations conducted with US spacecraft and/or by US private operators.

A. NASA 'Jurisdiction' over Human Space Activities

To the extent the United States itself has been involved in human spaceflight and this was considered to require any exercise of jurisdiction on the part of the US government, NASA was the governmental agency to handle this, being tasked to "exercis[e] control over aeronautical and space activities sponsored by the United States."[57] Thus, the NASA Administrator "shall be responsible for the exercise of all powers and the discharge of all duties of the Administration and shall have authority and control over all personnel and activities thereof."[58]

As already indicated, the application of US jurisdiction to completely public space operations and spacecraft did consequently not

---

[55] The Outer Space Treaty thus provides "States Parties to the Treaty (…) shall conduct all their activities in outer space (…) with due regard to the corresponding interests of all other States Parties to the Treaty." Outer Space Treaty, *supra* note 1, Art. IX

[56] *See e.g.* the United Kingdom, Outer Space Act, 1986, c. 38, Sec. 1 (U.K.) ("This Act applies to (...) any activity in outer space."); Russia, , Law of the Russian Federation on Space Activities, No. 5663-1, Art. 9(2), 1993 in NATIONAL SPACE LEGISLATION OF THE WORLD, VOL. I 101 (2001) ("Subject to licensing shall be the space activities (...)" in conjunction with Art. 2(1), defining the term "space activities" for the purposes of the Law); and Sweden, Act on Space Activities, 1982:963, Sec. 1 in NATIONAL SPACE LEGISLATION OF THE WORLD, VOL. I 398 (2001) ("This Act applies to activities in outer space (space activities).").

[57] 51 U.S.C. § 20102(b).

[58] 51 U.S.C. § 20111(a).

require specific acts of extension of such jurisdiction since the nationality of the people, entities and craft[59] involved guaranteed that at least US personal jurisdiction, as well as, through the contract of government-employed astronauts, effective control by the relevant government agency could be asserted.[60]

This also applied to the US contribution to, and activities undertaken in, the context of the *ISS*, where obviously modules from other states, registered with such states, as well as astronauts and cosmonauts from other states were also implicated, and issues of jurisdiction had to be carefully and internationally negotiated. The only specific elements to be further so arraigned, as discussed, concerned criminal law, where NASA would not have any such jurisdiction properly speaking,[61] and intellectual property jurisdiction, which involves NASA potentially only as an intellectual property-owner.[62]

It was NASA therefore which took care (as far as the US interests were concerned) of the complications caused by the visit of the first 'space tourist' to the *ISS* in 2001. It did so by firstly agreeing with Russia and the other *ISS* partners on a special *ad hoc* arrangement, taking care of, among other issues, potential third-party liability risks resulting from the visit of Tito. NASA then concluded with the *ISS* partners the Principles Regarding Processes and Criteria for Selection, Assignment, Training and Certification of ISS (Expedition and Visiting) Crewmembers towards the end of 2001.[63]

---

[59] Though formally speaking, Art. VIII of the Outer Space Treaty does not provide for a 'nationality' of a spacecraft, for all practical purposes the effect of registration of a space object amounts to precisely that, following from the fundamental right to exercise jurisdiction on a quasi-territorial basis and the fact that a space object can only have one registration state. *Cf.* Registration Convention, *supra* note 4, Art. II(2).

[60] *See also* Young, *supra* note 18, 154-6.

[61] The registration of the US modules, as per Art. 5 of the Intergovernmental Agreement, basically could have allowed US criminal law to be applied on board those modules on a quasi-territorial basis, were it not that Art. 22 imposed nationality as the basis for exercising jurisdiction in a criminal law context. Intergovernmental Agreement, *supra* note 27, Art. 5. In view of its nature, NASA obviously would not be part of any such US exercise of criminal jurisdiction, but that is essentially a US sovereign choice, not predicated by international law. *See also infra* § V.

[62] *Cf.* 51 U.S.C. § 20135 for the relevant arrangements in US law in this context. *See also* Young, *supra* note 18, 171-4.

[63] At Principles Regarding Processes and Criteria for Selection, Assignment, Training and Certification of ISS (Expedition and Visiting) Crewmembers, http://www.spaceref.com/news/viewsr.html?pid=4578 (Nov. 2001). *See also* R.P. Veldhuyzen & T.L. Masson-Zwaan, *ESA Policy and Impending Legal Framework for Commercial Utilisation of*

This document defines 'spaceflight participants' as including crew-members of non-Partner space agencies, engineers, scientists, teachers, journalists, filmmakers or tourists, and provides for specific guidance regarding the extent to and conditions under which amongst others such tourists might be allowed on board of the *ISS*.

Whilst it still makes sense to have NASA continuing to exercise this pragmatic version of US jurisdiction in the specific context of NASA-operated, -owned, and -controlled spacecraft, *vice versa* any extension of such exercise of jurisdiction *outside* of that context makes considerably less sense – and consequently is unlikely to come about. Even where the option of NASA astronauts flying on private vehicles is now being arranged for within the federal government, this only addresses the issue of whether the Federal Aviation Administration's (FAA) exercise of *its* jurisdiction over such private vehicles, notably the safety-related aspects of their flights, is sufficient for NASA to 'entrust' its astronauts to flights on them.[64]

B. FCC Jurisdiction over Space Communication Activities

Ever since the 1934 Communications Act, the US Federal Communications Commission (FCC) has the authority to license the use of "all the channels of radio transmission" within the United States or from US-registered vessels or aircraft elsewhere,[65] which as of 1970 has officially been confirmed to include the licensing competence *vis-à-vis* persons or entities interested in operating such channels to or from satellites in outer space.[66] In other words, with the help of licenses the United States through the FCC in principle

---

the European Columbus Laboratory Module of the ISS, in THE INTERNATIONAL SPACE STATION 54-6 (eds. F.G. von der Dunk & M.M.T.A. Brus 2006).

[64] *See, for example,* D. Messier, NASA, FAA Cooperate on Commercial Crew Program, PARABOLIC ARC, Feb., 27 2014, http://www.parabolicarc.com/2014/02/27/nasa-faa-cooperate-commercial-crew-program/. For the FAA's exercise of jurisdiction, see *infra* § IV.D.

[65] , Communications Act, 47 U.S.C. 151, §301 (2016). The scope of the Act does not only refer to US territory, but also includes in quasi-territorial fashion vessels and aircraft with US nationality. *See* P.A. Vorwig, *Regulation of Satellite Communications in the United States*, in NATIONAL REGULATION OF SPACE ACTIVITIES 422*ff* (ed. R.S. Jakhu 2010) and P.A. SALIN, SATELLITE COMMUNICATIONS REGULATIONS IN THE EARLY 21ST CENTURY 149-90 (2000).

[66] *See* Establishment of Domestic Communications Satellite Facilities by Non-Governmental Entities, Report and Order, 22 F.C.C. 2d 86, Appendix C, p. 1 (1970).

exercises jurisdiction over any satellite or other spacecraft – including human – operated from US territory or US-registered vessels or aircraft, namely to the extent that the use of radio transmission channels is at issue.

As to this licensing competence, furthermore, it allows the FCC both to ensure upfront, by way of the license requirements, that the use of radio channels in outer space will take place in conformity with the requirements considered necessary by the US government, and to monitor (at least in theory; with spacecraft obviously site visits are impossible and monitoring could only be done by radio-contact and other telemetry, tracking, and control devices) that post-grant the licensee will continue to comply with such requirements.[67]

By definition, however, this is limited to those requirements predicated by the FCC, hence effectively envisaged necessary prior to the actual launch of the space object (although there would be a limited opportunity to suspend a license post-grant in case one of the events specifically listed would occur[68]), and then of course only limited to those related to the actual use of radio channels. A fall-back clause offering further possibilities to exercise jurisdiction also post-launch arises from the authority to "[m]ake such rules and regulations and prescribe such restrictions and conditions, not inconsistent with law, as may be necessary to carry out the provisions of this chapter, or any international radio or wire communications treaty or convention, or regulations annexed thereto, including any treaty or convention insofar as it relates to the use of radio, to which the United States is or may hereafter become a party."[69]

An interesting final element in the exercise of FCC jurisdiction, in particular within the context of active debris removal, concerns the imposition by the FCC in the context of licensing satellite operators of orbital debris mitigation standards, notably an orbital

---

[67] *Cf.* Communications Act, *supra* note 62, § 303, esp. *sub* (b), (e), (f), (h)-(n) for such requirements and monitoring competences. *See also Id.* at §§ 307, 308, 312, 318.

[68] See *id*. at §§303(m)(1), 316.

[69] *Id.* at §303(r). While this provision has purportedly on occasion been used to address 'character' violations, including court-adjudicated criminal conduct unconnected as such to the radio station's activities, it remains questionable to what extent the FCC might be the proper authority to address such criminal law issues – read: whether this does not amount to a certain 'competence creep', better to be undercut by way of proper establishment of jurisdiction of the appropriate US authorities.

debris mitigation plan. This particular FCC authority emanates from a primary responsibility to license the use of satellites and operations for the general public's benefit also beyond the core of licensing their use of radio frequencies and orbital positions, and to effectively ensure that the occupation of orbital positions during or beyond the operational life of the satellite does not result in undue hazards to others operating in the same environment – or indeed to third-parties elsewhere, in particular on the ground.[70]

At the same time, the Commercial Space Launch Act[71] provides for the FAA's AST (the present 'label' of the Office for Commercial Space Transportation) to undertake a payload review for every launch to be licensed with the aim "to determine whether (…) launch [of the payload] would jeopardize public health and safety, safety of property, U.S. national security or foreign policy interests, or international obligations of the United States."[72] From that perspective, one could even argue that the FCC's exercise of its jurisdiction on this particular issue amounts to a sort of 'competence creep,' as orbital debris only tangentially relates to the proper issue of use of radio frequencies over which the FCC's core regulatory authority is to be exercised and would, from many perspectives, be more logically included as part of the payload review to be conducted by the FAA's AST.[73]

In any event, neither of the two would be able to currently address in any comprehensive fashion an effort at active debris removal. And while certainly laudable from an overall perspective of preserving outer space for future activities and developing international (space) law on the matter, this FCC 'competence creep' again

---

[70] 47 U.S.C. §303. Licenses should be handed out only if, *i.a.*, "the public interest" will be served thereby. *Id.* at § 309. *See also* 47 C.F.R. Pts 5, 25 & 97 (2016); and Futron, *Orbital Debris Mitigation: Regulatory Challenges and Market Opportunities*, at 3 (Mar. 15 2006).

[71] Commercial Space Launch Act, Pub. L. No. 98-575 (1984). *See also infra* §IV.D.

[72] 14 C.F.R. 415.51. For purposes of this review, the FAA AST will notably consult with the Departments of Defense, Department of State, and any other appropriate federal agencies such as NASA. *See* §415.57. For more on the FAA's role see *infra* §IV.D.

[73] It may be further noted that NASA, *inter alia* giving rise to its role in co-establishing the Inter-Agency Space Debris Coordination Committee, had started to address space debris and relevant mitigation measures as early as the beginning of the 1980s. *See* C. Williams, *Space: The Cluttered Frontier*, 60 J. AIR L. & COMM. 1166-67 (1995) and P.S. Dempsey, *Overview of the United States Space Policy and Law*, in NATIONAL REGULATION OF SPACE ACTIVITIES 392 (ed. R.S. Jakhu 2010).

raises issues as to how the exercise of US jurisdiction in outer space more generally should be established on a more coherent footing.

C. NOAA Jurisdiction over Space Remote Sensing Activities

A further US government entity exercising some substantial and direct measure of US jurisdiction over space activities concerns the National Oceanic and Atmospheric Administration (NOAA) within the Department of Commerce. Under the two national acts addressing the licensing of private remote sensing satellite operators, the 1984 Land Remote-Sensing Commercialization Act[74] as then superseded by the 1992 Land Remote-Sensing Policy Act,[75] NOAA was the government agency actually handling the licensing.[76] The licensing competence refers to private remote sensing systems, more particularly their operation and the follow-on handling of data generation, treatment, and distribution – and to only those aspects.[77]

Whilst the soon-to-be-expected private sub-orbital flights may not likely become involved in remote sensing operations (which would then essentially be private in nature, hence possibly subject to the application of the Land Remote-Sensing Policy Act), somewhat further into the future one cannot exclude such involvement either. The two currently leading contenders in prospective sub-orbital 'space tourism', Virgin Galactic and XCOR, have both indicated they would also entertain opportunities to fly certain small experimental payloads into the lower regions of outer space, and sooner or later a research or other institute might be interested in flying a remote sensing-experiment, with or without an accompanying researcher on board. At the same time, the general understanding is that NOAA jurisdiction is even further limited to *orbiting* remote sensing devices; excluding for example at least according to the letter both Moon missions and the aforementioned sub-orbital flights.

---

[74] Land Remote-Sensing Commercialization Act, Pub. L. No. 98-365 (1984).

[75] Land Remote Sensing Policy Act, Pub. L. No. 102-555 (1992). *See also* E. Sadeh, *Politics and Regulation of Earth Observation Services in the United States* in NATIONAL REGULATION OF SPACE ACTIVITIES 455-58 (ed. R.S. Jakhu 2010).

[76] See 51 U.S.C. §60121.

[77] 51 U.S.C. § 60121(a). *cf.* esp. *sub* (2): "In the case of a private space system that is used for remote sensing and other purposes, the authority of the Secretary under this subchapter shall be limited only to the remote sensing operations of such space system."

D. FAA Jurisdiction over Private Human Spaceflight

Obviously, the most directly relevant element of US jurisdiction for the current discussion is that of the FAA over private human spaceflight. Like the specific US government agency competences of FCC and NOAA addressed above, this competence also started out as a competence addressing robotic space activities.

When in 1984 with the Commercial Space Launch Act[78] the first fundamental possibility was created for private entities to start engaging in the provision of launch services for commercial purposes subject to a licensing regime, under the Secretary of Transportation's responsibility the Office for Commercial Space Transportation (OCST), which eleven years later was relocated' to the FAA, was made directly responsible for properly licensing those activities.[79]

Addressing the relevant possibilities for such private launch service providers to offer launches with expendable launch vehicles to customers interested in having their payload – usually a commercial communication satellite – launched into the desired orbit, the licensing focused essentially on the launch phase. This phase was supposed to begin at the "commencement of licensed launch activities" and to end, for "orbital launches, until the later of (i) Thirty days following payload separation, or attempted payload separation in the event of a payload separation anomaly; or (ii) Thirty days from ignition of the launch vehicle."[80] For non-orbital launches, this phase supposedly came to an end upon "completion

---

[78] See Commercial Space Launch Act, *supra* note 68. *See also* P.A. Vorwig, *Regulation of Private Launch Services in the United States* in NATIONAL REGULATION OF SPACE ACTIVITIES 405-16 (ed. R.S. Jakhu 2010).

[79] *Cf.* 51 U.S.C. §50903(d), indicating that the Secretary of Transportation, formally charged under the Act with supervising commercial launches, could call upon an executive agency to perform such tasks; in conjunction with § 50921, headed "Office of Commercial Space Transportation."

[80] 14 C.F.R. §440.11. Note that this 'definition' strictly speaking remains confined to the required insurance coverage or financial responsibility of the licensee. The Commercial Space Launch Act itself does not define launch other than as the effort "to place or try to place a launch vehicle or re-entry vehicle and any payload, crew, or space flight participant from Earth (A) in a suborbital trajectory, (B) in Earth orbit in outer space; or (C) otherwise in outer space, including activities involved in the preparation of a launch vehicle or payload for launch." 51 U.S.C. Sec. 50902(4). *See also* Kerrest de Rozavel & Von der Dunk, *supra* note 28, 146.

of licensed launch activities at the launch site," which presumably includes flight control and monitoring of the launch at the launch site.[81]

The Commercial Space Launch Act and its implementing regulations focused their licensing requirements on the safety and security aspects of the launch, which included third-party liability – partly since the United States as such might be held liable if such damage occurred in an international setting triggering the application of the Liability Convention.[82] Thus, a license is to be granted "[c]onsistent with the public health and safety, safety of property, and national security and foreign policy interests of the United States";[83] the licensing authority "may establish procedures for safety approvals"[84] or prescribe "any additional requirement necessary to protect the public health and safety, safety of property, national security interests, and foreign policy interests of the United States."[85]

Once actual launches of private manned launch vehicles were being contemplated seriously, the FAA firstly was provided with the authority to, mirror-wise as it were to the launch, also regulate and exercise its licensing competence *vis-à-vis* the re-entry of such vehicles – as obviously these launch vehicles should also return safely, and, as a matter of fact, the operators-to-be were focusing on reusable vehicles for commercial reasons as well. This was purportedly done by way of the 1998 Commercial Space Act[86] which resulted in the Commercial Space Launch Act to be "amended (...) to address liability and government indemnification concerns and to address licensing authority for RLVs [reusable launch vehicles]," thus allowing the FAA already in principle to start licensing re-entry operations in addition to launches.[87]

---

[81] 14 C.F.R. §440.11. Also, this provision actually addresses the required insurance coverage or financial responsibility of the licensee only.

[82] *Cf.* Liability Convention, *supra* note 3, Arts. I(c), II, III.

[83] *E.g.* 51 U.S.C. §50905(a)(1).

[84] 51 U.S.C. §50905(a)(2).

[85] 51 U.S.C. §50905(b)(2)(B).

[86] Commercial Space Act, Pub. L. No. 105-303 (1998). The Act was enunciated for addressing several and rather varied issues of space commercialization and the resulting involvement of private entities in space operations. *See* Dempsey, *supra* note 70, 389-90.

[87] Hughes & Rosenberg, *supra* note 44, 4. *See also Id.* at 19-24 (including references to FAA regulations drafted in consequence, 14 C.F.R. §401.5 (2000)). *Cf.* Commercial Space Act, *supra* note 83, §§14751-14753.

With the victory of Scaled Composites in the X-Prize contest[88] and the ensuing establishment of Virgin Galactic this process quickly gave rise to the conclusion that the most appropriate way to handle such flights on a more consolidated basis in the future would be to adapt the regime of the Commercial Space Launch Act, which had regulated launch activities precisely for similar reasons of public interests (notably safety-, liability-, and national security-related) to the specifics of launches with humans on board.[89] The result was the 2004 Commercial Space Launch Amendments Act[90] amending the 1984/1988 Act to achieve such goals, followed by further legal measures as part of the Code of Federal Regulations.[91]

Most fundamentally, the licensing obligation was now also applied to re-entry, whereas formerly it only applied to launches.[92] 'Re-entry' is defined to mean "to return or attempt to return, purposefully, a reentry vehicle and its payload, crew, or space flight participants, if any, from Earth orbit or from outer space to Earth";[93] in other words, still a somewhat vague and potentially broad definition, as no specific point of begin of a re-entry phase is indicated (whilst that phase may of course be presumed to have ended at the latest upon actual landing). The House Committee on Science then fortunately shed some further light in narrowing this loose 'definition' down to "that phase of the overall space mission during which re-entry is intentionally initiated," more specifically "when the vehicle's attitude is oriented for propulsion firing to place the vehicle on its reentry trajectory."[94] This seems to allow determination of the beginning of the re-entry phase rather precisely.

---

[88] Note that the FAA licensed the first-ever private flight into the edge of outer space of Scaled Composites' SpaceShipOne on 1 April 2004 using the Commercial Space Launch Act as amended in 1988. Commercial Space Launch Act Amendments, Pub. L. No. 100-657 (1988). Although an experimental airworthiness certificate under 14 C.F.R. Pts. 21 & 91 was also required. Hughes & Rosenberg, *supra* note 44, 37-8 & 66-7.

[89] *See Id.* at 21 ff. and P. van Fenema, *Suborbital Flights and ICAO*, 30 AIR & SPACE L. 399-400 (2005).

[90] Commercial Space Launch Amendments Act, Pub. L. No. 108-492 (2004).

[91] To wit 14 C.F.R. Chap. III: Commercial Space Transportation, Federal Aviation Administration, Department of Transportation.

[92] See also 51 U.S.C. §50904(a). See furthermore §§50904-50905, for the general licensing requirements. *See also* Hughes & Rosenberg, *supra* note 44, 21 ff.

[93] 51 U.S.C. §50902(13).

[94] Commercial Space Act of 1997, H.R. Rep. No. 105-347, 105th Cong., 1st Sess. at 21 (quoted in Hughes & Rosenberg, *supra* note 44, 20). *See also* Hughes & Rosenberg, *supra* note 44, 21.

Interestingly the broadness in particular of the applicable concept of 'launch' allowed the FAA to *de facto* regulate the whole sub-orbital trajectory at least as far as the near-term private sub-orbital flight projects are concerned, with the launch more or less seamlessly transitioning into the re-entry – and as far as public safety is directly at issue.

Launch and re-entry operations are still far from routine and actually presumably still hazardous – witness the 'informed consent' requirement giving rise to a strong defence by the operator against any claim for damage under contractual liability by a spaceflight participant now also giving rise to a waiver of liability.[95] Consequently, almost any behaviour of such a spaceflight participant that would be out of sync, whether during ascent, descent or even during the five minutes or so of micro-gravity to be experienced, such as for example what would make a spaceflight participant an 'unruly passenger' as this concept is known in aviation, would raise safety-related concerns, hence at least in theory be addressable under FAA rules, in the sense that licensing conditions could include specific requirements protecting the safety of flight in light of such 'unruly passengers.' Whether such paper requirements could actually preclude such unruly behaviour from endangering the safety of flight, *vice versa* whether more forceful instruments were to be called for *and* would be feasible (such as requiring physical restraint), would then of course be the next issue to be addressed.

Still, as long as sub-orbital flights do not provide transportation services across major sections of the globe effectively the comprehensive flight could essentially be thus regulated – as far as this concerns the safety-related activities in the broadest sense of the word. But what if two passengers marry on board or completely peacefully engage in another contract's signature? Or if, indeed, they start taking commercially-valuable high-resolution pictures from their windows, noting that presumably this would fall outside of NOAA's jurisdiction?

---

[95] *Cf.* Sec. 112, U.S. Commercial Space Launch Competitiveness Act. *See also* R.A. Yates, *State Law Limitations on the Liability of Spaceflight Operators*, 9/1 THE SCITECH LAWYER 15 (Summer 2012) and T. Knutson, *What is "Informed Consent" for Space-Flight Participants in the Soon-to-Launch Space Tourism Industry?*, 33 J. SPACE L. 105 (2007).

This is where the issue of absence of 'on-orbit' jurisdiction – the standard US term for jurisdiction in the realm of outer space[96] – for the FAA as asserted by the US Congress becomes a real issue. The FAA was authorized only to license launch and re-entry,[97] wherefore this jurisdiction does not amount to proper commercial, civil, or criminal jurisdiction. This lack of 'in-space jurisdiction' would in particular start to become a problem once flights would be extended beyond the sub-orbital 'hops' currently envisaged. Such a development would also essentially open up a major gap between, on the one hand, the international liability and responsibility of the United States under the space treaties for example for damage caused or threatened by commercial spaceflight operations due to unruly passengers being the root cause of such damage or threat thereof, and, on the other hand, the seeming possibility for – especially – the FAA to try and make sure by way of regulation that such unruly passengers will be duly restrained and prosecuted.

C. Jurisdiction over Celestial Bodies Resource Exploitation?

Looking yet further ahead, such an absence of 'in-space' jurisdiction also would become problematic in case of missions launched for the purpose of celestial bodies resource exploitation. While the

---

[96] *Cf.* Perlman, *supra* note 13, 940-1.

[97] *Cf.* 51 U.S.C. §50904 and Perlman, *supra* note 13, 930, 935-7. *See also* GOV'T ACCOUNT. OFF., INDUSTRY TRENDS, GOVERNMENT CHALLENGES, AND INTERNATIONAL COMPETITIVENESS ISSUES, GAO-12-836T, 19 (2012). Strictly speaking, §50904 only refers to 'launch' and 're-entry,' without specifying whether this does encompass (parts of) the flight in outer space, which of course also means that in the licensing process the FAA will keep an eye out also for what might happen in the outer space-portions of any space object's flight, if only for international third-party liability reasons, and insert as possible relevant conditions, for example in a safety approval if at issue. Furthermore, firstly §50902(4), defines launch with reference to placing or trying to place spacecraft, manned or unmanned, into outer space, *suggesting* that the in-space part of the operations should no longer be defined as part of the launch – but since normal payload separation *does* take place in outer space, one cannot simply assume that there is *no* FAA jurisdiction in outer space whatsoever as such. Secondly, it may be noted that 14 C.F.R. §440.11 requires insurance obligations under a launch license to cover the period up to thirty days from payload separation alternatively from the launch properly speaking, apparently extending FAA authority over the licensed operations to that extent into outer space also. The underlying rationale for these limitations largely seems to refer back to a hesitation on the part of the United States to exert extra-territorial jurisdiction in the 'global commons' of outer space. *Cf.* Perlman, *supra* note 13, 942*ff*. Nevertheless, the whole approach could obviously be made much more straightforward, simple, transparent and coherent.

FAA could and would, again, regulate launch and re-entry, possibly extending somewhat into any in-between operations as long as related to the overall safety of the flight and the consequent re-entry, such jurisdiction normally speaking does not extend to any on-site harvesting operations of the licensee. This, in spite of the risk that such operations may invoke the United States' international responsibility and liability, as well as require some US protection in the international realm in view of the discussion referred to earlier on political and legal ramifications.[98]

While Title IV of the U.S. Commercial Space Launch Competitiveness Act represents a laudable effort to develop a first measure of US regulatory authority over private resource exploitation missions on celestial bodies, it still leaves open the question regarding which part of the US government should actually exercise that authority for the purpose indicated, as it merely provides that a report is to be submitted around the time of writing "that specifies – (1) the authorities necessary to meet the international obligations of the United States, including authorization and continuing supervision by the Federal Government; and (2) recommendations for the allocation of responsibilities among Federal agencies for the activities" concerned.[99] To that extent also the new Act still begs the question how such 'in-space' jurisdiction should be established and exercised in the US context, in this particular realm of celestial bodies resource exploitation – and more generally in outer space when private US companies are concerned.

Again, the current absence of any detailed regime both gives rise to an unacceptable measure of legal uncertainty for any *bona fide* endeavours to undertake celestial bodies resource exploitation, and would allow the United States to take the lead and set the precedent at the international level for such a regime. It would also, consequently, give the United States a strong legal argument to protect any such activities duly licensed, including with due regard for the global public interest as reflected in US obligations under international space law.

For example, the licensing regime should reflect and respect the absence of territorial sovereignty and appropriation, the impos-

---

[98] See *supra* at §III.D.

[99] Sec. 51302(b).

sibility for permanent ownership of celestial bodies as such (as contrasting in particular to that over mineral resources once extracted), should not prejudice other states' rights, interests and potential activities with regard to the celestial body at issue, including in particular as regards scientific exploration, and should incorporate an appropriate registration, liability, and insurance regime. As said, the reference in Title IV to continued compliance by the United States with its international obligations should be seen as addressing precisely these issues.[100]

V. TOWARDS SOME FORM OF 'IN-SPACE' JURISDICTION OVER SPACE OBJECTS IN THE US CONTEXT

Interestingly, even apart from the specific realm of intellectual property right protection the United States does already exercise jurisdiction of a rather more comprehensive nature in outer space – namely when it comes to criminal jurisdiction *per se*. The Federal Criminal Code applies to "[a]ny vehicle (...) in space and on the registry of the United States pursuant to the [Outer Space Treaty] and the [Registration Convention], while that vehicle is in flight."[101] In other words, the United States applies its criminal jurisdiction on a quasi-territorial basis to US-registered space objects.

While that application thus addresses crimes, including economic crimes such as money laundering, in space, it might not seem to address more normal commercial behaviour, mining activities outside of US-registered space objects or even such events on board as 'unruly passengers' if they would not meet the threshold of criminal conduct.[102]

More importantly, it is far from clear how the US criminal law system would (attempt to) apply to such 'in-space' activities in practice, without any expert agency involved to make it work. In spite of its official stance that no boundary should be formally established (yet) between airspace and outer space, this application of the Federal Criminal Code also implicitly recognizes the clear international legal difference between the two realms. As for airspace namely, the Tokyo Convention – to which the United States is also

---

[100] See Sec. 51302.

[101] 18 U.S.C. §7(6) (2006), as quoted by Perlman, *supra* note 13, 937.

[102] So *e.g.* Perlman, *supra* note 13, 937.