# \*\*\*Case\*\*\*

# RLV Turn 1NC

A. For space tourism to be viable reusable launch vehicles have to be used

Ryabinkin, 2004

[Charity Trelease, JD Candidate, Georgetown University Law Center, Journal of Air Law and Commerce, “Let there be flight: It’s time to reform the regulation of commercial space travel,” [http://heinonline.org/HOL/Page?handle=hein.journals/jalc69&div=8&g\_sent=1&collection=journals]WZ](http://heinonline.org/HOL/Page?handle=hein.journals/jalc69&div=8&g_sent=1&collection=journals%5dWZ)

The successful development of space tourism is inextricably linked with favorable regulation of RLVs. As one expert stated, "[s]pace tourism more than any other commercial space ven- ture has the potential to support low-cost-launcher operations and therefore justifies development of RLV technology."3" A 2001 NASA study likewise concluded that only space tourism of- fers a large enough market to enable RLVs to reduce the cost of getting in to orbit.39 Access to space has been dominated by expendable launch vehicles (ELVs) since the inception ofspaceflight in the 1950s.4" While one-time-use rockets have an impressive track record, they suffer from one unavoidable defect: high cost.41 Current estimates put the cost of delivering one pound of cargo into Earth's orbit at $5,000 to $10,000.42 U.S. Space Shuttles re- present a reusable alternative to ELVs. Unfortunately, they too are prohibitively expensive; NASA has spent more than $3 bil- lion annually on its fleet of Shuttles.43 A Space Shuttle launch requires several thousand support personnel and two or more months of preparation, amounting to a launch cost of approxi- mately $20,000 per kilogram.44 More important, the Space Shuttle program has been a public relations disaster.45

It is not surprising, then, that a new class of spacecraft is emerging to provide a less costly means of delivering payload. As the name would suggest, reusable launch vehicles survive launch and reentry. Their capacity for repeated use enables them to recover the huge costs involved in building a launch vehicle and provides tremendous cost benefits over compar- able ELVs.46 According to some estimates, RLVs could reduce space launch costs from $10,000 per pound to $1,000 per pound.47

Such a radical reduction has obvious implications for space tourism - an industry whose costs are still far beyond the fiscal grasp of most people. While few could afford to spend $20 mil- lion dollars on a visit to space, lower price tags are sure to come with private development of RLVs. Because space tourism de- pends on the success of RLV development, the regulations gov- erning this industry must be reexamined."

B. RLVs are dangerous and result in debris and accidents

Ryabinkin, 2004

[Charity Trelease, JD Candidate, Georgetown University Law Center, Journal of Air Law and Commerce, “Let there be flight: It’s time to reform the regulation of commercial space travel,” http://heinonline.org/HOL/Page?handle=hein.journals/jalc69&div=8&g\_sent=1&collection=journals]WZ

The operation of an RLV carries more potential risk than the operation of an ELV.18 3 Because an RLV is designed to survive reentry and return to a particular reentry site, the likelihood of damage is doubled. Another reason the risk associated with an RLV is greater is that it uses a thermal protection system-if an RLV explodes during the launch portion of the flight, the result- ing debris would probably not disintegrate as easily as the debris caused by a similar ELV failure. 84 The heat of a rocket explo- sion would more likely cause the debris from an ELV to break into smaller pieces as it approached the ground. In contrast, an RLV failure would most likely result in larger and more danger- ous pieces of debris because the thermal protection system would keep heat in check and prevent further disintegration.18 5 Additionally, the larger debris from an RLV failure would also have a higher lift coefficient, which would make debris more likely to fly and disperse over a larger area than debris from a

comparable ELV failure. 18 6 Finally, an RLV is not designed to destroy itself during the launch process because they are in- tended for repeated use. RLV designers consequently will be more inclined to build their vehicles with higher fault tolerances. 87

More debris kill will destroy our satellites- they are key to hegemony and readiness

**Imburgia 11**{Lieutenant Colonel Joseph S. Imburgia, (B.S., United States Air Force Academy (1994); J.D., University of Tennessee College of Law (2002); LL.M., The Judge Advocate General’s Legal Center & School, U.S. Army, Charlottesville, Va. (2009)) is a Judge Advocate in the United States Air Force and is presently assigned as a legal exchange officer to the Directorate of Operations and International Law, Defence Legal, Australian Defence Force, Canberra, Australia. He is a member of the Tennessee and the Supreme Court of the United States bars, and he is a member of the Australian and New Zealand Society of International Law. Prior to becoming a Judge Advocate, Lieutenant Colonel Imburgia was a Targeting Officer, United States Strategic Command, Offutt Air Force Base, Neb., “ Space Debris and Its Threat to National Security: A Proposal for a Binding International Agreement to Clean Up the Junk”, http://www.google.com/url?sa=t&source=web&cd=1&ved=0CBYQFjAA&url=http%3A%2F%2Flaw.vanderbilt.edu%2Fpublications%2Fjournal-of-transnational-law%2Fdownload.aspx%3Fid%3D6574&rct=j&q=Joseph%20S.%20Imburgia%20is%20usaf%20University%20of%20Tennessee%20College%20of%20Law&ei=m9wITqmzFsfV0QHt4KnbCw&usg=AFQjCNEglOEqH\_3OfmcbgE6HXwiHKrBz8g&sig2=NRXHp8brVZYLKQSpoUqqFA&cad=rja}RC

These gloomy prognostications about the threats to our space environment should be troubling to Americans. The United States relies on the unhindered use of outer space for national security.151 According to a space commission led by former Secretary of Defense Donald Rumsfeld, “[t]he [United States] is more dependent on space than any other nation.”152 According to Robert G. Joseph, former Undersecretary for Arms Control and International Security at the State Department, “space capabilities are vital to our national security and to our economic well-being.”153 Therefore, a catastrophic collision between space debris and the satellites on which that national security so heavily depends poses a very real and current threat to the national security interests of the United States. Since “the [1991] Gulf War, the [United States] military has depended on satellites for communications, intelligence and navigation for its troops and precision-guided weapons.”154 Satellites are also used for reconnaissance and surveillance, command and control, and control of Unmanned Aerial Vehicles.155 According to the United States Space Command’s Fact Sheet: Satellites provide essential in-theater secure communications, weather and navigational data for ground, air and fleet operations and threat warning. Ground-based radar and Defense Support Program satellites monitor ballistic missile launches around the world to guard against a surprise missile attack on North America. Space surveillance radars provide vital information on the location of satellites and space debris for the nation and the world. Maintaining space superiority is an emerging capability required to protect our space assets. With the modern speed of warfare, it has become difficult to fight conflicts without the timely intelligence and information that space assets provide. Space-based assets and space-controlled assets have created among U.S. military commanders “a nearly insatiable desire for live video surveillance, especially as provided from remotely piloted vehicles like the Predator and now the Reaper.”157 Moreover, military forces have become so dependent on satellite communications and targeting capabilities that the loss of such a satellite would “badly damage their ability to respond to a military emergency.”158 In fact, the May 2008 malfunction of a communications satellite demonstrates the fragile nature of the satellite communications system.159 The temporary loss of a single satellite “effectively pulled the plug on what executives said could [have been] as much as 90 percent of the paging network in the United States.”160 Although this country’s paging network is perhaps not vital to its national security, the incident demonstrates the possible national security risks created by the simultaneous loss of multiple satellites due to space debris collisions.

U.S. hegemony solves nuclear war.

Zalmay **Khalilzad 95**(Dep. Secretary of Defense) Spring 1995 The Washington Quarterly.}RC

A world in which the United States exercises leadership would have tremendous advantages. First, the global environment would be more open and receptive to American values--democracy, free markets, and the rule of law. Second, such a world would have a better chance of dealing cooperatively with the world's major problems, such as nuclear proliferation, renegade states, and low level conflicts. Finally, U S leadership would help preclude the rise of another global rival, enabling the U S and the world to avoid another cold or hot war and all the attendant dangers, including a global nuclear exchange.

# RLV Turn 2NC: Turns Case

If there were an accident the industry would die

Ziliotto, 2009

[Véronique, European Space Research and Technology Centre, “Relevance of the futron/zogby survey conclusions to the current space tourism industry,” Acta Astronautica, [http://www.sciencedirect.com/science?\_ob=MImg&\_imagekey=B6V1N-4XC3X36-3-5&\_cdi=5679&\_user=655954&\_pii=S0094576509004378&\_origin=search&\_zone=rslt\_list\_item&\_coverDate=07%2F31%2F2010&\_sk=999339988&wchp=dGLzVzb-zSkzk&md5=707c5c4d99c0379d4546b9c5dd3af8fc&ie=/sdarticle.pdf](http://www.sciencedirect.com/science?_ob=MImg&_imagekey=B6V1N-4XC3X36-3-5&_cdi=5679&_user=655954&_pii=S0094576509004378&_origin=search&_zone=rslt_list_item&_coverDate=07%2F31%2F2010&_sk=999339988&wchp=dGLzVzb-zSkzk&md5=707c5c4d99c0379d4546b9c5dd3af8fc&ie=/)]WZ

The commercial future of suborbital space travel is deemed promising and the interest in private spaceflight has built up during the last few years.

Nevertheless, it still faces major challenges and win- ning the potential customers’ confidence about the safety of the flights is not the least one. An accident in the early phases of commercial operation could bring the industry to a halt and jeopardize its future.

Another difficulty faced by this nascent industry is its perception among space experts: SpaceShipOne’s 2004 achievement has been deemed as ‘‘insignificant in the overall scheme of space flight’’ by ex-NASA historian Roger Launius [9].

Yet the space industry needs to find new ways to fuel exploration dreams of mankind and reach a public that is increasingly loosing interest in science and technology, especially among young people. Private access to space for ordinary citizens would be a unique way to let a broader public, and especially politicians and decision-makers, get in touch with what is described by astronauts as the most thrilling experience one can have: seeing the beauty and fragility of Planet Earth from space.

# RLV Turn Extension: Yes Deaths

RLV flight is dangerous and can result in death

Hardy, 2005

[Terry, FAA, Office of Commercial Space Transportation, presented at the 1st International Association for the Advancement of Space Safety Conference, “Risk perception and communication in commercial reusable launch vehicle operations,” http://www.systemsafetyskeptic.com/yahoo\_site\_admin/assets/docs/IAASS\_Risk\_Perception\_Paper\_final.26865903.pdf]WZ

Space flight participants voluntarily choose to ride in an RLV. In fact, as in other activities such as skydiving or

hang gliding, the risk may be part of the thrill of performing the activity. The space flight participant activity would not be dreaded, would be seen as a chronic rather than catastrophic risk (catastrophic being defined as many deaths at one time), and the consequences are knowable. The risks are fairly distributed because the participants voluntarily choose to accept the risk, and there would probably be no moral concerns. On the other hand, the risk is not natural, the technology is not familiar, and memorable accidents such as Space Shuttle Challenger may make the activity seem risky. In addition, the space flight participants would not control the vehicle, increasing their perception of the risk. It is not clear whether their sources of information would be trusted or not.

# Warming Turn

Soot from launches would send temperatures soaring

Shiga, 2010

[David, contributing writer, New Scientist, “Two Words,” http://www.lexisnexis.com/hottopics/lnacademic/?verb=sr&amp;csi=158275]WZ

IF SPACE tourism ever gets off the ground, soot from rockets carrying travellers into space could disrupt the stratosphere and send temperatures soaring at the poles. in Los Angeles, California, and colleagues, modelled the effect of 1000 suborbital trips per year. They assumed they were fuelled by a rubber-burning engine similar to the one Virgin Galactic's SpaceShipTwo might use.

They found that soot would dwarf the effect of the carbon dioxide emissions from the launches. Rain washes soot from planes out of the atmosphere in days or weeks, but rocket soot, which reaches altitudes above 40 kilometres, can hang around for 10 years.

Soot absorbs sunlight, warming the stratosphere, and this could strengthen currents that carry air from the equator to the poles. The process may help explain why polar temperatures rose by 1 °C during winter in the simulations.

The extra warmth would also melt sea ice at each pole, especially in Antarctica, where seasonal ice cover shrank by as much as 18 per cent in the model (Geophysical Research Letters, in press). "It's not a pretty picture," says Charles Zender of the University of California, Irvine, who was not on Ross's team.

Future studies should use data on soot emissions rather than estimates, the team says.

Great view, pity about the poles.

# I-law = dissencintive

International law uncertainty makes a viable Comerica space tourism industry difficult

Freeland, 2006

[Steven, professor of International Law at the University of Western Sydney, Australia. “Up, up and . . . Back: The Emergence of Space Tourism and Its Impact on the International Law of Outer Space *Symposium: Issues in Space Law*,” Chicago Journal of International Law, <http://heinonline.org/HOL/Page?handle=hein.journals/cjil6&id=30&type=text&collection=journals>, 2005-2006]WZ

In the end, what is required is the development of laws at the international level-supplemented by laws at the national level-to meet these issues. Without a uniform set of widely accepted international rules, the development of space tourism activities will be restricted by uncertainty. However, in order to facilitate the emergence of a viable commercial space tourism industry, the principles will need to strike an appropriate balance between providing certainty and sufficient minimum standards on the one hand, and protection and encouragement of innovation on the other. 18 Before considering this issue further, this Article will raise a number of significant areas requiring legal clarification.

A new distinction between commercial aviation and commercial space flights needs to be developed to incentivize space tourism

Freeland, 2006

[Steven, professor of International Law at the University of Western Sydney, Australia. “Up, up and . . . Back: The Emergence of Space Tourism and Its Impact on the International Law of Outer Space *Symposium: Issues in Space Law*,” Chicago Journal of International Law, <http://heinonline.org/HOL/Page?handle=hein.journals/cjil6&id=30&type=text&collection=journals>, 2005-2006]WZ

The term "space tourism" has been defined as "any commercial activity offering customers direct or indirect experience with space travel"'9 and a space tourist as "someone who tours or travels into, to, or through space or to a celestial body for pleasure and/or recreation." 20 These definitions, though acceptable for the purposes of discussion, immediately give rise to the fundamental question: What is space? It may come as a surprise to most people to discover that, from a strictly legal perspective, there is as yet no clear definition of outer space-or put another way-it is unclear where (and how) air space ends and outer space begins. While outer space activities have continued to develop without significant restrictions notwithstanding this uncertainty, there are important practical reasons why a clear legal distinction between "commercial aviation flights" and "commercial space flights"'" should now be properly determined, given the impending advent of space tourist activities particularly involving suborbital flights. This is even more appropriate as the fundamental premises upon which air law and outer space law are respectively based are wholly divergent.

International law needs to be developed for space tourism

Freeland, 2006

[Steven, professor of International Law at the University of Western Sydney, Australia. “Up, up and . . . Back: The Emergence of Space Tourism and Its Impact on the International Law of Outer Space *Symposium: Issues in Space Law*,” Chicago Journal of International Law, <http://heinonline.org/HOL/Page?handle=hein.journals/cjil6&id=30&type=text&collection=journals>, 2005-2006]WZ

It has been said by one of the foremost space commentators that, in the context of meeting the new legal challenges which arise from ever expanding space activities, an essential element for effective rulemaking at the international level is a "perceived need on the part of the states concerned" to devise or change certain rules.69 We have reached the point where the development of space tourism activities makes it appropriate to reconsider the broad fundamentals of the international law of outer space. The corpus of space law that already exists represents an important base from which to develop the legal tools to properly regulate the next stage of space activities. Yet, quite clearly, it is not sufficient even for present purposes, let alone for the coming years and decades. The imminent advent of space tourism raises many as yet unanswered legal questions, some of which have been highlighted in this article. Other legal issues will also arise. As more space tourism (and other) activities take place, appropriate dispute resolution procedures must be agreed to deal with the inevitable conflicts that will arise, both at the public and private international law level. Detailed traffic and coordinated management systems must be developed to cope with the increased number of space flights. A clear and comprehensive legal framework must be established at the international level to reflect the wishes of the wider (global) community and to provide certainty. At the same time, however, the broader philosophical and ethical aspects of human activities in outer space-indeed the place of human beings in the universe-demand that we continually reassess the wy and what in relation to our ongoing exploration and use of outer space. It is essential that the underlying notions of cooperation and shared benefit remain as cornerstones in this next phase of human achievement.

# Investment = Prerequisite

Billions in investment is a prerequisite to affordable tourism

Elias, 2001

[Dr. Antonio Elias, chief designer of the Pegasus, former VP and current GM of the Advanced Programs at Orbital, Air and Space Europe, “Affordable Space Transportation: Impossible Dream or Near-term Reality?” ]WZ

Reducing the cost of space launch faces both financial and technological chal- lenges. The financial challenge is that any new launch vehicle development materi- ally improving launch cost will require investments at the level of several billion dollars, face considerable technical risks, and with a market demand that is uncer- tam at best. In the mid nineties, the promise of new and lucrative telecommu- nication opportunities based on constella- tions of medium-sized, new technology

satellites wet the financial community’s appetite for multi-billion dollar invest- ments and at the same time offered the potential for many hundreds of initial deployment and replacement launches over the next 10 years f&-we 1). Iridium, for example, represented a US$4 billion investment and a market for about a dozen new commercial launches per year, a sudden 50% increase on the traditional geosynchronous communication satellite launch market of about 25/year. Teledesic, with its original 924 satellites, expanded this potential market even further.

This financial and market bubble burst in late 1999 and 2000 with the bankruptcy of Iridium and Orbcomm, and the seri- ous doubts about the viability of a reduced Globalstar (with ‘only’ 288 satel- lites) and, in fact, any other low-earth orbit communication constellation. Ironically, if the cost of launch had been lower even by a ‘modest’ factor of two, the business viability of these ventures may have been sufficiently improved to insure their survival and success.

# Laundry List

Multiple barriers to space tourism – price, safety, small demographic, militarization, and ethical questions

Billings, 2006

[Linda, research associate, SETI institute, “Exploration for the masses? OR Joyrides for the ultra-rich? Prospects for space tourism,” Science Direct, http://www.sciencedirect.com/science?\_ob=MImg&\_imagekey=B6V52-4KGX8DJ-3-1&\_cdi=5774&\_user=655954&\_pii=S0265964606000440&\_origin=search&\_zone=rslt\_list\_item&\_coverDate=08%2F31%2F2006&\_sk=999779996&wchp=dGLzVzb-zSkzk&md5=19d0390683d1b497decb1827db774229&ie=/sdarticle.pdf]WZ

First, human space flight is dangerous and expensive. While there is no doubt that Burt Rutan is a brilliant inventor and designer, even he may not be able to break through the price barrier to commercial space travel. And if it does get off the ground, space tourism will be very pricey. Though Virgin Galactic claims it is ‘‘developing space tourism for everybody,’’ the luxury market is definitely the niche it is after [18]. Second, US interest in the greater militarization of space could get in the way of space tourism [19]. And third, the ethical, legal, and social implications of expanding human presence into space and allowing commercial operations in the space environment have not been thoroughly examined. Advocates claim space tourism will drive the commercial development of space. But is unfettered corporate activity in this environ- ment desirable? Humans are intrusive creatures, and wherever they have gone on Earth, they have made a mess of things: the idea of preserving pristine environments in space [20] deserves some serious consideration. With the 1967 United Nations Treaty on the Peaceful Uses of Outer Space as a foundation, a framework of international law and regulation needs to be put in place to govern commercial space activities.

Many obstacles prevent tourism—cost, safety, and credibility

**O’Neil et al 98** (Daniel, compiler at the Marshal Space Flight Center, February 19, Space News, “General Public Space Travel and Tourism - Volume 1 Executive Summary,” <http://www.spacefuture.com/archive/general_public_space_travel_and_tourism.shtml#Recommendations>)

However, substantial obstacles remain that prevent the immediate creation of a large scale business. Today, the cost of access to space for people using currently operational vehicles remains very high; a half-dozen astronauts can accompany the delivery of payloads to space on Shuttle trips that cost some $400 million each. In addition, the safety and reliability of operational space transportation vehicles is presently far too low: a risk of some 1-in-100 of failure involving fatalities may be acceptable today for government missions and for a few adventure travelers, but not for airline-like general public passenger-carrying operations which will have to be safer by several factors of ten. Finally, there has been a persistent lack of credibility because now it is generally thought that only NASA and the Russian government can send people to space and that they must be highly trained professional astronauts. This so-called giggle factor is especially prevalent among some experienced aerospace systems engineers unfamiliar with potential new capabilities that are inherent in recent technological advances and the increased insistence of the Congress that public spending in space result in greater economic growth, especially in the human spaceflight area. And they may not recall the enormous strides made in commercial aviation over just a few decades. The general public is actually more accepting of the idea of public space travel than these engineers.

# Legal Doubts

There are many legal questions about space tourism

Hobe, 2009

[Stephen, University of Cologne, Institute of Air and Pace Law, “The Legal Regime for private space tourism activities – an overview,” Acta Astronautica, http://www.sciencedirect.com/science?\_ob=MImg&\_imagekey=B6V1N-4XJF340-2-1&\_cdi=5679&\_user=655954&\_pii=S0094576509004251&\_origin=search&\_zone=rslt\_list\_item&\_coverDate=07%2F31%2F2010&\_sk=999339988&wchp=dGLzVzb-zSkzk&md5=af2e535b1af09b477d88c25d20407ab4&ie=/sdarticle.pdf]WZ

Viewed from a legal perspective, it thus becomes clear that questions of air law and space law may be involved [4]. This poses particular problems, because the rules of air law and space law are fundamentally different in character [5]. Air law is characterized by the sovereignty of the subjacent States over their airspace, whereas outer space is free for exploration and use according to Article I of the Outer Space Treaty.

Although we see such space tourism activity as one coherent activity and could thus think of a comprehensive aerospace convention, such convention does not yet exist. Rather, we have, on one hand, for example the basic law for aviation activities in the Chicago Convention of 1944 with its Annexes [6] and, on the other hand, the basic and fundamental law for space activities in the Outer Space Treaty of 1967 [7]. It is, however, certainly worthwhile to seriously consider the drafting of a comprehensive aero- space convention.

The problem

As has been indicated, although such a comprehensive convention is currently missing, many problems can still be solved by having recourse either to air law or to space law. In that respect, some of the most important legal aspects relevant to space tourism activities shall be indicated in the following:

(a) There is, first of all, the crucial question of the delimitation of airspace and outer space [8]. This question is not finally settled in law; however, almost finally settled in practice. There is an engaged discussion about such delimitation that stems from the beginning of the space age. It used to have military background and has today lost a lot of its factual importance. Therefore, it is only consequent that, for example, the new Australian national space law precisely lists delimits the airspace from outer space at a height of 100km above sea level [9]. Even before, according to the different theories of separation of airspace and outer space, one could say that the delimitation of airspace and outer space is somewhat between 80 and 110km above sea level. And in the foreseeable future, the International Institute of Space Law will come up with a proposal to settle this problem even in law. Somewhere between 80 and 110 km above sea level the delimitation will probably be somewhere around 100km which equals the highest apogee of an airplane and the lowest perigee of a space object.

(b) Without any doubt, the International Space Station circulates in low Earth orbit which is part of outer space and thus, space law is applicable for any conduct of tourists in this environment [10]. This has been recog- nized explicitly in the respective Intergovernmental Agreement [11], and the ‘‘Memoranda of Understanding’’ [12], as the basis for the building of the International Space Station in 1998.

However, with regard to ‘‘SpaceShipOne’’ or other sub- orbital space activities, one must, in my opinion, differ- entiate between the function of an aircraft and the one of a space vehicle with different legal regimes. If space tourism activities are modeled on ‘‘SpaceShipOne’’, two objects must be distinguished: the aircraft and the space vehicle attached to the aircraft until the time of separation [13]. Quite obviously, air law applies to the aircraft used both before and after separation. The question then is whether the space vehicle can be considered either an aircraft of a part of the aircraft before and after separation.

As is well known, the term ‘‘aircraft’’ is mentioned in the Annexes to the Chicago Convention of 1944 as well as in some national air laws, such as Article 1 of the German Air Traffic Code. They are defined as ‘‘all machines which can derive support in the atmosphere from the reactions of the air’’ [14]. Until separation, the combined vehicle has the characteristics of an aircraft in terms of technical functions such as flight pattern and maneuverability: the space vehicle constitutes merely an additional cabin. Indeed, before separation, the space vehicle does not contribute to the propulsion and is fully dependent on the aircraft. Also, the dangers related to space missions are typically connected with the time of the launch, not with the transport by aircraft. Therefore, the aircraft and the attached space vehicle should be considered an aircraft until separation and air law should apply both to the aircraft and to the space vehicle before separation [13]. After separation, however, the space vehicle does not ‘‘derive support in the atmosphere from reaction of the air’’ and should not be considered an aircraft [13]. The vehicle may use the ‘‘reactions of the air’’ in the landing process, but it may be argued that partial fulfillment of the definition is not sufficient to qualify the vehicle as an aircraft [15]. The purpose of the vehicle at that point further supports the conclusion that the vehicle should

not be regarded as an ‘‘aircraft’’. Instead, the sub-orbital vehicle may be regarded as a ‘‘space object’’ after separation from the aircraft. There is no full definition of the term ‘‘space object’’ [16]. Both the Liability Convention and the Registration Convention illustrate that the component parts of a space object as well as the launch vehicle and parts thereof are included in the term ‘‘space object’’ [17].

As has been indicated, for the time being, the status of the entire zone between 80 and 110km is still in legal uncertainty. But, if an attempted launch suffices for the qualification of a space object, it is likely that the purpose of the object will become a decisive factor. After its separation from the aircraft, the sub-orbital vehicle might only reach an altitude just slightly below the low satellite perigee. Nonetheless, the vehicle clearly has the objective of reaching outer space as can be seen from such flights being advertised as space flights or space travel. Therefore, the sub-orbital vehicle after separation can be classified as a space object and space law should apply to the sub-orbital vehicle after separation from the aircraft [18].

(c) It turns out that questions of authorization of the activities are crucial. A decisive factor is whether the vehicle gets authorized as an aircraft or as a spacecraft. In that respect, next to the Federal Aviation Authority FAA, the European Air Safety Agency EASA could be such an authority [19]. As has been discussed, air law will likely be applicable to the aircraft and the attached space vehicle prior to separation if an air launch is undertaken. In contrast, space law may be applicable to the separated sub-orbital vehicle using rocket propulsion for thrust, as well as to the two space objects used when a space capsule is launched by a rocket. The authorization after separation has to be made, according to Article VI of the Outer Space Treaty, in line with the respective national space legislation. By now, only around 15–20 countries possess the respective national space legislation [20]. In that respect, countries must be encouraged to get more deeply involved in the process of drafting national space legislation [21].

(d) With regard to registration, such registration has to be made either according to Article 17 to 21 and Annex 7 of the Chicago Convention of 1944 for the airplane, or in pursuance to Article II of the Space Registration Conven- tion for the space plane. If space tourism activities are modeled like SpaceShipOne, the space vehicle should be considered as a part of the aircraft prior to the separation and should share its registration [22]. According to Article 17 of the Chicago Convention, an aircraft shall have the nationality of the State in which it is registered. The registration or the transfer of registration of the aircraft shall be made in accordance with the national laws and regulations of any contracting State to the Chicago Convention. Because air law provides comprehensive and detailed regulations, registration does not raise further difficulties in the context of air law.

After separation, the space vehicle should be registered as a space object in accordance with Article II of the Registration Convention. If there is more than one launching State involved, an agreement between the parties is required to determine which State shall register the launched space object. With respect to the Space- ShipOne model, it seems to be correct to consider the separation of the sub-orbital vehicle from its aircraft as the launching of the space object. Thus, the problem of possible dual registration resulting in a conflict of jurisdictions can be avoided. As a result, the space vehicle becomes a space object when it separates from the aircraft. From that moment on, the vehicle should be registered in accordance with the Registration Convention [23]. The State of registry of the aircraft would be the launching state. According to Article VIII of the Outer Space Treaty, the State of registry ‘‘shall retain jurisdiction and control over such object, and over any personnel hereof while in outer space’’.

(e) Of uttermost interest are questions of liability. Passenger liability involves liability for damage occurring while on board the aircraft. Here, the air law system of the Montreal and Warsaw Conventions (of Article 17 to 21) are applicable [24]. The modern Montreal Convention knows a two-tier system of liability [25]. In cases of passenger injury or death, the Montreal Convention provides for unlimited liability of carriers. In the first tier, i.e. for damages not exceeding 100,000 Special Drawing Rights the carrier is not able to exclude or limit its liability except to the extent where it can prove contributory fault of the passenger. The carrier may avoid liability in the second tier, i.e. for damages exceeding 100,000 SDRs only if the carrier proves that the damage was not due to the negligence or other wrongful act or omission of the carrier or its servants or agents or that such damage was solely due to the negligence or other wrongful act or omission of a third party. Limited liability, however, applies to damages in case of delay unless due to willful misconduct. Interestingly enough and importantly enough, there is no precise regulation of passenger liability in space law because the Liability Convention does not address these questions [26].

With regard to third-party liability, we have for airplanes the system of the Rome Convention and the current discussion on a renewal of this Convention which is not very well accepted to date. Unfortunately, also the two new conventions that came out of the diplomatic conference in May 2009 may not receive enough support [27]. On the other hand, for space planes the question is addressed by the Liability Convention of 1972. And as always with regard to liability, all comes down to the question of how much the risks incurred by space tourism activities are insurable. With regard to liability for medical risks exposure, we find at present mostly national rules regulating passenger liability. The regulation of reusable launch vehicles (RLV) by the Federal Aviation Administra- tion (FAA) was governed by the 1989 Commercial Space Launch Act [28] and the final rules of the ‘‘Commercial Space Transportation Reusable Launch Vehicle and Reentry Licensing Regulations’’. In 2004, the United States enacted the ‘‘Commercial Space Law Amendment Act’’ amending Chapter 701 of Title 49 USC. with the objective, ‘‘to encourage the development of a commercial space flight industry’’. The Act defines space flight participants as individuals who are not crew, carried

within a launch vehicle or reentry vehicle providing for additional license requirements for launch vehicles carry- ing a human being for compensation. On 11 February 2005, the FAA published the Draft Guidelines for Com- mercial Suborbital Reusable Launch Vehicle Operations with Space Flight Participants. On 29 December 2005, it released a Notice of Proposed Regulations of ‘‘Human Space Flight Requirements for Crew and Space Flight Participants’’. The final regulations were issued on 15 December 2006 and became effective on 13 February 2007 [29].

(f) The legal status of space tourists is rather unknown at the moment. There is national space legislation as we have just indicated before that gives specific treatment to so-called ‘‘space flight participants’’ [30]. Whether or not the space tourist should have a separate legal status is not yet clear. Any amendment to existing international law could be done either by a new convention or, more realistically, by a protocol to the Rescue Agreement.

# No Demand

The aff can’t solve – we need many more studies about market demand before space tourism can be a viable investment

Crouch, 2001

[Geoffery, Ph.D. Chair of Marketing at La Trobe University’s School of Business, “Researching the Space Tourism Market,” presented at the annual Conference of Travel and Tourism Research Association, <http://www.spacefuture.com/archive/researching_the_space_tourism_market.shtml>]WZ

In 2001, are we on the brink of a new space odyssey, the start of orbital space tourism? The current public interest in space tourism and the determined and persistent efforts of a number of entrepreneurs, space transport technologists, and other active proponents such as the Russians, the Japanese Rocket Society, and the Space Travel and Tourism Division of the U.S. Space Transportation Association lend credence to suggestions that it may be just years rather than decades away. One of the most encouraging signs is that many space policy experts are now advocating the development of space tourism as the most effective means of radically reducing the cost of space transportation systems and thereby signifi- cantly facilitating a new era of space exploration and science in which funding and investment is based on a thriving com- mercial industry rather than being constrained by tightening government coffers (Commercial Space Transportation Study Alliance 1994).

Of course, history tells us that predictions of this nature can go badly astray. As with most future events, we can be more certain they will happen than we can be about the pre- cise timing. What we can be more confident predicting is that it would seem rather unlikely, as we look ahead from this 1st year of the 21st century, that space tourism will not become an enormously important component of the tourism industry before the century’s end.

It is also clear that the success of space tourism develop- ment will depend on extensive and rigorous research of the space tourism market. This latent market is not a fixed thing. Its shape, size, and growth will be determined by the prod- ucts, prices, competition, and strategies developed and adopted by commercial space interests, guided by solid mar- ket research and resulting marketing strategies.

Although a number of market studies have been con- ducted to date, these have barely scratched the surface in

terms of the needs that lie ahead. For academic researchers, there exist numerous research opportunities on the verge of this new industry.

# Regulation

Regulatory chains bar space tourism

Hudgins, 2001

[Edward L., director of regulatory studies at the CATO institute, Subcomittee on Space and Aeronautics, US House of Representatives, Official Testimony, “Space Policy and Space Tourism,” <http://www.cato.org/pub_display.php?pub_id=12326>]WZ

The creation of the Office of Commercial Space Transportation (OCST) in the Department of Transportation was suppose to avoid the jurisdictional confusion that Conestoga faced. The Challenger disaster in 1986 eventually led to the removal of the ban on government payloads from private rockets. In 1995 the OCST was transferred to the Federal Aviation Administration. Securing permission to launch still involves safety requirements, reentry licensing, financial responsibility requirements, site operations licensing, and various environmental impact requirements. If this sort of regime had been in place in the early part of this century, the civil aviation industry probably would still be a dream waiting for a deregulated future to be realized. Because of this regulatory regime, Kistler Aerospace, which is developing a reusable launch vehicle, was required to meet with local interest groups and Indian tribes, and draft extensive environmental impact statement as part of its effort to secure permission to launch from a federal test facility in Nevada. J.P. Aerospace of California was competing for the private Cheap Access to Space (CATS) prize of $250,000 for placing a payload 124 miles above the Earth by November 8, 2000. It began the effort to secure permission to launch from the Black Rock Desert in northern Nevada in May, 2000. The company was informed in late September by the government that it would take another two months to process the license. J.P. Aerospace missed the deadline. Other companies too have lost business because of the licensing process. Potentially customers generally want two month lead time for launches. Since it often takes launchers six or more months to secure a license, it is obvious how private providers are hindered. It is no wonder that other countries, for example, Australia, are openly courting American companies to launch from their less-regulated facilities. Add to the licensing difficulties the fact that many government branches and agencies still have jurisdiction over the activities of space enterprises and it is also little wonder that they have failed to develop faster. The Commercial Space Act of 1998 sought to remove barriers to private space efforts. It did, for example, remove the ban on private providers bringing vehicles and payloads, including private travelers, back from space. It also required NASA to purchase services rather than hardware whenever possible. But due to lack of enforcement, NASA has not had to honor this mandate. Further, the fact that the regulatory regime continues to change introduces uncertainty to a sector in which uncertainties in technologies are already major problems. This uncertainty concerning the regulatory regime itself is a major barrier to investments and the expansion of private space activities. Another extremely serious hindrance to private space activities in general is the export control regime. In 1998 Congress passed the Strom Thurmond National Defense Authorization Act. That law transferred jurisdiction over exports from the Commerce Department to the State Department, which has been much stricter and slower in approving exports. Already the American satellite industry is being seriously harmed. We saw how the delay in authorizing the export of a tether helped kill the Mir space station. This law is harming the private space sector in general and certainly will hinder the emergence of private space travel. Perhaps one way to deal with the regulatory problems faced by private space entrepreneurs, in addition to changing the laws, would be to establish an ombudsman both to help such entrepreneurs through the regulatory process and to monitor each step of the process. This monitoring will illuminate the regulatory roadblocks and thus better allow policy makers to eliminate them. Other ways to help the space sector in general and thus private space travel would be to create and enterprise zone in orbit, to not tax or regulate commercial activities off the Earth's surface. After all, taxes are one of the greatest burdens on private commerce. Private parties in space would provide all of their own services and thus the government would have little cause to charge them for services provided on Earth. In the long run potential problems with the Outer Space Treaty also will have to be dealt with to ensure that private space travelers and the companies providing such services are secure in their property and liberties.

# \*\*\*CP S\*\*\*

# Private Actor S

The space industry should regulate itself to allow the best innovation

Parsons, 2007

[Catherine E Parsons, Chapman Law Review, 2005-2006, JD Candidate, Chapman University School of Law, BS in Mathematics, “Space Tourism: Regulating Passage to the Happiest Place on Earth,” http://heinonline.org/HOL/Page?handle=hein.journals/chlr9&div=22&g\_sent=1&collection=journals]WZ

Dedicated dreamers like the X PRIZE Foundation, Burt Ru- tan, and Sir Richard Branson have worked tirelessly to make space tourism a reality. The spark needed to fuel the industry has launched a competitive business, with several companies fighting to be first to transport paying customers into space. As commercial space tourism develops in the coming years, consum- ers will take orbital rides, stay in space hotels, and go to low gravity resorts on the moon. Competition will increase, prices will drop, and the everyday family will get to ride the real Space Mountain.264 The space industry, not the FAA or AST or any other regulatory agency, is in the best position to make space travel both efficient and safe. As pure entertainment, it must of- fer the highest standards of safety and service. Space tourism will deliver one of the greatest experiences of this generation. "You really do get the feeling that you've touched the face of God."265

NASA competition will stifle the private sector

Hudgins, 2001

[Edward L., director of regulatory studies at the CATO institute, Subcomittee on Space and Aeronautics, US House of Representatives, Official Testimony, “Space Policy and Space Tourism,” <http://www.cato.org/pub_display.php?pub_id=12326>]WZ

In addition to changing the regulatory regime, something must be done about the ISS. We have seen how NASA often uses its influence to stifle private space efforts. There is also always the danger of unfair NASA competition with the private sector. The ISS and NASA's role in it poses just such a problem. Those dangers must be contained if private space travel is not to face even more roadblocks. It would be best if the station were privatized, but that would be politically difficult since the United States is in partnership with other governments in the ISS. Thus a possible alternative would be to organize the ISS like an airport authority or a multi-jurisdictional port authority like the Port Authority of New York and New Jersey. Such a station authority would be chartered among the station's owners, that is, the governments that are participating. NASA would not be U.S. government representative on the authority though it could be a customer or tenant on the station. That authority initially would provide infrastructure, safety, utilities and a regime that would allow private parties to run commercial operations on the station. The private sector could take over even those functions at some point. The authority would not be allowed to finance any station business operations, to expand into unrelated businesses, or to own any stock in station contractors. Those restrictions also would apply to NASA itself. In addition to commercial activities, the private sector would provide and pay for all future travel to and from the station, station operations, maintenance, and expansion. Such an approach would mean that station resources would be allocated for the highest valued activities. A real market would be created. Because market prices would be paid, this approach would help contain the danger of unfair competition from a government station to a private station. It is also important that a station port authority arrangement allow for private sector expansion and perhaps even eventual takeover of the station. For example, perhaps to expand activities, one provider wants to add infrastructure that would provide energy cheaper than the shared energy facilities. It would not be sound policy if the station owners, the governments, could veto such a move in order to hold on to their control and stake in the station.

Private sector solves—companies are doing it now

**O’Neil et al 98** (Daniel, compiler at the Marshal Space Flight Center, February 19, Space News, “General Public Space Travel and Tourism - Volume 1 Executive Summary,” <http://www.spacefuture.com/archive/general_public_space_travel_and_tourism.shtml#Recommendations>)

Judgments must be somewhat reserved as to when a large space business can be created inasmuch as, to date, our aerospace industry has principally served human spaceflight objectives delineated and paid for by the Federal government, whereas private space travel and tourism services must be provided in a free enterprise, privately financed, fashion. That is, entrepreneurial drives and fortunes, and the true character of the marketplace, will decide how and when the general public will begin to take trips to/from space. Already, private interests are working on initial space trip vehicle designs, and travel and tourism business interests are offering initial space trip services that could begin in the next few years. The future is almost upon us -- carpe diem.

Private sector key – empirical cost differences and political motivation to increase cost for NASA

Collins, 03

[Invited speech to the AIAA/ICAS Symposium "The Next 100 Years" in honour of the Wright Brothers' First Flight, 17 July 2003, Dayton Ohio. “Space Tourism Market Demand and the Transportation Infrastructure” By Patrick Collins, Professor, Azabu University, Sagamihara City, Kanagawa, Japan, and a Collaborating Researcher with the Institute for Space & Astronautical Science, performed the first market research on space tourism in Japan in 1993, and in the USA in 1995 and is the co-founder of Space Future Consulting, in Space Future, <http://www.spacefuture.com/archive/space_tourism_market_demand_and_the_transportation_infrastructure.shtml>]

How much progress we will actually make towards the future illustrated in Figure 3 depends of course on how much is invested in achieving passenger space travel, how soon it is invested, and how effectively it is invested. This particularly includes achieving efficient, complementary roles for both government organisations and private companies. Unfortunately it is currently unclear how much space agencies are capable of contributing to this very desirable outcome, due to their inappropriate organisational structures. This problem can be seen from the orders of magnitude difference in cost between G7 space agencies' procedures, and what can be taken as a proxy for commercial "best practice" today. This was put into sharp focus recently when it was stated that the Russian company NPO-Energia builds Soyuz crew vehicles for $12 million, Progress cargo craft for a little more than $6 million, and Soyuz launch vehicles for about $16 million [30]. By contrast, Nasa estimates the cost of developing a 4-to-6-person "orbital space plane" (OSP) to be launched on an existing expendable rocket by 2010 at $13 billion or more [31]. Even after allowing for the fact that the OSP is intended to be reusable, and ignoring the higher cost of U.S. expendable rockets, it is clear that its cost/flight would not approach that of Soyuz in even 1,000 flights. When the difference in reliability between the two systems Soyuz having made nearly 2,000 flights, including hundreds of successful manned flights are taken into account, it is clear that Nasa's technical capabilities are of little economic value. Indeed, at the time of writing, the latest news is that Nasas proposed Orbital Space Plane may actually be a non-reusable capsule, which closes the circle: Nasa is now proposing to use $13 billion of taxpayers money to redevelop an Apollo capsule 40 years after the original [32]. Some people might conclude, puzzled, that the US space industry cannot compete with 50 year old Russian technology! But this is not so. Even despite the Soyuz's advantages of having low labour costs and development costs written off long ago, if given a free hand US companies can get at least close to the same costs, as can be seen from a single example. HMX Inc proposed its reusable XV cargo carrier in 2000 for Nasas Alternate Access to Space program ( AAS) [33]. Total program costs for four XV launches carrying 300 lb payloads were estimated at $145 million. If produced, the first flight would have been in 2003; this would have been invaluable after the loss of the space shuttle Columbia, and would save US taxpayers billions of dollars. However, the AAS program was imposed on Nasa by the Office of Management and Budget (OMB) and the Congress in an attempt to get value for money for U.S. taxpayers; consequently, out of $62.7 million that Congress provided for the AAS program in 2003, Nasa brazenly redirected $40 million to its favoured OSP program, and announced that AAS will not continue in 2004 [34]! Why is AAS resisted by Nasa in favour of OSP? The answer is plainly because it is not in the short-term economic interest of Nasa and its client companies to permit such a simple low-cost solution to their requirements. Unfortunately, as Niskanen also explains, nor would it be in the short-term interest of the politicians who nominally "oversee" Nasa and its budget. One might paraphrase Winston Churchills famous description of Russia as ..a riddle wrapped in a mystery inside an enigma by saying that G7 space agency cost estimates are a scandal wrapped in a sham inside a farce. In truth, Nasa's own cost estimates in this case are economically meaningless. Quite apart from being undependable and prone to balloon, they refer to the development of a service for which there is no demand except from Nasa itself, devised in a "sui generis" manner and hence under no pressure to be an economically competitive or "best-practice" result, and following no agreed standard so that the resulting service cannot be judged. An aviation expert involved in the JRS space tourism study programme accurately described the difference between civil aviation and space industry practice in vehicle development by saying that the latter are like children making model aeroplanes: they make up rules as they go along, deciding what is acceptable (to themselves) on an "ad hoc" basis rather than following agreed rules derived from accumulated experience, and designed to achieve a target level of performance [35]. That is, after more than 40 years, governments' role in space activities is still at the same stage as the early days of aviation when government aircraft development projects suffered repeated disasters from which the fundamental lesson was learned that the three roles of customer, manufacturer and safety regulator must be performed by independent organisations. If they are not, the conflicts of interest that arise between political and commercial objectives ensure failure. This is well illustrated in the book " Slide Rule", which describes the simultaneous development of the successful, company-developed R100 and the disastrous, government-developed R101 airship projects [36]. As a result of experience, governments (reluctantly) corrected their role in aviation from (disastrously) developing aircraft directly, to (successfully) supporting the development of commercial aviation [37]. U.S. government actions such as the 1925 Airmail Act privatising the air mail, and the 1926 Air Commerce Act giving the Department of Commerce responsibility to promote aviation, were in much the same vein. In order to make progress in this situation, the single most important step for the space industry is to collaborate with the civil aviation industry, as discussed in [38]. As Antunano has described, the "aviation approach", its fundamental way of thinking, is the opposite of space agencies: the objective of aviation authorities is to enable as many people as possible to enjoy the services they wish. Consequently instead of government defining rules for selecting candidates for space flight, passengers select themselves, and it is necessary only to advise them of possible risks [39]. However, space agencies currently have no plans to even study the feasibility of passenger travel services, let alone initiate the fundamental rethinking needed to generate economic value for taxpayers in this way from their massive investment in space technology development. The huge cost to taxpayers' of permitting the present economically wasteful situation to continue, that is the cost of governments' continuing failure to amend their mistaken approach to space development contrary to what they did successfully in aviation is discussed next.

# Prizes S

Prizes for passengers solve Orbital flights – current funding ensures launch success

Globus, 11

[“Paths to Space Settlement,” by Al Globus, Senior Research Associate at San Jose State University Research Foundation and chairs the space settlement committee of the National Space Society, paper presented to NASA, http://alglobus.net/NASAwork/papers/PathsToSpaceSettlement2011.pdf]

Orbital flight is far more difficult due to much higher velocities required, longer exposure to the space environment, and high-speed atmospheric reentry. To be in orbit a spacecraft must travel fast enough horizontally so that as the spacecraft falls towards the surface it travels far enough to curve around Earth rather than crash into the surface; about 25,000 km/hour. Using current technology this involves very large forces, high temperatures and other major challenges. Not surprisingly, launch failure is common, particularly during the first few launches of a new vehicle. Only 5 of the first 9 Pegasus launches succeeded, 9 of 20 for Atlas, 3 of 5 for Ariane, 9 of 18 for Proton, and 9 of 21 for Soyuz. In "Contest-Driven Development of Orbital Tourist Vehicles," 14 this author proposed using prizes to develop orbital vehicles for the tourism industry. The idea is to provide a series of prizes for successive launch of people into orbit. The dollars-per-passenger ratio decreases as more and more passengers are own; starting at something near current costs ($30 million) and ending at the desired price point of $10,000. A simple computer program was developed to explore the implications of this model. Using development cost and operations data from commercial firms circa 2006 it appears that one to eight billion dollars in prize money might be sufficient to get the orbital tourism market going. For reference, space shuttle flights cost over one billion each! The usual experts may say such a prize could not work, but they were wrong about the Ansari-X prize. Of course, prizes may fail to stimulate the desired development, but in that case no prize money need be spent. In a dramatic pro-free enterprise and pro-space settlement move, president Obama recently proposed a $6 billion program (reduced somewhat by Congress) to develop private, commercial human space launch. Successful candidates will get contracts to y astronauts to the ISS. Several companies, both new and old, are positioning themselves to win these fixed-price contracts. If this is successful, the winning companies would develop launchers suitable to fly orbital tourists and provide customer transportation to private space stations, which brings us to the next step.

Prizes for the launch of each passenger lower cost of launches and tickets

Globus, 06

[“Contest-Driven Development of Orbital Tourist Vehicles,” a paper presented to NASA, by Al Globus, Senior Research Associate at San Jose State University Research Foundation and chairs the space settlement committee of the National Space Society, 2007, AIAA Space 2006, San Jose, California, September 2006. http://alglobus.net/NASAwork/papers/AIAASpace2006Contest.pdf]

We now explore the structure and size of prizes to stimulate the development of a large scale orbital tourism industry. The X-Prize was structured to provide a large fraction of the development cost in a lump sum, with the hope that ﬂying tourists at one or two hundred thousand dollars per trip would turn a proﬁt. This appears to have worked well, as there are a number of current eﬀorts that expect to ﬂy customers at these prices within the next few years. However, the lowest published cost estimate to develop a Earth-to-LEO vehicle is $400 million for development and $20 million per four person ﬂight 14 by Transformational Space Corporation (t/Space), and this may be optimistic. If t/Space could meet their cost targets and recoup all of development cost from a prize, seats would still cost at least $5 million per passenger. This would continue to limit the market to a small number of extremely wealthy individuals. Furthermore, if all the prize money is expended on a single entrant, there may be no competitive pressure to reduce prices to the $10-100 thousand range that market research suggests is required to support a truly high ﬂight rate.

IV. Prize Structure

**We propose avoiding these pitfalls with a series of prizes for successive launch of people into orbit. The dollars-per-passenger ratio decreases as more and more passengers are ﬂown**; starting at near current costs ($20 million) and ending at the desired price point of $10,000. A simple computer program, written in Java, was developed to explore the implications of this model. Tables 3-7 contain diﬀerent prize structures produced by the program. Each prize structure is deﬁned by the number of levels, prize value per person ﬂown, and the number of passengers (or crew) at each level. Source code is available on request. The program has been used to investigate the consequences of the ﬁve prize structures on three hypothetical competitors. Table 2 contains the results. Each competitor is characterized by development cost, cost per ﬂight, and number of passengers (and crew) on board. This simple model assumes that costs will never change. Three competitors were created, one based on t/Space and the other two on DreamChaser, a six passenger reusable vehicle under development at SpaceDev. Although there are no published data on projected development and operational costs, SpaceDev’s Richard Slansky was kind enough to provide high and low ﬁgures for ’DreamChaser-like’ spacecraft: development cost between $250 million and $1 billion and cost per ﬂight of 10% of development cost. These are represented in table 2 as DC Low and DC High respectively. Table 2 shows that DC Low is proﬁtable for all contests, and DC High for only the two most expensive contests. Note that the X Prize by itself was not enough to bring SpaceShipOne to proﬁtability. However, it was enough for Scaled Composites to build a successful vehicle and many other competitors to try. The costs for all three of the hypothetical competitors are far below those of current launch vehicles (current orbital tourist rides are eﬀectively and heavily subsidized by the ISS program which requires the ﬂights in any case). For example, the Shuttle cost many billions to develop and per-ﬂight costs are between half and one billion depending on accounting assumptions. The CEV/CLV, based on shuttle technology, is expected to cost far more than even DC High. Of course, the Java program can be used to examine prize structure for any cost vehicle, but there is some reason to believe the hypothetical vehicles may be in the ballpark. First, note that SpaceShipOne was developed for a few tens of millions of dollars. Few, if any, with substantial experience in the aerospace sector believe that NASA or any of the traditional primes could have developed a reusable sub-orbital manned vehicle at such a low cost. Second, unlike the Shuttle and CEV/CLV, tourist vehicles can be optimized for a single mission, to be repeated many, many times. This simpliﬁes requirements and allows mission-speciﬁc optimizations for high ﬂight rates. Given the assumptions above, the tables show that prize structures totaling between one and seven and a half billion dollars may be suﬃcient. Most competitors would be proﬁtable after 4-6 ﬂights for most prize structures. However, the lower-valued prizes are not utilized since it is assumed that competitors will not continue ﬂying once the prize-per-passenger is lower than their cost-per-passenger. This may not be a valid assumption if the cost-per-ﬂight drops with experience and/or the passengers pay a suﬃciently large ticket price.

Prizes empirically solve suborbital commercial tourism innovation – more funding is necessary to spark an orbital industry

Globus, 06

[“Contest-Driven Development of Orbital Tourist Vehicles,” a paper presented to NASA, by Al Globus, Senior Research Associate at San Jose State University Research Foundation and chairs the space settlement committee of the National Space Society, 2007, AIAA Space 2006, San Jose, California, September 2006. http://alglobus.net/NASAwork/papers/AIAASpace2006Contest.pdf]

This paper assumes (without proof!) that launch vehicle development is stuck not because it’s impossible to develop the technology (the equivalent of breeding ), but because the incentives (the equivalent of the ﬁtness function) are improperly structured. All human-capable orbital vehicles to date have been developed as national projects by the U.S., Russia/USSR, and China. For sub-orbital vehicles the picture is quite diﬀerent. Spurred by the $10 million Ansari X-Prize, a change in the way launch development was rewarded, Scaled Composites, LLC built and ﬂew SpaceShipOne into space twice in as many weeks in 2004. Interestingly, these were the only U.S. manned space ﬂights that year as the Shuttle was grounded after a fatal accident in 2003. While Scaled Composites reportedly spent considerably more than the purse to win, other commercial deals involving advertising and technology sales netted a small proﬁt. As a direct result, Scaled is now developing SpaceShipTwo for Virgin Galactic. Virgin Galactic is building a space port in New Mexico and intends to ﬂy tourists into space for a few hundred thousand dollars per trip within a few years. Furthermore, Virgin has a couple of competitors. Not only did the X-Prize spur a promising eﬀort to initiate a sub-orbital tourism industry, but over 20 teams competed for the X-Prize. Only Scaled won, but the other 20+ eﬀorts provided training for well over a hundred individuals in human space ﬂight development. If $10 million may have jump-started the sub-orbital tourism industry, what prize might do the same for orbital ﬂight? Orbital ﬂight is far more diﬃcult due to much higher ∆v, longer exposure to the space environment, and high-speed atmospheric reentry. Also, failure is common, particularly during the ﬁrst few launches of a new system. Only 5 of the ﬁrst 9 Pegasus launches succeeded, 9 of 20 for Atlas, 3 of 5 for Ariane, 9 of 18 for Proton, and 9 of 21 for Soyuz. Thus, one might expect orbital ﬂight to require a much larger prize. Indeed, Bigalow Aerospace has oﬀered a $50 million prize for private development of an orbital vehicle, but this has not generated a level of eﬀort comparable to that expended for the X-Prize. Not only is the prize money apparently insuﬃcient, a diﬀerently structured prize may be needed.

# A2 Prizes disort the market

Prize limits ensure healthy competition

Globus, 06

[“Contest-Driven Development of Orbital Tourist Vehicles,” a paper presented to NASA, by Al Globus, Senior Research Associate at San Jose State University Research Foundation and chairs the space settlement committee of the National Space Society, 2007, AIAA Space 2006, San Jose, California, September 2006. http://alglobus.net/NASAwork/papers/AIAASpace2006Contest.pdf]

VII. Developing More than One Competitor There is at least one additional problem. A healthy market requires at least two, and preferably many, viable competitors. Limiting the prizes per company at each dollar-per-passenger level provides a mechanism to support multiple competitors. We suggest limiting any single competitor to no more than 70% of the prizes at any one level. The break even ﬂight and proﬁtability data in the tables assume this ﬁgure with one exception, noted in the caption. 70% is enough to give a substantial advantage to the ﬁrst winner, but leaves large sums ($300 million to $2.5 billion in our examples) for a second.

# \*\*\*Generics Links\*\*\*

# Space Debris

Space tourism leads to more space debris

Freeland, 2006

[Steven, professor of International Law at the University of Western Sydney, Australia. “Up, up and . . . Back: The Emergence of Space Tourism and Its Impact on the International Law of Outer Space *Symposium: Issues in Space Law*,” Chicago Journal of International Law, <http://heinonline.org/HOL/Page?handle=hein.journals/cjil6&id=30&type=text&collection=journals>, 2005-2006]

Space tourism activities will inevitably result in greater pressures on the space environment. They will lead to the pollution of previously pristine areas. In contrast, however, to the imposition of rules relating to space debris, the control of human activities like littering would cost relatively little in dollar terms to regulate. It is imperative that this be done in order to minimise as much as possible any additional disruption to the space environment. Moreover, as the level of space tourism activities becomes more sophisticated, it will be necessary to construct infrastructure-hotels, dams, storage facilities, roads, and other "conveniences"--on the moon and (eventually) other celestial bodies. As has been the case on earth, mistakes will be made and there will be environmental accidents. Even though it envisages exploitation of the moon's natural resources, the Moon Agreement imposes obligations on parties to protect "the existing balance of its environment."6 The construction of any form of space tourism infrastructure on the moon will only add to the irreversible alteration of the space environment and worryingly it is difficult to imagine what the overall effect will be. There is an unavoidable conflict between the development of space tourism activities and any environmental protection principles that form part of international space law. It will therefore be necessary to establish clear guiding principles to regulate such activities.

# Politics

Space tourism is an incredibly divisive issue in congress – the plan will bring up regulatory fights

Parsons, 2007

[Catherine E Parsons, Chapman Law Review, 2005-2006, JD Candidate, Chapman University School of Law, BS in Mathematics, “Space Tourism: Regulating Passage to the Happiest Place on Earth,” http://heinonline.org/HOL/Page?handle=hein.journals/chlr9&div=22&g\_sent=1&collection=journals]

Space Wars on Paper: The Fight in Congress and Their Interpretations

Several members of Congress recognize that space tourism will play an important role in the future of space technology and that space tourism requires a proper foundation in order to pros- per. "Failing to provide a precise and consistent form of man- agement will negatively affect the industry's ability to plan for its future, compete with international providers and attract financ- ing from investors."192 Supporters felt that

[t]his is about a lot more than joyrides in space, although there is nothing wrong with such an enterprise. This is about the future of the U.S. aerospace industry. As in most areas of American enterprise, the greatest innovations in aerospace are most likely to come from small entrepreneurs .... The goal of this bill is to promote robust experi- mentation, to make sure that entrepreneurs and inventors have the incentives and the capabilities they need to pursue their ideas. That is important to our Nation's future. 193

Supporters further contended these trailblazing space entre- preneurs "just need government to get out of the way," but still "are seeking a government regulatory regime that will provide

predictability,.., stability and support to help them attract pri- vate capital .... In short, this industry requires government regulation, but not so much regulation as to stifle it."194

Supporters in Congress' main argument was balance- creating a regulatory system that would protect crew and general public, while still giving the industry the most latitude possible to experiment.195 California Republican representative Dana Rohrabacher, who sponsored the bill, said that "[olverall, the bill will help get this new industry on its way and on its feet and give the existing space launch industry more time to grow."196 The House almost unanimously agreed that commercial human space flight should be officially placed under the AST, and that issu- ance of permits and licenses needed to be streamlined.97 Other provisions, however, were not so warmly embraced.

49 U.S.C.A. § 70105 was the most controversial section of the Space Launch Act. Specifically, the liability waivers and eight- year buffer, which would temporarily restrain the FAA's regula- tory control, were hotly contested. Supporters wanted to allow developers freedom to experiment and generate start-up revenue, so long as the passengers were fully informed.198 The FAA must wait patiently for the industry to no longer be a "risky nov- elty...... [It seems to me kind of silly to regulate Burt Rutan's vehicle, which has flown three times, as if it was a Boeing 747. If we regulate it that way, then his craft will never evolve into the equivalent of a 747."199

Congressional opponents to the Space Launch Act believed its drafters were establishing freedom in the industry at the cost of safety, where someone would have to be killed before regula- tors could step in.200 The opponents also felt that the eight-year block before the FAA could regulate was similar to the FAA's original, but inappropriate role as both promoter and watchdog of the aerospace industry.201 At a minimum, opponents wanted to delay the bill and more thoroughly discuss "when it would be ap- propriate to begin to regulate for the health and safety of passen- gers on these space crafts.202

Supporters responded that some regulation now is better than no regulation.203 They firmly believed that there needed to be an initial framework to create security for the industry and its investors.204 Supporters also noted that the bill would be the only way to protect the federal government from liability for li- censed launches because the FAA would "continue to license pri-

vate space flights without adequate authority to protect either the safety of the public or the finances of the government."205 The Space Launch Act already represented "the most feasible compromise possible in this session of Congress."206 Space flight technology will be developing for far longer than the Space Launch Act allows, and Congress should be cautious with its regulatory approach.207

In the end, the Space Launch Act received the necessary two- thirds majority in the House, and "went virtually unmentioned on the Senate floor" when it passed in December 2004 "tacked onto a package of House bills that were approved by unanimous consent in the Senate.208 Representative Rohrabacher said it was "a 'great victory for the future of America's space efforts."'209 Rep-

resentative James Oberstar has continued to contest the Space Launch Act, and in February 2005, introduced a bill, H.R. 656, to amend the Act to grant the FAA more regulatory powers, taking into account the "inherently risky nature of human space flight."210 After the Space Launch Act passed, Burt Rutan said that the

"current regulatory system is [still] in need of repair and nearly

destroyed his program."211 The AST still has control over launches by private companies in the United States; their mis- sion statement indicates they must ensure that these "activities do not harm public interests, including safety of the public and property as well as U.S. national security and foreign policy in- terests."212 However, Rutan said that the process promulgated by the AST under the FAA "increased the risk for my test pilots. It did not reduce the risk to the non-involved public. It destroyed our safety policy of 'always question the product, never defend it."'213 Rutan explained that the current process "is likely to be misapplied for the regulation of future commercial spaceliners," just as it "was grossly misapplied for our research tests."214 Ru- tan also explained that the FAA was already thin on staff and could not effectively regulate the airline industry.215 Eight years from now, giving the FAA even more power will