Space Tourism: Regulatory Framework of Private Initiatives and Projects with a Special Interest on RLV Regulations (IAC-06-E6.1.08)

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ABSTRACT

The airline experience has shown us that it is not just technology that provides safety but the maturity that comes from a high level of flight activity.
Entrepreneur Burt Rutan before the U.S. Congress on 20 April 2005.

Independent market research data compiled over the last several years shows that commercial space travel has the potential to be a billion-dollar industry in the next 20 years and the success of RLV (Reusable Launch Vehicles) projects has contributed to this observation. In April 2005, SpaceShipOne designer Burt Rutan as one of several entrepreneurs in the emerging commercial space market reported before the House Subcommittee on Space and Aeronautics in the attempt of the Congress to define what role the government should or should not play in supporting entrepreneurial space progress. Public interest has to be served by creating a clear legal, regulatory safety regime and certification for commercial human spaceflight carried on by private companies.

I. INTRODUCTION: SPACE BUSINESS AND COMPLEXITY

The structure of space industry evolves rapidly due to the technological and commercial progress and strategies. Space faring nations increasingly recognized the potential of outer space whose commercial prospects lead to significant participation by the private sector.[1]
Due to its complex structure and from a strict legal point of view, space business is particularly difficult to regulate.

Satellites or others space objects are at the same time "space assets", commercial items, money providers and actors of international public space law. The *corpus iuris specialis* is in the meantime more than forty years old. Its conventions were drafted during the cold war period and influenced by the fierce competition between the two only space faring nations of the time, the U.S. and the former USSR.

Any other space business venture involves an extraordinarily high amount of money along with a remarkably high level of technology requirement. If, in the early years, governments were the only actors involved in outer space activities, the commercialization of outer space increasingly influences the typical

[1] S. Freeland, *Up, Up and...Back: The Emergence of Space Tourism and its Impact on the International Law of Outer Space*, Chicago Journal of International Law, vol. 6 No.1, Summer 2005 at p.5.

customers profile and the current needs of the space business industry. The problems the satellite industry has been recently facing due to the privatization and the commercialization is an illustration thereof. With the development of yet dynamic projects involving space tourism, other major issues, questions and problems come to the fore. Existing international space law will need to keep pace with technological and commercial progress. With the commercial development of the space tourism industry, hence of Reusable Launch Vehicle (RLV) technologies, there is a crucial need for uniform, clear national and international regulations.

A space business venture involves the participation of a significant amount of actors, as well as it requires several and various licenses and authorizations. The financing of the space sector evolved considerably. As an illustration, satellite financing was twenty years ago rather straight forward: *Governments were using their treasury, the few private groups involved in the satellite " business" had enough cash treasury, while the few private groups owned to rely on pure equity financing. The banks involved were providing loans only when the corporate treasures preferred to leave the cash untouched. For example, the European Investment Bank would occasionally finance Eutelsat, as is convenient between governments.*[2]
That situation changed in the late 1980s. First and as a consequence of the cyclical downturn that affected satellites markets, there was a lack of new financial backers and the satellite community started to search for other sources of financing, such as commercial sources. Second, the profiles of the customers interested in space financing constantly evolve due to an actual trend towards the commercialization of space.

Typical customers, such as governmental or intergovernmental agencies, and large multinationals with a long credit history and capable of guaranteeing the entirety of their assets are not anymore the only ones looking for financial resources. Start-up companies with no real credit history and no assets to offer as collateral other than a satellite are the new generation of clientele. Raising the necessary capital for any space activity is extraordinarily difficult, also based on the amounts required and the many risks involved.
In the example of the satellite industry: *Such satellites will be typically commercial communication satellites each of which with an estimated value of 75-100 million U.S. dollars. It is anticipated that more than 1,000 satellites for commercial telecommunications will be launched over the next decade and generating well over 500 billion U.S. dollars in revenues. Clearly, this represents a unique opportunity for asset-based financing.*[3]

The success of the RLVs and the hopes raised in this technology are another key step on a further and continuously growing commercialization and privatization of space business. SpaceShipOne and SpaceShipTwo are entirely privately funded projects by a very successful space entrepreneur, Sir Richard Branson. Smaller companies involved in the space sector or wishing to do so, do not have such an asset(s). These figures do not allow to

[2] S. Chenard, *Financing satellites: easier said than done*, Air & Space Law Europe, vol.1, issue 1,1999, p. 29-32

[3] Martin J. Stanford & Alexandre de Fontmichel, *Vue d'ensemble de l' avant-projet de Protocole sur les questions spécifiques aux matériels d'équipement spatial et son examen par le COPOUS*, Uniform Law Review (2001-1), p.61-77.

acknowledge the existence of an open access to space commercialization. The access is made rather restrictive.
The authors of this paper will accordingly address the issue of whether the Draft Protocol to the Convention on International Interests in Mobile Equipment on Matters specific to Space Assets[4] [hereinafter Space Protocol] could contribute to change this situation. The development and sustainability of RLV technology is the cornerstone of the development of a viable commercial space tourism industry. In order to understand how critical this path is, it is first necessary to introduce the concept of RLV as well as the evolution of their regulation.

II. REUSABLE LAUNCH VEHICLES: AN INTRODUCTION

A- Key Feature for Space Tourism

A RLV, a Reusable space vehicle or a reusable launch system can be defined as a launch vehicle capable of launching into space more than once, in contrast with expendable launch vehicles (ELVs) or systems where the launch vehicle is discarded after the launching.
An expendable launch vehicle is made up of one or more rocket stages. After each stage has burned its compliment of propellant, it is expended (jettisoned from the vehicle) and left to crash back to Earth. As an example, the entire Saturn V rocket was expended while sending humans to the Moon. The U.S. Space Shuttle, which transports astronauts to Low Earth Orbit and back, is reusable.

The vehicle charged with a payload or with humans is released to space from a shuttle or launched on top of an expendable and then operates in space. At the end of the mission the RLV will de-orbit, return to Earth and can be used again for other similar missions.
As space vehicle designed to perform multiple missions and being re-used, RLVs dramatically reduce the cost of access to low orbit, a quality desirable for various types of missions, including human trips to and from space. Moreover, RLV construction costs could be amortized over multiple launches, reducing the financial charge not only for governments but also at the same time opening access to space to private commercial users.

However, the technical challenges of designing a system to fly to orbit and return are phenomenal. RLV technology development is thus an extremely challenging enterprise, "not only technologically and operationally but as well in terms of performance requirements, market developments and costs." [5]

A number of government research projects, most notably in the United States the X-33, X-34, X-37 and X-38, were initiated to develop and test new RLV technologies to reduce the risk of developing a next generation of RLVs. At the same time, a number of entrepreneurial companies have developed their own RLV concepts in an effort to reduce launch costs and undercut established launch vehicle providers.

Historically, payloads have been government and commercial communications satellites, such as satellites, remote observation satellites as well as many other types of unique spacecraft.

[4] UNIDROIT draft Space Protocol www.unidroit.org

[5] 2004, U.S. Commercial Space Transportation Developments and Concepts: Vehicles, Technologies and Spaceports, FAA/AST.

In terms of RLVs, there are no true orbital launch systems in use at present. The Space Shuttle is the first and remains actually the only operational partially reusable launch vehicle. The orbiter, which includes the main engines, and two solid rocket boosters, are reused after several months of refitting work for each launch. The external fuel drop tank is discarded.
The former Soviet Union developed Energia-Buran, a partially reusable launch vehicle similar to the U.S. Space Shuttle, which however only flew once in 1988. The Shuttle Buran program was eventually abandoned in 1993.

In terms of other planned orbital initiatives, one can find the PlanetSpace Silver Dart, a partly reusable spaceplane, based on hypersonic glider design, SpaceX Falcon 1, announced as partially reusable, but the maiden flight on March 24, 2006 failed; SpaceX Falcon 5/Falcon 9, announced as fully reusable whose maiden flight is scheduled for the first quarter of 2008; Skylon, an airbreathing SSTO spaceplane, the Kistler Aerospace K-1, Hopper (proposed reusable European launch system) and the RLV/Avatar, a proposed reusable Indian launch system for small payloads. The Excalibur Almaz initiative, whose holding is headquartered on the Isle of Man, is by far the most ambitious.[6]

If orbital RLVs are supposed to be a vector for a high reliable space access by providing low costs, reusability, however implies weight penalties such as reentry shielding and possibly a stronger structure to survive multiple uses, and given the lack of experience with these vehicles, the actual costs and reliability are yet to be seen. These entrepreneurs are well aware of the latter, as commercial risk reduction is a key to the success of such ventures.

B- RLVs Regulations in the United States: a Brief Genesis

The RLV regulations were subject to hesitations, uncertainty and lacked uniformed system of legislation. Private space entrepreneurs, such as Burt Rutan addressed virulent critics to the FAA and on the AST applicable regulations.
Gary C. Hudson, in his testimony before the House Subcommittee on Space and Aeronautics in November 2003, reproached the AST to have grown increasingly bureaucratic and not up to challenge of the RLVs technological development. He established a comparison between the U.S. regulatory system to the one established for commercial launches in the Russia Federation: *There are no launch licenses, no environmental impact statements, no two-year process costing hundreds of thousands of money. Provide your insurance certificate, submit proper notifications and you are good to go. Bureaucrats from the former Soviet Empire are more sensible than we are.*[7] He went as far as suggesting the closing of the AST, as in his opinion, no third parties were really at seriously high risk from space launch activities. He further invited the withdrawal of the United States from the 1972 UN Liability Convention.
According to Burt Rutan declarations in 2003 and to the documents provided by Scales Composites at the rollout, SpaceShipOne was conducting the flight tests under experimental license to avoid the burden of the regulatory costs.

[6] Excalibur Almaz Ltd.

[7] Available from www.house.gov/science/hearings/space03/nov5/hudson.pdf Accessed on 30 July 2006.

Developers of RLVs have been concerned with the potentially high cost of the regulatory paperwork. "To go from an experimental vehicle to a certified vehicle is typically a ten times increase in price, on the rough order of magnitude" as put by X-Prize chairman Peter Diamandis during the Space Access 2003 conference in Scottsdale, Arizona. Dan DeLong, chief engineer for XCOR Aerospace, estimated certification costs up to 100 times as much as development. *It's tough raising the money to build the vehicle [...] but if you have to certify it before you're allowed to make money with it, it will be 100 times harder and it just won't happen.*[8]

However, according to FAA officials and industry executives, the regulatory issues, while significant, may not be as big an obstacle as some entrepreneurs fear. Although the various issues and obstacles regarding RLV licensing may create an antagonistic relationship between the companies and the government, the FAA and the industry representatives made it clear that the two sides get along quite well with each other. The AST wants to be proactive and anticipate industry needs in order to reduce regulatory risks.

While against regulations imposing perfect safety that would stop everyone to fly, Jeff Greason, president of XCOR Aerospace declared: *I don't think it's bad in a free society to have a situation where certain minimum requirements have to be imposed on people before they can launch something with destructive potential that can kill people. The mere presence of a federal agency requiring you to demonstrate a certain level of public safety is not bad. The details can be quibbled over, but we need something, because if we don't have something someone is going to go out and kill 100 people with a rocket.*[9]

As to RLVs, until the U.S. Space Act of 2004, there was no express statutory jurisdiction for the licensing and safety regulation of private human space flight. Moreover, until very recently, only ELVs and certain types of ballistic missiles were available for private sector use.

After President Bush presented its " Vision for exploration" in January 2004, the United States issued during the same year a new National Space Transportation Policy recognizing commercial human space flight: *To exploit space to the fullest extent [...] requires a fundamental transformation in U.S. space transportation, capabilities and infrastructure. In that regard, the United States Government must capitalize on the entrepreneurial spirit of the U.S. private sector, which offers new approaches and technology innovation in U.S. space transportation, options for enhancing space exploration activities and opportunities to open next commercial markets, including public space travel.*[10]

The 1984 Commercial Space Launch Act [hereinafter the CSLA] is the principal legislation governing the licensing and the regulation of commercial space transportation. The law was drafted

[8] Jeff Foust, *RLV regulation: licensing vs. Certification* Monday, April 28, 2003. Available from www.thespacereview.com/article/18/1

[9] *Ibid.*

[10] Vision for Exploration for Space and a New National Space Transportation Policy the 21st of December 2004 establishing Guidelines and Actions to ensure Nation's Ability to maintain Access and Use of Space. Available from www.ostp.gov/html/Space/TransFactSheet2005.pdf Accessed 12 June 2006.

especially for the commercial ELVs and established the Department of Transportation (DOT) as the lead branch authority to oversee and coordinate space launch activities in the U.S.
In 1990, a license needed to be issued on the reentry of a vehicle, COMET, a vehicle developed in conjunction with NASA Center for the Commercial Development of Space, for the purpose of returning experimental payloads from space to Earth. The DOT delivered for the first time a licensing reentry, however in order to avoid exceeding its bounds of authority, the license was issued by focusing exclusively on public health and safety issues.
Consequently at that time there was no clear and identifiable statutory authority for the licensing of payloads, as DOT was considered as the licensing authority exclusively for ELVs.

In 1998, nevertheless, the Congress amended the CSLA to explicitly grant authority to the FAA to license the return of vehicles from space to Earth and extend the DOT licensing authority to reentry vehicle operators.

In 2000 the FAA's Office of Commercial Space Transportation (AST) issued final rules defining the licensing process for RLV missions, including RLV missions with on-board crew and reentry of a reentry vehicle. On-orbit operations were excluded from the scope of the FAA license.

Despite the Congress enactment of legislation extending licensing authority and indemnification for reentry flights and the above regulations of the FAA, it was not clear what the FAA approach was to hybrid regulations for hybrid concepts combining both airframe and rocket characteristic and technology. Should they be regulated as civil aircraft (FAA civil aviation, AVS Aviation Safety) or as launch vehicles subject to licensing standards established by AST, or under both regimes? Another issue is whether they were considered as "suborbital rocket" under the provisions of the CSLA? According to the HR 3752 bill, AST was the primary and central entity regulating "all commercial space flight authority, including authority to regulate commercial human space flight."[11] Due to the fact that the CSLA did not define the term "suborbital rocket" the classification of hybrid vehicles remained open to interpretation. In fact there was no need for such definition until the advent of the private sector RLV technology development. One important issue was therefore to clearly avoid two separate regulatory regimes.

The experimental permits now issued by the FAA were previously absent from the regulatory landscape for licensing rockets. These permits were called for by the HR 3752 to allow for RLV research and development similar to experimental airworthiness certificate issued in the aviation area. By issuing the experimental permits the intention was to grant more quickly and with fewer requirements than licenses.
The Committee Report instructed AST to work closely with the applicants on a case-by-case basis to determine what modification may be made to suborbital rocket without changing the vehicle design

[11] Commercial Space Launch Amendments Act of 2004. Available from http://thomas.loc.gov/cgi bin/query/D?c108:1:./temp/~c108CuqpzE::Library of congress THOMAS Accessed on 12 June 2006. *See also,* the detailed article of T.R. Hughes and E. Rosenberg, *Space Travel Law (and politics): The Evolution of the Commercial Space Launch Amendments Act of 2004*, Journal of Space Law, 2005, vol.31 (page 3-79).

to an extent that would invalidate the permit.

Thanks to the efforts of the U.S. Congress, the FAA accordingly issued the first-ever RLV mission license to Scaled Composites on April 1, 2004. Because of the hybrid nature, the FAA also required Scaled Composites to obtain an Experimental Airworthiness Certificate (EAC) under 14 CFR parts 21 and 91. Some of the tests flights needed an RLV mission license and others because of their short duration engine burn times, were to be conducted solely under the EAC. Twenty days after the FAA issued another mission license to XCOR Aerospace Inc., a multiple RLV suborbital mission based exclusively on plans and blueprints, as the Sphinx vehicle had not yet been constructed. The HR 3752 was a general framework for the 2004 Space Act.
Under the above Space Act The FAA is required to issue the experimental permits in order to allow for RLV research and development. It is a more rapid regulatory procedure with fewer requirements; shorter review period and involving a different approach to public risk analysis than the one employed by the FAA in issuing launch licenses. The experimental permits however are issued only under restrictive conditions such as the R&D testing for new design concepts, equipment or operating techniques. Consequently, once an operator obtains a license to operate the vehicle, the latter can no longer be operated under an experimental permit.

One major difference, however, is that the definition of suborbital rockets is much broader, allowing a wider range of vehicles to be defined as such: a *vehicle, rocket-propelled in whole or in part, intended for flight on a suborbital trajectory, and the trust of which is greater than its lift for the majority of the rocker-powered portion of its ascent.*[12]

Jurisdiction for orbital operations remains undefined under the current regime.
Suborbital flights are at present the major issue to be dealt with under the current legislation. SpaceShipOne launched successfully a new era making human suborbital flight possible. Ambitious similar initiatives are being developed, however none of them did materialize so far. As vehicle technologies develop, RLVs may provide point-to-point delivery and transportation services on a suborbital and orbital basis. It is not clear what will be the applicable law. It is to be expected that the issues will depend on different national legislations. One can thus wonder how the standardization, so necessary to ensure the development of commercial suborbital or orbital flights, will be achieved.

C- Existing Projects and Private Initiatives

The 1990s saw increasing interest in the development of new reusable vehicles. The military Strategic Defense Initiative program "Brilliant Pebbles" required low cost, rapid turnaround space launch.[13] From this requirement came the McDonnell Douglas Delta Clipper VTVL SSTO. From a commercial point of view, large satellite constellations such as Iridium were proposed which also had low cost space access demands. The nineties

[12] 49 U.S.C. § 70102(19) (2000 & Supp. 2005).

[13] Available from http://www.missilethreat.com/systems/bp_usa.html Accessed on 18 June 2006.

hence encouraged the development of a private launch industry, including partially reusable vehicle players, such as Kistler, and reusable vehicle players such as Rotary Rocket.
The end of that decade saw the implosion of the satellite constellation market with the bankruptcy of Iridium and the nascent private launch industry collapsed. The "Brilliant Pebbles" program was abandoned due to the collapse of the former Soviet Union. The EELV program replaced the old expendable launchers evolved from ballistic missiles.

From the eve of the 21st century, rising costs lead to cancellation of both the X-33 and the X-34 program. Then followed the dramatic event of the Space Shuttle Columbia disaster that lead to the suspension of the Shuttle program until the summer of 2005.

With the Ansari X-Prize competition, inspired by the aviation competitions made hundred years before, a new entrepreneurial era in space was launched. Among many private competitors that disputed the Ansari X-Prize, Scaled Composites won with the reusable SpaceShipOne ten million dollars prize, by reaching 100 kilometers in altitude twice in a two week period with the equivalent of three people on board, with no more than ten percent of the non-fuel weight of the spacecraft replaced between flights. While SpaceShipOne is suborbital like the X-15, the private sector hopes it can be eventually developed for reusable orbital vehicles.

On 17 December 2003, Scaled Composites, formerly the Rutan Aircraft Factory announced SpaceShipOne's first supersonic flight, the first flight of its kind by a privately funded aircraft. SpaceShipOne successfully made this flight, reaching 68000 feet and 930mph (Mach 1.2). The craft was brought aloft by the White Knight carrier aircraft. On the same day, Paul Allen, one of the founders of Microsoft, confirmed publicly the rumors that he was the angel investor behind the SpaceShipOne venture. On 1 April 2004, the U.S. Department of Transportation issued the company the world's first license for a suborbital manned rocket flight. The license was approved by the Federal Aviation Administration's Office of Commercial Space Transportation (AST). Scaled Composites Model 316 SpaceShipOne completed the first privately funded human spaceflight on June 21, 2004.

SpaceShipTwo is a suborbital vehicle currently under development by The Spaceship Company, a joint venture between Scaled Composites and Sir Richard Branson's Virgin Group of the U.K. The Virgin Galactic space line plans to operate a fleet of five of these craft in passenger-carrying private spaceflight service starting in 2008. The SpaceShipTwo craft is based on a technology developed for SpaceShipOne as part of the Scaled Composites Tier One program, funded by Paul Allen. Both SpaceShipTwo and its new carrier aircraft, Eve (or White Knight Two), will be twice the size of the first generation spacecraft and mothership that won the Ansari X-Prize. In August 2005, the president of Virgin Galactic stated that if the upcoming suborbital service with SpaceShipTwo is successful, the follow-up SpaceShipThree will be an orbital craft.[14]
Virgin Galactic remains convinced, nearly 18 months after the SpaceShipOne flight,

[14] Presentation of Mr. Whitehorn, President of Virgin Galactic, to European Centre for Space Law/ESA, yearly Practionners forum, Paris, 17 March 2006.

that space tourism will be a healthy and sustainable business.[15] Financially supported by Sir Richard Branson and the Virgin Group, Virgin Galactic is investing between $200 million and $240 million to build five SpaceShipTwo vehicles, with a first flight planned in 2008 or 2009 — a year or two later than originally planned. Passengers will be paying $200,000 each to make the flight, and will be permitted to leave their seats to experience weightlessness. The entire flight is expected to last about two hours.
The Virgin Galactic business plan calls for 50,000 passengers to be flown in the company's first 10 years of operations. With that revenue stream, the company is assured of an average 25 percent annual return on invested capital. Mr. Whitehorn declared the FAA could have killed all hopes for Virgin Galactic if it had insisted on full certification of SpaceShipTwo as an aircraft, which would have cost a billion dollars under the estimation of Virgin Galactic.[16]

III- UNIDROIT DRAFT PROTOCOL AS FINANCING MODEL LEGISLATION? AN ILLUSTRATION

ARCA (Aeronautics and Cosmonautics Romanian Association)[17] is a non-governmental organization promoting aerospace projects as well as other space-related activities. Officially registered in 1999, ARCA was founded by a group of Romanian students with no funds and no support but with passion and a strong will to change the limited space activities landscape in Romania.
The work for participation to the X-Prize Competition on the first rocket, Demonstrator 1, started in 2001. The results were positive and the vehicle was presented in August 2002. Soon after that, ARCA joined the X-Prize Competition in September 2002. The space suborbital vehicle ORIZONT, in competition at the X-Prize, developed by ARCA took 8 years to be created, built and being operational due to the cruel lacks of funds. ARCA actually developed projects in partnership with other international private or governmental organizations involved in the space business launch. The public projects of ARCA are financed mainly from donations and sponsorships.

The example of ARCA is one of the many illustrations of projects and initiatives that due to lack of financial support, took a huge amount of time to develop. In most cases, projects were abandoned. A developing country space operator or company would not be able to carry out a whole space commercial project technically or financially. Quite to the opposite, the SpaceShipOne and SpaceShipTwo initiatives were from the start supported by wealthy companies and successful entrepreneurs.
Moreover, space activities and respectively RLVs launches involve a high level of risks: market, schedule, regulatory and liability, export controls, technical risks, strategic risks and management risks.
Insurance is required and insurance premiums are prohibitive. Some states or companies will accordingly always be in the position to have access to space independently of the market changes and customer demands, while others will not.

Given the existence of the UNIDROIT Convention and its draft Space Protocol, it becomes interesting to assess if such a model protocol could be a way of developing and securing space commercial activities, including commercials business

[15] *Ibid.*
[16] *Ibid.*
[17] Available from www.arcaspace.ro Accessed on 14 July 2006.

plans based on RLVs transportation. The protocol could hence become a financial instrument that by addressing private law issues, would secure space business transactions.

As an illustration of the above, Dr. Fleissing, World Bank economist is of the opinion that "*the acute credit problems of many developing countries is a direct consequence of their security interest law. Their laws do not provide for the creation of secured interests in movable property; such interests cannot be perfected or enforced. Potential borrowers that own movable property, such as cars, airplanes or space assets can rarely borrow. Lenders in developing countries largely prefer real estate as a guarantee for their money.*"[18]

Similarly: "*If there were a line of credit, companies from developing countries could contract the specialized services of companies from developed countries. Developed countries would benefit directly through commercialization of components and satellites, this increasing jobs, profits and subsequent tax revenues.*" [19]

The main problem of a security interest in mobile equipment is the lack of recognition, priority or enforcement in one State. The space sector, due to its many specificities, cannot in a very efficient way be the object of a traditional security interest. Compared to other infrastructure projects, space business is for the most part, based on the credit worthiness of the borrower.

The main purpose of the Convention on International Interests in Mobile Equipment (CIME) is to facilitate the financing of the acquisition and use of mobile equipment. The instrument provides for an international regime for the enforcement, registration and protection of international interest in mobile equipment of particular financial significance such as airframes, aircraft engines and helicopters, railway rolling stock and space assets.

The Space Protocol is not only applicable to satellites, first items to be subject to a growing commercialization and privatization, but through its broad definition of space objects / space assets, it is relevant as well to the Reusable Launch Vehicles. Its draft Article I(2)(g), Definition of Space Assets, reads as follows: (i) Any identifiable asset that is intended to be launched and placed or that is in space; (ii) Any identified asset assembled or manufactured in space; (iii) Any identifiable launch vehicle that is expendable or can be reused to transport persons or goods to and from space; and, (iv) Any separately identifiable component forming a part of an asset referred to in the preceding sub-paragraphs or attached to or contained within such an asset.

Unfortunately, due to the fragmented space community encompassing individual satellite manufacturing companies, satellite operators, banks, insurance companies, regional intergovernmental organizations like the European Space Agency, national space agencies and space lawyers, the Protocol is currently still under consideration and no substantial advances have been accomplished from 2004.

It nevertheless remains that the draft Space Protocol remains a very interesting tool for the private sector to secure their investments. Space assets are not defined in any of the five space law treaties. It is

[18] Heywood Flessing, *Secured Transactions: The Power of Collateral*, Fin. & Dev., June 1996, p. 44

[19] Alvaro Fabricio dos Santos, *Developing countries and the UNIDROIT Protocol on Space Property*, Proceedings of the 45th Colloquium on the Law of Outer Space, IISL/IAF, Texas USA (2002), p. 23-32

also a very innovative financial instrument, as the security rights apply to the moveable thing itself. Moreover, the security rights also apply to the economic benefits (creditor rights) devolving from the use thereof. The draft Space Protocol is thus benefiting countries with different levels of economic and technological development that can take part in space activities by reducing the financial risk arising from these activities.
It is possible that the efficiency of such a protocol will be assessed on a short-term. Indeed, some nations that are not developing nations are considering adopting part of the model protocol in their legislation, such as, for example, the Isle of Man in the U.K.

CONCLUDING REMARKS

In any business venture, there is always a risk if an activity is pursued without a commercial perspective. Commercial risk reduction is hence critical. The approach of the draft UNIDROIT Space Protocol takes into account the importance of private activities in the future development of outer space activities, and the need to facilitate the establishment of adequate financing mechanisms. The new U.S. Space Policy guidelines include the development of international and commercial participation stressing the pursuance of commercial contributions and opportunities for providing space transportation to NASA.
The entrepreneurial risks in the space sector are many: technological, economic as well as institutional, legal and regulatory.

The Organization for Economic Co-Operation and Development (OECD),[20] encourages private sector participation in space applications. The OECD recommendations are divided into pillars. It is interesting to note, in terms of the need for standardization of the regulatory framework, the recommendations in the fifth pillar: *Recommendation 5.1* – Develop national space laws when none exists, or complement existing ones; *Recommendation 5.2* – Make existing space laws and regulations more business-friendly; *Recommendation 5.3* – Adapt international space laws to business needs; *Recommendation 5.4* *Special Focus* – Review the application of general laws and their impacts on the development of space applications.

The OECD also foresees the possibility that suborbital space tourism may be a critical path for commercial viability of orbital flights. If commercial success follows progressive technical mastery of suborbital flights, one may expect the initialization of a virtuous circle with a) more activities and accumulation of experience and, b) development of systems that fly faster and higher. Along this virtuous circle, the systems developed and operated for space tourism may converge with orbital space planes and RLV systems by 2030 and add into the operation of commercial RLV the experience accumulated with tourism to develop orbital space tourism.[21]

Space Entrepreneurship needs to be fostered as it creates opportunities.
In other words, space commerce needs…commerce.

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[20] OECD, Space 2030: Exploring the Future of Space Applications, OECD, 2004, ISBN 92-64-02032-2.
[21] *Ibid*, at 147.