Commercial Human Space Flight in the United States: Federal Licensing and Tort Liability

By

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Abstract

In the early 21st century, the private commercial space transportation industry demonstrated that commercial human space flight is both technologically and economically feasible. In 2004, the United States Congress responded by passing legislation authorizing the Department of Transportation to license and regulates commercial human space flight.

This thesis examines and assesses the U.S. commercial human space flight vehicle licensing and regulatory law. Tort liability is inextricably linked to the success of the commercial human space flight industry and to that end this thesis provides an analysis of U.S. tort liability law in the event of a commercial human space flight vehicle accident.

Résume

Au début du vingt unième siècle, l'industrie spatiale démontra que le voyage commercial des hommes dans l'espace était désormais possible économiquement grâce aux technologies. En 2004, le Congrès des Etats-Unis instaura une législation autorisant le Ministère des transports à breveter et réguler le voyage spatial commercial.

Cette thèse examine la régulation des vols commerciaux dans l'espace par les autorités américaines. Ainsi, elle donne une analyse de la loi étasunienne sur les dommages et intérêts en cas d'un accident d'une navette lors d'un voyage commercial dans l'espace.

Acronyms and Abbreviations

AST	Associate Administrator of Commercial Space Transportation
CATEX	Categorical Exclusion
CHSF	Commercial Human Space Flight
CLSAA-2004	Commercial Space Launch Amendment Act 2004
CR	Controlled Reentry
DOD	Department of Defense
DOS	Department of State
DOT	Department of Transportation
EA	Environmental Assessment
EAC	Experimental Airworthiness Certificate
EIS	Environmental Impact Statement
ELV	Expendable Launch Vehicle
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FAA-AST	Office of Commercial Space Transportation
FCC	Federal Communications Commission
HAUAV	High Altitude Unmanned Arial Vehicle
HAVP	High Altitude Vehicle Platform
HT	Horizontal Take-off
HTOL	Horizontal Take-off and Landing
IRS	Internal Revenue Service
LEO	Low Earth Orbit
MPL	Maximum Probable Loss
MS	Multiple Stage
NAS	National Air Space
NASA	National Aeronautics Space Administration
NEPA	National Environmental Policy Act
PRLV	Partially Reusable Launch Vehicle
PTP	Point to Point Carriage
RLV	Reusable Launch Vehicle
SOT	Secretary of Transportation
STOL	Single Take-Off and Landing
SFP	Space Flight Participants
SS	Single Stage
UR	Uncontrolled Reentry
U.S.	United States
VT	Vertical Take-off

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Introduction

In the early 21st century, the private commercial space transportation industry demonstrated that commercial human space transportation is both technologically and economically feasible. In 2004, the United States Congress responded by passing legislation authorizing the Department of Transportation to license commercial human space flight.

Today, the U.S. commercial human space flight (CHSF) industry is developing launch vehicles that will carry paying participants on suborbital flights. Licenses have been granted by the DOT to test this experimental vehicle technology and in it anticipated that CHSF vehicles carrying space flight participants will enter into operation in the near future.

This thesis focuses on two areas of the law applicable to the U.S. CHSF industry: (1) U.S. CHSF vehicle licensing and regulatory law and (2) U.S. tort liability law in the event of a CHSF vehicle accident. These two areas of law were chosen because of their importance to the immediate development of the CHSF industry. Launch vehicle licensing and regulation is a critical element of the legal environment governing CHSF that must be mastered by legal counsel in order to appropriately advise clients engaged in the CHSF industry. Tort liability is inextricably linked to the financial viability of the CHSF industry.

The primary objectives of this paper are to (1) provide the reader with an examination and assessment of U.S. federal CHSF licensing and related regulatory law, and (2) to provide an analysis of U.S. tort liability law in the event of a CHSF vehicle accident.

Chapter I: Commercial Human Space Flight provides the reader with the historical and technical background of CHSF that is necessary before one can delve into the legal analysis of CHSF.

Chapter 2: Federal Law and Regulation Governing CHSF is an examination and assessment of the primary federal law governing CHSF operations. Focus is given to the CHSF vehicle licensing regime.

Chapter 3: U.S. Tort Liability Law and Legal Risk Management in the Event of a CHSF Vehicle Accident examines and assesses negligence, strict liability for 3rd party damage, and products liability as it relates to CHSF operators, pilots/crew, SFP, and vehicle manufacturers.

Although not required for an L.L.M. thesis, this thesis does constitute original scholarship and an advancement of knowledge in the domain of space law. This thesis is the first comprehensive analysis of U.S. tort law in the event of a CHSF vehicle accident. These contributions provide guidance and insight on the complexities of CHSF licensing and tort liability law. Members of the CHSF industry, law and policy makers, space flight participants, academics, and legal counsel advising the CHSF industry can all benefit from insights provided by this research on U.S. CHSF licensing and tort liability law.

Chapter I. Commercial Human Space Flight

To facilitate the legal analysis of U.S. law and regulation governing commercial human space flight, this chapter defines the phrase 'commercial human space flight' (CHSF) , categorizes CHSF mission characteristics, explains CHSF vehicle technology, and provides a brief history of CHSF.

A. Defining Commercial Human Space Flight (CHSF)

Commercial human space flight is the carriage of persons to, from, or through outer space for compensation. The critical element that distinguishes CHSF from other forms of human space flight is the commercial nature of the carriage.

CHSF is not defined in either international law or United States law. The definition provided for *supra* is derived from an examination of the common usage of the terms commercial, human, space, and flight.

In common usage the term commercial is related to or pertains to commerce and the engagement of commerce.[1] Commerce, in this context, is the buying, selling, or exchange of merchandise or services.[2] Transportation is the action or process of moving, carrying, or conveying people or goods from one place to another.[3] Flight is one mode of transportation related to flying or moving through air.[4] In this sense, the use of the term 'space flight' is misleading, as vehicle propulsion in outer space does not exhibit the same characteristics of traditional terrestrial air flight. Nonetheless, the term 'human space flight' has been adopted in the language of U.S. federal law and regulatory

[1] *The New Shorter Oxford English Dictionary,* 1993 ed., *s.v.* "commercial."
[2] *The New Shorter Oxford English Dictionary,* 1993 ed., *s.v.* "commerce."
[3] *The New Shorter Oxford English Dictionary,* 1993 ed., *s.v.* "transportation."
[4] *The New Shorter Oxford English Dictionary,* 1993 ed., *s.v.* "flight."

documents relating to commercial human space transportation.[5] For the purpose of consistency with U.S. law and regulatory documentation, this paper will adopt the phrase 'human space flight.' CHSF should be viewed as a mode of transportation distinct from flight and be considered a unique class of commercial space transportation.

No rule of conventional or customary international law has been established that defines where airspace ends and outer space begins.[6] Likewise, no U.S. law or regulation defines or demarcates air and outer space. This author accepts the proposition that a logical minimal inferred legal definition of outer space is "beginning *at least* from the height above the Earth of the lowest perigee of any existing or past artificial satellite that has orbited the Earth without encountering any protest."[7] It is interesting to note that the U.S. Department of Transportation awards commercial astronaut wings to pilots and flight crew on board a licensed launch vehicle on a flight that exceeds 80.45 km as recognition for having reached outer space.[8] As suborbital transport systems and high-altitude platform vehicles enter into service, this legal ambiguity in demarcation of air and outer space will needed to be addressed in order to resolve questions of concurrent conflicting air and outer space legal norms.

B. Mission Characteristics of CHSF: Categorizing Types of CHSF

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[5] See e.g. *Commercial Space Launch Activities*, 49 U.S.C. §70101(a)(3) (2008).
[6] Michael C. Mineiro, "The U.S. and the Legality of Outer Space Weaponization: A Proposal for Greater Transparency and a Dispute Resolution Mechanism" (2008) 33 Ann. Air & Sp. L. 441 at 444.
[7] Christopher M. Petras, "Space Force Alpha": Military Use of the International Space Station and the Concept of "Peaceful Purposes" (2002) 53 A.F.L. Rev. 135 at 155.
[8] Remarks by Patricia Grace Smith, Associate Administrator for Commercial Space Transportation, Federal Aviation Administration, at a presentation of FAA commercial astronaut wings to *SpaceShipOne* pilot Mike Melvill (June 21, 2004), available online at <http://www.faa.gov/about/office_org/headquarters_offices/ast/media/PGS_Melvill_wings_2004-06-21.pdf> (Accessed April 13th, 2008).

The term 'commercial human space flight' encompasses a variety of mission characteristics. The three primary mission characteristics that differentiate forms of CHSF are whether or not the CHSF is national or international, suborbital or orbital, and adventure travel or traditional point-to-point (P-T-P) commercial carriage. These three characteristics provide a means of categorizing different types of CHSF.

Table of CHSF Mission Characteristics[9]

Suborbital Flight	Orbital Flight
National/Domestic Flight	International Flight
Adventure Travel	Traditional P-T-P Carriage

Whether or not a CHSF is national or international is a question of point-of-origin and point-of-destination for the flight. If the CHSF departs and arrives in the same national territory, then the flight was national. If the CHSF departs and arrives from different national territories, the flight was international.[10] An unanswered question remains to the legal status of CHSF that depart, arrive, or lay-over in a location that is not the sovereign territory of a State. For example, a CHSF that originates from an orbiting space station or celestial body may or may not be considered as having conducted an

[9] Table created by the author, Michael Mineiro, on April 22nd, 2008.

[10] The conclusion that a CHSF departs and arrives from different national territories is international is derived from a common understanding of the term 'international' within the context of transportation. For example, Article 1 of the *Montreal Convention of 1999* states "the expression international carriage means any carriage in which, according to the agreement between the parties, the place of departure and the place of destination, whether or not there be a break in the carriage or a transshipment, are situated either within the territories of two States Parties, or within the territory of a single State Party if there is an agreed stopping place within the territory of another State, even if that State is not a State Party. Carriage between two points within the territory of a single State Party without an agreed stopping place within the territory of another State is not international carriage for the purposes of this Convention."

international flight.[11] Ultimately, the status of such CHSF will need to be determined among the interested States, either by national legislation or international agreement.

CHSF can be undertaken as either suborbital or orbital flights. Suborbital is "designating or having a trajectory that does not make a complete orbit of a planet [or celestial body]."[12] Orbital is "a circular or elliptical path traced by a moving body."[13] Under U.S. law, suborbital trajectories are "the intentional flight path of a launch vehicle, reentry vehicle, or any portion thereof, whose vacuum instantaneous impact point does not leave the surface of the Earth."[14] Logical inference recognizes an orbital trajectory as an intentional flight path whose vacuum instantaneous impact point does leave the surface of the Earth.

Current U.S. law and regulations characterize CHSF participants "not as typical passenger[s] with typical expectation of transport, but someone going on an adventure."[15] This characterization is accurate given the current nature of CHSF, an industry focused on suborbital flights for the purpose of providing passengers the experience of outer space.[16] However, CHSF has potential far beyond adventure travel. CHSF could serve as a mode of transportation providing human beings point-to-point carriage (PTP). PTP carriage could be between two terrestrial locations (such as New York and Beijing), a terrestrial and non-terrestrial location (such as Spaceport America and an Earth orbiting

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[11] A related question is whether the passage of a CHSF vehicle through space affects its status, as either domestic or international carriage, for the purposes of national customs and border control.
[12] *The New Shorter Oxford English Dictionary,* 1993 ed., *s.v.* "suborbital."
[13] *The New Shorter Oxford English Dictionary,* 1993 ed., *s.v.* "orbital."
[14] *Commercial Space Launch Activities*, 49 U.S.C. §70102(19) (2008).
[15] Tracey Knutson, "What is "Informed Consent" (2007) 33 J. Space. Law 105 at 109; quoting 14 C.F.R. Parts 401, 415 et al. Human Space Flight Requirements for Crew and Space Flight Participants, Proposed Rule, 70 Fed. Reg. 77261, 77269, at § II(B)(1) (wherein the FAA/AST expressly states that the CSLAA characterization of "Space Flight Participants" "...signifies that someone on board launch vehicle or re-entry vehicle is not a typical passenger with typical expectations of transport, but someone going on an adventure ride.").
[16] This form of CHSF is sometimes dubbed adventure travel or space tourism.

space object), or between two non-terrestrial locations (such as the Moon and an Earth orbiting space object).

Table of Different Types of CHSF based on Mission Characteristics *supra*[17]

Suborbital International Flight P-T-P	Orbital International Flight P-T-P
Suborbital National Flight P-T-P	Orbital National Flight P-T-P
Suborbital International Flight Adventure Travel	Orbital International Flight Adventure Travel
Suborbital National Flight Adventure Travel	Orbital National Flight Adventure Travel

Although not indicated *supra* as a mission characteristic, it is also possible for CHSF to conduct flights the depart Earth orbit, either inter-celestially or into deep space.

C. CHSF Vehicle Technology

CHSF can be undertaken in any vehicle capable of transporting human beings in, to, or through outer space. Current space vehicle technology consists of three classes of space vehicles: expendable launch vehicles (ELV), reusable launch vehicles (RLV),

[17] Table created by the author, Michael Mineiro, on April 22nd, 2008.

partially reusable launch vehicles (PRLV).[18] Any of these vehicles classes could potentially serve as CHSF vehicles.[19]

These three classes of vehicles can exhibit combinations of eight different functional characteristics: vertical take-off (VT), horizontal take-off (HT), vertical landing (VL), horizontal landing (HL), controlled reentry (CR), uncontrolled reentry (UR), single-stage (SS), or multiple-stage (MS).

The most promising CHSF vehicle technology involves reusable launch technology. RLV offer several advantages over ELV. First, RLV should provide CHSF lower operating costs due to the reusable nature of the vehicles. Second, RLV can be operationally tested before carrying commercial passengers. While ELV rely on the same design, they do not have this capacity because ELV vehicles are only launched once and there are no opportunities to fully test or experiment with a specific ELV vehicle. Third, the design, manufacturing, and operation, of vehicles are improved when a vehicle can be operational assessed over a period of time. One can look to civil aviation as a parallel, where the safe operation and improved technology of airplanes is attributed to ongoing operational assessment. RLV allow for ongoing assessment that overtime should result in improved reliability.

While RLV do show considerable promise, a commercial need has been demonstrated for ELV to ferry crew and passengers into low earth orbit (LEO). Space

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[18] ELV are designed to be used only once and components of the launch vehicle are not recovered; the Delta II and Proton launch vehicles are examples of ELV. RLV are designed to be reused and components of the launch vehicle are recovered; *SpaceShipOne* is an example of an RLV. PRLV recover some components and disregard other components of the launch vehicle; the Space Shuttle is an example of a PRLV.

[19] So long as a launch vehicle is capable of transporting human beings (presumably alive and in relative safety), the launch vehicle has the capacity to conduct CHSF, subject to applicable law and regulation.

law practitioners should not discount a possible demand for human-qualified ELV launch licensing. [20]

D. History of CHSF

Until the early 1980s, space launch activities were the exclusive domain of States. While some private commercial space activity had begun in the satellite telecommunication industry, launch vehicles and related services to launch commercial satellites were government operations. During the 1980s, Europe and then the United States began offering private commercial launch services. While there are a variety of reasons why this change occurred, the end result is that today commercial launch services are available on a world-wide basis.

In 1998 Eric Anderson, a young aerospace engineer and entrepreneur, founded *Space Adventures,* the first company in the world to offer space tourism flights to private citizens.[21] *Space Adventures* successfully marketed and booked private citizens to fly on Russian manned space vehicles. While the vehicles were owned and operated by the Russian government, the flights were for remuneration and could arguably be considered the first commercial human space flights.

On October 4, 2004, *SpaceShipOne* won the Ansari X-Prize by successfully launching a vehicle carrying human beings on suborbital trajectories to an altitude of 112 kilometers.[22] Subsequently, Richard Branson established Virgin Galactic, the world's

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[20] Brian Berger, "Bigelow wants dozens of Atlas 5 Launchers for New Space Station" *Space News* at 6, February 4th, 2008. Bigelow Aerospace is negotiating with United Launch Alliance for launches of a man-rated Altas 5 to ferry crew and passengers to an orbiting space platform in low earth orbit.
[21] James M. Clash, "Space Cowboy" *Forbes Magazine Online*, May 5th, 2005, available online at <http://www.forbes.com/business/forbes/2005/0509/058.html> (Accessed February 24th, 2008).
[22] Alan Boyle, "SpaceShipOne Wins $10 Million Dollar X-Prize" *MSNBC Online,* October 5th, 2004, available online at < http://www.msnbc.msn.com/id/6167761/> (Accessed February 24th, 2008).

first CHSF operator to offer suborbital flights to private passengers.[23] Today, a number of U.S. CHSF operators are preparing to offer suborbital adventure flights, in some cases already training and medically screening passengers.[24]

[23] See Press Release, "Virgin Group Signs Deal With Paul G. Allen's Mojave Aerospace" *Scaled Composites Press Release*, September 27th , 2004, available online at < http://www.scaled.com/projects/tierone/092704_scaled_paul_allen_virgin_galactic.htm> (Accessed April 22nd, 2008).

[24] Jeff Foust, "Screening and Training for Commercial Human Spaceflight" *The SpaceReview*, February 18th, 2008, available online at < http://www.thespacereview.com/article/1062/1> (Accessed April 22nd, 2008).

Chapter II. Federal Licensing Law and Regulation Governing Commercial Human Space Flight

U.S. federal law and regulation governing CHSF derives from a system of federal governance in accordance with the U.S. Constitution. The Constitution establishes three branches of government, each with their own authority and obligations. Congress enacts legislation, the Executive Branch (i.e. President) implements the legislation, and the Judiciary ensures Congressional and Executive acts are within the bounds of law.

Congress has passed legislation to regulate CHSF in the Commercial Space Launch Act (CLSA) as amended by the Commercial Space Launch Act Amendments of 2004 (CSLAA-2004). The CLSA and CSLAA-2004 and related provisions are codified in 49 U.S.C. §70101 et seq. (herein referred to as 'the Act'). To avoid confusion, this paper will primarily refer to 'the Act.' The Act is the codification of the CLSA and all of her amendments, including the CLSAA-2004, as of June 1st, 2008.

Pursuant to this legislation, the Executive Branch has issued regulations governing CHSF (herein referred to as the 'Regulations').[25] In addition the President has issued National Space Policy and Space Transportation Directives relevant to CHSF (herein referred to as the 'Directives'). Together the Act, Regulations, and Directives are the primary law and regulation governing U.S. CHSF.

It should be clarified at this point that the Act, Regulations, and Directives are not the *sole* federal laws governing CHSF operations. Like any business, CHSF will include an array of activities, from marketing to financing to actual flight operations. As a result,

[25] *Commercial Space Transportation Regulations,* 14 C.F.R. §401 et seq.(2008).

CHSF is subject to a range of federal laws and regulations (such as FCC radio frequency licensing and IRS tax compliance).

The Act is legislation designed fundamentally to license commercial space launch vehicles and launch sites and serves as the regulatory regime for actual commercial human space *flight* (i.e. the carriage of persons on a vehicle to outer space for remuneration). This regulatory authority has been placed within a vehicle licensing regime and the Act and Regulations must be assessed accordingly. One should keep in mind that the Act regulates CHSF as a licensed vehicle operation and the examination of federal law is limited to this area. Launch vehicle licensing and regulation is a critical element of the legal environment governing CHSF that must be mastered by legal counsel in order to appropriately advise clients engaged in the CHSF industry.

This chapter is divided into four sections: (1) "Section A: The Act," (2) "Section B: Regulations," (3) "Section C: Directives," and (4) "Section D: Summary and Conclusions." Section A provides a comprehensive overview of the Act within an organized framework. Section B examines and assesses the CHSF vehicle licensing regime and regulations relating to human space flight requirements. Section C explains and evaluates U.S. National Space Policy relevant to CHSF. Section D summarizes the Act, Regulations, and Directives and addresses the issue of regulatory reform. The goal of this chapter is to provide the reader with a strong understanding of the principle U.S. federal law and policy governing CHSF.

A. 49 U.S.C. §70101 et seq. ('the Act')

The Commercial Space Launch Act (CSLA) as amended is the principal law governing the licensing and regulation of commercial space transportation in the United States.[26] As originally enacted in 1984, the CSLA was limited to the regulation of expendable launch vehicles (ELVs) and launch sites. This regulatory authority was granted to the Department of Transportation (DOT). To implement this authority, DOT established the Office of Commercial Space Transportation, and later the Associate Administrator for the Office of Commercial Space Transportation (FAA-AST) under the administration of the FAA. In 1988, the CSLA was amended to provide a three-tier liability risk-sharing regime, including conditional indemnification for catastrophic accidents.[27] In 1998, CSLA was amended to extend DOT licensing authority to reentry licensing, allowing effective licensing of reusable launch vehicles (RLVs). In 2004, Congress amended the CSLA "to promote the development of the emerging commercial human space flight industry" and granted the DOT the authority to implement regulatory standards to govern commercial human space flight.[28] The CSLA and related amendments are codified in 49 U.S.C. Title 49 Subtitle IX Chapter 701 (herein referred to as 'the Act').

In the following section, public policy objectives of the Act are identified, compliance with international obligations is assessed, and substantial provisions of the Act are identified and explained within an organized framework.

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[26] Timothy Hughes & Esta Rosenburg, "Space Travel Law (And Politics): The Evolution of the Commercial Space Launch Amendments Act of 2004" (2005) 31(2) J. Space L. 12.
[27] *Ibid.*, at 17.
[28] United States, Bill H.R. 5382, *Commercial Space Launch Amendments Act of 2004*, 107th Cong., 2004 (enacted). Stated in H.R. 5382 preamble.

A1. Public Policy Objectives of the Act

The Act is driven primarily by two public policy objectives: (1) "to ensure compliance with the international obligations of the United States" and (2) "to protect the public health and safety, safety of property, and national security and foreign policy interests of the United States."[29] Regulation of private sector launches, reentries, and associated services including human space flight should only be regulated to the extent necessary to achieve these public policy objectives. [30]

Congressional legislation pertaining to the regulation of human space flight has attempted to strike a balance between these objectives and the needs of the nascent human space flight industry to evolve in a regulatory environment that "neither stifles technology development nor exposes crew or space flight participants to avoidable risks as the public comes to expect greater safety for crew and space flight participants from the industry."[31] FAA-AST regulations derive their authority from the Act and are implemented within the context of these larger policy concerns.

A1.1Compliance with International Obligations relating to Commercial Human Space Flight established under *Corpus Juris Spatialis*

International law is the legal system governing relationships between nations.[32] International law is composed of literally thousands of treaties, agreements, resolutions, and judicial decisions. The United States government is obligated to carry out their activities consistent with obligations assumed under international law in accordance with

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[29] *Commercial Space Launch Activities*, 49 U.S.C. §70101(a)(7) (2008).
[30] *Ibid.*
[31] *Commercial Space Launch Activities,* 49 U.S.C. §70101(15) (2008).
[32] *Black's Law Dictionary,* 8th ed., *s.v.* "international law".

the Constitution of the United States.[33] This section examines the international obligations of the United States relating to CHSF that are established under *Corpus Juris Spatialis* and implemented through the Act.

Five treaties have been drafted and adopted specifically as agreements on outer space and these treaties comprise the *Corpus Juris Spatialis*. Of these, four have been signed, ratified, and entered into force in the United States:[34] *Outer Space Treaty (1967),*[35] *Rescue Agreement (1968),*[36] *Liability Convention (1972),*[37] and *Registration Convention (1974).*[38]

Corpus Juris Spatialis contains several provisions relevant to CHSF and these provisions should be duly considered by the United States and CHSF licensees. A meaningful assessment of these provisions must recognize that CHSF was not a consideration at the time the treaties of *Corpus Juris Spatialis* were drafted.[39] Those provisions of *Corpus Juris Spatialis* that are relevant to CHSF involve general principles

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[33] Anthony Aust, Modern Treaty Law and Practice , (Cambridge: Cambridge University Press, 2007) at 179. Anthony Aust states: "Article 26 [of the Vienna Convention on the Law of Treaties 1969] contains the fundamental principle of the law of treaties: *pacta sunt servanda.*" Also note that Article VI of the *United States Constitution* establishes that Treaties entered into pursuant to the Constitution are the law of the United States. Article VI states: "This Constitution, and the Laws of the United States which shall be made in Pursuance thereof; and all Treaties made, or which shall be made, under the Authority of the United States, shall be the supreme Law of the Land; and the Judges in every State shall be bound thereby, any Thing in the Constitution or Laws of any State to the Contrary notwithstanding."

[34] The *Agreement Governing the Activities of States on the Moon and Other Celestial Bodies*, 1363 UNTS 3, is the fifth agreement that has not been entered into force in the United States.

[35] *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies* (Also known as the *'Outer Space Treaty'*), January 27, 1967, 610 U.N.T.S. 205 (entered into force on October 10, 1967).

[36] *Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space* (Also known as the *'Rescue Agreement'*), April 22, 1967, 672 U.N.T.S. 119.

[37] *Convention on International Liability for Damage Caused by Space Objects* (Also known as the *'Liability Convention'*), March 29, 1972, 961 U.N.T.S. 187.

[38] *Convention on the Registration of Objects Launched into Outer Space* (Also known as the *'Registration Convention'*), November 12, 1974, 1023 U.N.T.S. 15.

[39] While each treaty of *Corpus Juris Spatialis* has unique motivations and considerations, in general the body of *Corpus Juris Spatialis* can be seen as agreements whose primary purpose was to lessen the likelihood of conflict between the two Cold-War space powers, Russia and the United States, through the implementation of legal regimes that clarified responsibilities and duties of the respective parties while prohibiting certain activities (such as the placement of WMD in Earth orbit) that would clearly escalate tensions.

of law and not specificities. In some instances, the application of relevant treaty provisions to CHSF activities fails to properly define the scope and application of relevant treaty provisions, and as a result the law is open to concurrent conflicting interpretations.[40]

Article I of the *Outer Space Treaty (OST)* establishes a freedom of action principle, stating that "outer space, including the moon and other celestial bodies, as free for exploration and use by all States without discrimination of any kind, on a basis of equality and in accordance with international law."[41] CHSF utilizes outer space and therefore this principle implicitly grants all States the right to undertake CHSF. The Act is the exercise of State authority over legal persons subject to their jurisdiction exercising this freedom of action.

Article VI of the *Outer Space Treaty* requires contracting States to authorize and continually supervise the space activities of non-governmental entities, including CHSF activities.[42] The United States fulfills this obligation by licensing and monitoring CHSF

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[40] E.g., international law fails to provide a clear legal demarcation between air and outer space. Commercial human space flight may sometimes fall within this legal ambiguity due to operation of these flights in a portion of the atmosphere (~ 100km) that remains undefined under international law. It remains unclear under what circumstances commercial human space flights are to be interpreted under international law as space activities subject to *Corpus Juris Spatialis*. This ambiguity is a reflection of the larger issue of concurrent conflicting legal obligations premised on the failure of international air and space law to harmonize relevant treaty provisions.

[41] Article I *Outer Space Treaty.*

[42] Article VI *Outer Space Treaty* states: "States Parties to the Treaty shall bear international responsibility for national activities in outer space, including the Moon and other celestial bodies, whether such activities are carried on by governmental agencies or by non-governmental entities, and for assuring that national activities are carried out in conformity with the provisions set forth in the present Treaty. The activities of non-governmental entities in outer space, including the Moon and other celestial bodies, shall require authorization and continuing supervision by the appropriate State Party to the Treaty. When activities are carried on in outer space, including the Moon and other celestial bodies, by an international organization, responsibility for compliance with this Treaty shall be borne both by the international organization and by the States Parties to the Treaty participating in such organization."

activities.[43]Licensing is a form of authorization and monitoring licensees is form of continual supervision.

Ratifying States, such as the United States, are internationally liable for public and private space activities in accordance with Article VII of the *Outer Space Treaty* and the *Liability Convention (1972).*[44] Accordingly, the Act requires launch activities to be insured and Congress provides licensees catastrophic accident indemnification.[45]

The *Registration Convention* establishes a mandatory system of registering objects launched into outer space.[46] Launching States are required to register launched space object in both a national registry and a United Nations registry.[47] Similar to the *Liability Convention*, a launching State includes a State from whose territory or facility a space object is launched (i.e. spaceport).[48] To assist the U.S. Government in implementing Article IV of the *Registration Convention (1974),* the Regulations require licensees who place objects, including launch vehicles and component parts, in outer space to notify the U.S. Government.[49] The flaw with this system is that every time a launch vehicle is placed in outer space, a registration obligation is triggered. CHSF vehicles that are launched on a regular basis are therefore subject to a cumbersome registration requirement. The equivalent in aviation would be to require registration of

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[43] *Commercial Space Launch Activities*, 49 U.S.C. §70101 et seq. (2008).
[44] *Convention on the International Liability for Damage Caused by Space Objects* (29 March 1972), 961 UNTS 187.
[45] *Commercial Space Launch Activities*, 49 U.S.C. §70112 and §70113 (2008).
[46] Preamble *Registration Convention* states (in part): "*Believing* that a mandatory system of registering objects launched into outer space would, in particular, assist in their identification and would contribute to the application and development of international law governing the exploration and use of outer space." [italics for emphasis added by author]
[47] Article II(1) and Article III(1) *Registration Convention.*
[48] Article I(a)(ii) *Registration Convention.*
[49] See *Commercial Space Transportation Regulations,* 14 C.F.R. §431.85 (2008) referencing the *Convention on the Registration of Objects Launched into Outer Space* (12 November 1974), 1023 UNTS 15.

airplanes every time they took off.[50] Ultimately this system will need to be modified to serve regularly scheduled commercial CHSF launches.

A2. Framework of the Act

With regards to commercial human space flight, the Act can be conveniently divided into six parts:

1. General Provisions: These consist of a statement of purposes, definitions, and a statement of general authority granted to the U.S. Secretary of Transportation (SOT).
2. SOT Regulatory Authority: These provisions establish and define the scope of SOT authority to issue regulations governing commercial human space flight.
3. Licensing Provisions: These explain when a license is required, the conditions to receive a license, the scope of licenses, and under what conditions and to what extent a license can be modified, transferred, suspended, or revoked.
4. Post-Licensing Provisions: These establish SOT authority to monitor licensees, SOT authority to enforce the Act and Regulations, penalties for violations of the Act and Regulations, and SOT authority to issue orders prohibiting, suspended, or ending a licensed activity.

[50] It should be noted that in the United States both aircraft and launch/reentry vehicles are required to file a 'flight plan' in most instances with the appropriate authority. This obligation serves an important safety function. Flight plans can be distinguished from registration requirements contained in the *Corpus Juris Spatialis*. These registration requirements need each space object launched to be carried on a registry, domestically and with the United Nations, that includes the name of launching State or States, appropriate designator of the space object, date and territory or location of launch, basic orbital parameters, and general function fo a space object.

5. Financial Responsibility Provisions: These require licensees to obtain insurance or to demonstrate the capacity to compensate for certain claims and establish federal indemnification provisions for certain catastrophic losses.
6. Other Provisions: The Act also contains provisions regarding interagency consultation, space advertising, preemption of scheduled launches/reentries, acquiring federal property and services, administrative hearings/review, and the relationship the Act to other executive agencies, law, and international obligations.

A2.1 General Provisions

The Secretary of Transportation is granted general authority to carry out the Act.[51] The SOT is tasked with overseeing and coordinating the conduct of commercial launch and reentry operations, issuing permits and commercial licenses and transferring commercial licenses authorizing those operations, and protecting the public health and safety, safety of property, and national security and foreign policy interests of the United States.[52] The SOT is also required to "encourage, facilitate, and promote the continuous improvement of the safety of launch vehicles designed to carry humans" and may "promulgate regulations" to that effect.[53] The Secretary of Transportation (SOT) has delegated this authority to the FAA Administrator who in turn has delegated this authority to the Associate Administrator of the Office of Commercial Space Transportation (FAA-AST).

[51] *Commercial Space Launch Activities*, 49 U.S.C. §70103(2008).
[52] *Commercial Space Launch Activities*, 49 U.S.C. §70101(b)(3) (2008).
[53] *Commercial Space Launch Activities*, 49 U.S.C. §70103 (2008).

The Act does not apply to space activities, including human space flight, carried out by the U.S. Government for the Government.[54] Two situations could exist that challenge this non-application provision. First, the U.S. Government could hire private companies to conduct CHSF. The Act does not clearly exclude CHSF operators under contract to provide flights for the U.S. Government. Second, the Government could carry out CHSF for private companies or individuals. The Act's non-application clause does not clearly exclude CHSF carried out by the Government for private companies.

A2.2 Commercial Human Space Flight Regulatory Authority

The SOT is granted general regulatory authority to implement the Act. Specific regulatory over commercial human space flight is also granted in various provisions of the Act. The SOT exercises regulatory authority over commercial human space flight through the:

(1) Issuance of licenses for launch and reentry vehicles carrying crew or space flight participants (SFP),[55]

(2) Issuance of permits for experimental suborbital rockets (intended to carry SFP once licensed),[56]

(3) Monitoring the activities of licensees to ensure compliance with the license or to carry out prescribed duties of the SOT,[57] and

(4) Promulgation of regulations consistent with the Act.

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[54] *Commercial Space Launch Activities*, 49 U.S.C. §70117(g) (2008) states: "Nonapplication – This chapter does not apply to (1) a launch, reentry, operation of a launch vehicle, operation of a launch site or reentry site, or other space activity the Government carries out for the Government; or (2) planning for policies related to the launch reentry, operation, or activity."

[55] *Commercial Space Launch Activities*, 49 U.S.C. §70105 (2008).

[56] *Commercial Space Launch Activities*, 49 U.S.C. §70105a (2008).

[57] *Commercial Space Launch Activities*, 49 U.S.C. §70115 (2008).

The FAA-AST has authority to promulgate regulations governing crew medical standards, crew training requirements, crew qualification, crew training requirements, SFP informed consent, and SFP training requirements.[58]

The FAA-AST has conditional limited authority to regulate design or operation of a launch vehicle to protect the health and safety of crew.[59] Until 2012, the SOT is limited to restricting or prohibiting design features or operating practices that have resulted in a serious or fatal injury to crew or SFP during a licensed or permitted CHSF or contributed to an unplanned event or series of events during a licensed or permitted CHSF that posed a high risk of causing a serious or fatal injury to crew of SFP.[60]The SOT may issue regulations governing the design or operation of a launch vehicle to protect health and safety of crew

A2.3 Licensing Provisions: Type, Jurisdiction, and Obligation to Obtain

The Act's licensing regime contains one category of permit and two categories of licenses: (1) Vehicle Licenses, (2) Experimental Suborbital Rocket Vehicle Permits, and (3) Site Licenses.[61] All commercial human space flights must be conducted in accordance with a vehicle license issued by the FAA-AST.[62] With an experimental permit commercial human space flight operators may operate suborbital rocket vehicles *solely* for the purpose of researching and developing vehicles, training their crew, and showing

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[58] *Commercial Space Launch Activities*, 49 U.S.C. §70101 et seq. (2008). Also see See *Final Rule on Human Space Flight Requirements for Crew and Space Flight Participants,* 71 Fed.Reg. 75616 (December 15th, 2006).
[59] *Commercial Space Launch Activities*, 49 U.S.C. §70105(c) (2008).
[60] *Commercial Space Launch Activities*, 49 U.S.C. §70105(c)(2) (2008).
[61] In the broadest sense, a license is a legal document giving official permission to do something. The Act's terms 'license' and 'permit' both act as licenses, giving official permission to conduct commercial space launch activities. However these are terms of art because the Act's licenses and permits serve different purposes and grant different legal rights.
[62] *Commercial Space Launch Activities*, 49 U.S.C. §70101 et seq. (2008).

compliance with vehicle license requirements, but cannot carry human beings for remuneration.[63] A site license is required for the operation of a launch or reentry site.[64]

All individual citizens of the U.S. and entities organized or existing under the laws of the U.S. or a state of the U.S. (i.e. U.S. corporations) are required to have a license or permit for the launch of a launch vehicle or the reentry of a reentry vehicle regardless of the territory in which these activities take place.[65] This is consistent with an interpretation of Article VI of the *Outer Space Treaty* that obligates authorization and supervision of non-governmental activities undertaken by nationals regardless of where the activity is taking place.

U.S. citizens or corporations that operate launch/reentry vehicles in a foreign state are required to comply with the Act. U.S. citizens or corporations that operate launch/reentry vehicles in a foreign country are also required to comply with the law of the foreign country where activities are undertaken.

The resulting extraterritorial application of the Act raises several issues. First, U.S. regulatory standards may impose additional costs upon U.S. human space flight operators as compared to foreign competitors, creating a cost disadvantage for U.S. human space flight operators. Second, other States party to the *Outer Space Treaty* may not obligate licensing for nationals outside of their territory, resulting in a non-uniform interpretation and application of Article VI *Outer Space Treaty* obligations. Third, U.S. citizens or corporations may attempt to skirt U.S. extraterritorial licensing requirements

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[63] *Commercial Space Launch Activities*, 49 U.S.C. §70105a (2008).
[64] *Commercial Space Launch Activities*, 49 U.S.C. §70105 (2008). Note that private exclusive use launch sites do not require separate launch/reentry site licenses. In 2000, the FAA announces that a launch licensee who operated a private site for its own launches did not need a license to operate a launch site. See *Final Rule on Experimental Permits for Reusable Suborbital Rockets* 72 Fed.Reg. 17001 (2007) at 17004(a).
[65] *Commercial Space Launch Activities*, 49 U.S.C. §70104(a) (2008).

by operating commercial human space flight ventures offshore through foreign corporations.

The Act prohibits U.S. citizens or corporations from avoiding U.S. extraterritorial licensing requirements through a long-arm statute requiring any entity organized or existing under the laws of a foreign country, if the controlling interest[66] is held by an individual or entity of the United States, to acquire licenses to launch launch/reentry vehicles or to operate launch/reentry sites.[67] This long-arm provision applies when activities are undertaken outside the territory of either the U.S. or the territory of the foreign country where the entity is organized or exists.[68]

While some may criticize the U.S. for this exercise of extraterritorial authority, the Act does remove a lacunae under international law by effectively shutting down flags of convenience for commercial human space flight activities, at least with regards to entities of the state in which a U.S. citizen or company maintains a controlling interest and in which the foreign state does not exercise jurisdiction and hence fails to authorize or supervise activities outside of their territory (i.e. the high seas or outer space). This long-arm provision does not apply if there is an agreement between the U.S. Government and the government of the foreign state where the entity is organized or exists providing that the government of the foreign country has jurisdiction over the launch or operator or reentry.[69] The Act does allow for the application of the long-arm provision in the territory

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[66] 'Controlling interests' is defined by the SOT in accordance with the *Commercial Space Launch Activities*, 49 U.S.C. §70102(a) (2008). The SOT currently defines controlling interests as ownership of an amount of equity in such entity sufficient to direct management of the entity or to void transactions entered into by management with ownership of at least fifty-one percent of the equity creating a rebuttable presumption that such interest is controlling. See *Commercial Space Transportation Regulations,* 14 C.F.R. §401.5 (2008).

[67] *Commercial Space Launch Activities*, 49 U.S.C. §70105 (2008).

[68] *Commercial Space Launch Activities*, 49 U.S.C. §70104(a) (2008).

[69] *Commercial Space Launch Activities*, 49 U.S.C. §70104(a)(3) (2008).

of a foreign state if there is an agreement between the U.S. Government and the government of the foreign state (where the entity is organized or exists) providing that the U.S. Government has jurisdiction over the launch or operator or reentry.[70]

With regards to the SOT, the Act requires the SOT to ensure that only one license or permit is required from the Department of Transportation (DOT) to conduct activities involving crew or space flight participants.[71] The SOT is granted a general authority to waive licensing requirements, but the SOT may not allow any vehicle to operate without a license or permit if a human being will be on aboard.[72]

A2.3a. Licensing Provisions: Modification, Transfer, Suspension, or Revocation

The SOT specifies the period for which a license issued or transferred is in effect.[73] A launch vehicle license can either be a *mission-specific license* or an *operator license.*[74] A mission-specific license terminates upon completion of all activities authorized by the license or the expiration date stated in the reentry license, whichever occurs first.[75]An operator license is valid for a two-year renewable term.[76]An experimental permit is valid for one year and is renewable.[77]

Licenses may be issued or *transferred* in accordance with the Act and Regulations. Currently, only the FAA can transfer a license.[78] Transfer applicants

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[70] *Commercial Space Launch Activities*, 49 U.S.C. §70104(a)(4) (2008).
[71] *Commercial Space Launch Activities*, 49 U.S.C. §70104(d) (2008).
[72] *Commercial Space Launch Activities*, 49 U.S.C. §70105(a)(3) (2008).
[73] *Commercial Space Launch Activities*, 49 U.S.C. §70107 (2008).
[74] *Commercial Space Transportation Regulations,* 14 C.F.R. §431.3(a)(2008).
[75] *Ibid.*.
[76] *Commercial Space Transportation Regulations,* 14 C.F.R. §431.3(b)(2008).
[77] *Final Rule on Experimental Permits for Reusable Suborbital Rockets* 72 Fed.Reg. 17001 (2007) at 17003(d)(3) (codified 14 C.F.R. §437.9 and §437.11).
[78] *Commercial Space Transportation Regulations,* 14 C.F.R. §431.13 and 14 C.F.R. §415.13 (2008).

undergo an application process similar to licensees.[79] Transfers are granted when applicants have satisfied the bases for the issuance of the vehicle license to be transferred.[80] Experimental permits are non-transferrable.[81]

The FAA may modify licenses on application of a licensee or on the initiative of the FAA.[82] Vehicle licenses are modified through either the issuance of a *license order* or written approval to the licensee that adds, removes, or modifies a license term or condition.[83]

FAA authority to suspend or revoke licenses and permits is established under the Act. This authority may be exercised in three situations. First, the FAA may suspend or revoke a license or permit if a licensee/permittee has not complied substantially with a requirement of the Act or a regulation prescribed under the Act.[84] Second, the FAA may suspend or revoke a license/permit to protect the public health and safety, the safety of property, or a national security or foreign policy interest of the United States.[85]

The third basis for suspension is established under the Commercial Space Launch Act Amendments of 2004 (CLSAA-2004). The CLSAA-2004 grants the SOT authority to "suspend a license when a previous launch or reentry under the license has resulted in a serious or fatal injury (as defined in 49 C.F.R. 830, as in effect on November 10, 2004) to crew or space flight participants and the Secretary has determined that continued operations under the license are likely to cause additional serious or fatal injury (as

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[79] Transfer applicants submit an application in accordance with 14 C.F.R. Part 413.
[80] *Commercial Space Transportation Regulations,* 14 C.F.R. §431.13 and 14 C.F.R. §415.13 (2008) requires transfer applicants to file in accordance with 14 C.F.R. Part 413.
[81] *Commercial Space Launch Activities*, 49 U.S.C. §70105a(f) (2008).
[82] *Commercial Space Launch Activities*, 49 U.S.C. §70107 (2008). Note that the Act grants authority to the Secretary of Transportation who has delegated that authority to the FAA Administrator.
[83] *Commercial Space Transportation Regulations,* 14 C.F.R. §431.11 and 14 C.F.R. §415.11(2008).
[84] *Commercial Space Launch Activities*, 49 U.S.C. §70107(c)(1) (2008).
[85] *Commercial Space Launch Activities*, 49 U.S.C. §70107(c)(2) (2008).

defined in 49 C.F.R. 830, as in effect on November 10, 2004) to crew or space flight participants."[86] This authority does not apply to experimental permits.[87]

Unless the FAA specifies otherwise, modifications, suspensions, and revocations take effect immediately and remain in effect during administrative review.[88] The Act creates an exception to this general rule, mandating that suspensions based on serious or fatal injury to crew of space flight participants be as brief as possible and cease when the licensee has taken sufficient steps to reduce the likelihood of a reoccurrence or has modified the license to sufficiently reduce the likelihood of a reoccurrence.[89]

A2.4. Post-Licensing Provisions

CHSF operators must allow federal officers or employees or other individuals authorized by the FAA-AST to observe any activity associated with their licensed or permitted activity.[90] This monitoring authority also extends to a CHSF operator's customers, contractors, or subcontractors to the extent the FAA-AST Associate Administrator considers reasonable and necessary to determine compliance with the license or permit.[91]

In carrying out the Act, the FAA-AST may conduct investigations and inquiries, administer oaths, take affidavits, enter a spaceport to inspect an object to which the Act applies or record or report required to be made or kept, and seize the object, record, or

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[86] *Commercial Space Launch Activities*, 49 U.S.C. §70107(d) (2008).
[87] *Commercial Space Launch Activities*, 49 U.S.C. §70107(d)(c) (2008).
[88] *Commercial Space Launch Activities*, 49 U.S.C. §70107(e) (2008).
[89] *Commercial Space Launch Activities*, 49 U.S.C. §70107(d) (2008).
[90] *Commercial Space Transportation Regulations,* 14 C.F.R. §431.83 & §405.1(2008). See also *Commercial Space Launch Activities*, 49 U.S.C. §70106 (2008).
[91] *Ibid.*

report when there is probable cause to believe the object, record, or report was used, is being used, or likely will be used in violation of the Act.[92]

CHSF operators should be advised that violating the Act, Regulations, and launch/reentry site license terms could result in civil penalties. Within the purview of the Act, violations may result in civil penalties of not more than $100,000 (USD) per violation. [93] However, under the Act a separate violation occurs for each day the violation continues.[94] Therefore, it is important to monitor operations closely and hire competent legal counsel to ensure activities are in conformity with the Act, Regulations, and license terms. CHSF operators should also be aware that other federal, state, or municipal laws applicable to CHSF operations could potentially impose civil and criminal penalties.

A2.4a. Post-Licensing Provisions: Emergency Orders

The FAA-AST has the authority to issue an emergency order prohibiting, suspending, or ending the launch of a CHSF vehicle without revoking the vehicle license if the FAA-AST decides vehicle operations are detrimental to the public health and safety, safety of property, or national security and foreign policy interests of the United States.[95] This order is effectively immediately and remains in effect during review.[96]

A2.5. Financial Responsibility, Cross-Waiver Provisions, and Indemnification

The Act requires vehicle license and experimental permit holders to obtain liability insurance or demonstrate financial responsibility in amounts to compensate for

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[92] *Commercial Space Launch Activities*, 49 U.S.C. §70115(b) (2008).
[93] *Commercial Space Launch Activities*, 49 U.S.C. §70115(c) (2008).
[94] *Ibid.*
[95] *Commercial Space Launch Activities*, 49 U.S.C. §70108(c) (2008).
[96] *Ibid.*

the maximum probable loss of claims by a third party or the U.S. government for death, injury, or property damage or loss resulting from an activity carried out under the vehicle operator license.[97] For some certain parties, the Act mandates cross-waivers of liability.[98] Conditional catastrophic loss indemnification is provided for licensed operations.[99] Financial responsibility, mandatory cross-waiver, and conditional indemnification provisions are assessed in greater detail *infra* in Chapter III: Tort Liability

A2.6. Other Provisions

The Act also contains provisions regarding interagency consultation, space advertising, preemption of scheduled launches/reentries, acquiring federal property and services, administrative hearings/review, and the relationship the Act to other executive agencies, law, and international obligations. Several of these provisions are directly relevant to CHSF vehicle licensing and operations.

A2.6a. Relationship to other Executive Agencies and Laws

In addition to the Act, CHSF vehicle licensees are subject to a range of Federal laws. The Federal Communication Commission (FCC), Department of State (DOS), Environmental Protection Agency (EPA), Department of Defense (DOD), NASA, and other federal agencies all have been delegated regulatory authority over some aspect of CHSF launch vehicle operations.[100]

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[97] *Commercial Space Launch Activities*, 49 U.S.C. §70112(a) (2008).
[98] *Commercial Space Launch Activities*, 49 U.S.C. §70112(b) (2008).
[99] *Commercial Space Launch Activities*, 49 U.S.C. §70113 (2008).
[100] *Commercial Space Launch Activities*, 49 U.S.C. §70117(a) (2008).

As part of the vehicle licensing process, the FAA-AST conducts interagency consultation and verifies compliance other federal laws relating to the operation of CHSF launch vehicles.

A2.6b. Administrative Hearings and Judicial Review

The SOT is obligated to provide a hearing on the record for applicants for a decision by the SOT to issue or transfer a license or permit with terms or deny the issuance or transfer.[101] In addition, for any modification, suspension, or revocation of a license or permit, as well as the prohibition, suspension, or end of vehicle operations, the SOT must provide a hearing.[102] A final action by the SOT under the Act is subject to judicial review.[103]

A2.6c. Acquisition of U.S. Government Property and Services

Purchasing launch or reentry property from the United States government may be a cost-efficient procurement method for CHSF operators developing or expanding launch, reentry, and support facilities. The Act provides for private sector and State government acquisition of excess U.S. Government launch or reentry property.[104] Property can be acquired by sale or transaction at fair market value.[105] The price for property not acquired by sale or transaction is an amount equal to the direct costs,

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[101] *Commercial Space Launch Activities*, 49 U.S.C. §70110(a)(1) (2008).
[102] *Commercial Space Launch Activities*, 49 U.S.C. §70110(a)(3) (2008).
[103] *Commercial Space Launch Activities*, 49 U.S.C. §70110(b) (2008).
[104] *Commercial Space Launch Activities*, 49 U.S.C. §70111(a) (2008).
[105] *Commercial Space Launch Activities*, 49 U.S.C. §70111(b)(2)(A) (2008).

including specific wear and tear and property damage, the Government incurred because of acquisition of the property.[106]

A2.6d. Space Advertising

Advertising is an alternative method for CHSF operators to generate revenue. CHSF operators should be able to market products to SFP during their training, orientation, space flight, and post-flight activities. Given the cost of human space flight, at first SFP will be mostly wealthy persons, a definite advantage when marketing advertising for high-end products and services. In addition, spaceports serving SFP may have substantial visitors to view spaceflight launches or to inquire about spaceport and spaceflight operations. These non-SFP persons may also be potential advertising revenue sources.

In 1993 a U.S. corporation, Space Marketing Inc., proposed to orbit a one-mile wide display satellite at an altitude of 180 miles that would be legible to the naked eye.[107] A public uproar ensued, and Congress passed a provision of the Act prohibiting licensees from launching payloads to be used for obtrusive space advertising.[108] Obtrusive space advertising is defined by the Act as "advertising in outer space that is capable of being recognized by a human being on the surface of the Earth without the aid of a telescope or other technological device."[109]As a result, advertising in outer space has been limited to non-obtrusive advertising such as corporate sponsorship logos and product placement.[110]

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[106] *Commercial Space Launch Activities*, 49 U.S.C. §70111(b)(2)(B) (2008).
[107] Malcolm W. Browne, "City Lights and Space Ads May Blind Stargazers" *New York Times [Late Edition-Final]* (4 May 1993) C1.
[108] *Commercial Space Launch Activities*, 49 U.S.C. §70109(a) (2008).
[109] *Commercial Space Launch Activities*, 49 U.S.C. §70102(9) (2008).
[110] See e.g., "Pizza Hut Becomes First Company to Deliver Pizza to Residents Living in Outer Space" *Business Wire website* at <http://findarticles.com/p/articles/mi_m0EIN/is_2001_May_22/ai_74847510>

CHSF operators should be aware of this provision and conduct activities that will not violate this provision.

The Act specifically allows non-obtrusive space advertising, including advertising on space vehicles and spaceport launch and support facilities.[111] A careful reading of this provision reveals that obtrusive terrestrial advertising is not prohibited. As a result, CHSF operators can advertise obtrusively on-site so long as their advertising does not violate any other federal, state, or local laws.

A3. Summary of the Act

The Act is a unique legislative initiative that provides CHSF with a domestic licensing and regulatory regime. The primary public policy objectives of the Act are to (1) "to ensure compliance with the international obligations of the United States" and (2) "to protect the public health and safety, safety of property, and national security and foreign policy interests of the United States."[112] Although challenges exist in the application of relevant treaty provisions to CHSF, the Act complies with the *Corpus Juris Spatialis* international obligations assumed by the United States. The Act grants the DOT regulatory authority over CHSF. This authority is primarily exercised through a vehicle licensing regime discussed *infra.*

(Accessed March 22, 2008). Pizza Hut has placed corporate logos on launch vehicles and even delivered the world's first "space consumable" pizza to the International Space Station.

[111] *Commercial Space Launch Activities*, 49 U.S.C. §70109 (2008).

[112] *Commercial Space Launch Activities*, 49 U.S.C. §70101(a)(7) (2008).

B. Commercial Space Transportation Regulations

The FAA-AST has promulgated regulations in accordance with authority delegated by the Secretary of Transportation established under the Act. The Regulations are listed as *Commercial Space Transportation Regulations* in Title 14 of the Code of Federal Registry §400-1169.

This section explains and compares the launch vehicle and experimental permit licensing process as established under the Regulations. Launch vehicle licenses are important because CHSF operators must receive a launch vehicle license in accordance with the Act and Regulations before launch operations can be conducted. Experimental permits are important because CHSF operators can launch developmental suborbital vehicles under a permit licensing regime that is more favorable than traditional RLV launch vehicle licenses.

No holder of a license or permit may launch or reentry crew or SFP unless the applicant has satisfied a group of regulations named *Human Space Flight Requirements for Crew and Space Flight Participants* ('HSF Requirements).[113] Therefore, this section also examines and assesses the HSF Requirements.

B1.a. Launch Vehicle Licensing Process

Vehicle licenses are required for the launch of a launch vehicle or reentry of a reentry vehicle. No vehicle can be launched or reentered without a vehicle license.

[113] See *Final Rule on Human Space Flight Requirements for Crew and Space Flight Participants,* 71 Fed.Reg. 75616 (December 15th, 2006). Also note that permit holders are prohibited from launching SFP. Only launch licenses can grant approval for launch with SFP.

While a variety of vehicle designs may meet the definition of either launch or reentry vehicle,[114] the FAA-AST has categorized three types of vehicles for licensing purposes: (1) Expendable Launch Vehicles (ELV)[115] [launch only]; (2) Reusable Launch Vehicles[116] [launch and reentry]; and (3) Other vehicles that Reenter but are not RLV[117] [launch and reentry]. Regardless of the type, all vehicles that carry a human being on board must comply with Part 460 of the Regulations (*Human Space Flight Requirements for Crew and Space Flight Participants*).[118]

ELV, RLV, and PRLV launch licensing follow very similar procedures and regulations. In this section the RLV licensing regime will be examined and ELV/PRLV licensing procedure and regulations will only be mentioned if they significantly depart from RLV licensing procedure and regulation.

An RLV launch license can either be a *mission-specific license* or an *operator license.*[119] A mission-specific license authorizes a licensee to launch and reenter, or otherwise land, one model or type of RLV from a launch site approved for the mission to a reentry site or other location approved for the mission.[120] A mission-specific license authorizing an RLV mission may authorize more than one RLV mission and identifies

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[114] *Commercial Space Launch Activities*, 49 U.S.C. §70102(8) (2008) defines launch vehicle is a vehicle built to operate in, or place a payload or human beings in outer space; and a suborbital rocket. *Commercial Space Launch Activities*, 49 U.S.C. §70102(16) (2008) defines reentry vehicle as a vehicle designed to return from Earth orbit or outer space to Earth, or a reusable launch vehicle designed to return from Earth orbit or outer space to Earth, substantially intact.

[115] *Commercial Space Transportation Regulations,* 14 C.F.R. §415.1 (2008).

[116] *Commercial Space Transportation Regulations,* 14 C.F.R. §431.1 (2008). RLV is defined in 14 C.F.R. §401.5 (2008) as "a launch vehicle that is designed to return to Earth substantially intact and therefore may be launched more than one time or that contains vehicle stages that may be recovered by a launch operator for future use in the operation of a substantially similar launch vehicle."

[117] *Commercial Space Transportation Regulations,* 14 C.F.R. §435.1 (2008).

[118] *Commercial Space Transportation Regulations,* 14 C.F.R. §431.8 (2008).

[119] *Commercial Space Transportation Regulations,* 14 C.F.R. §431.3(a)(2008).

[120] *Ibid.*

each flight of an RLV authorized under the license.[121] A licensee's authorization to conduct RLV missions terminates upon completion of all activities authorized by the license or the expiration date stated in the reentry license, whichever occurs first.[122]

An operator license for RLV missions authorizes a licensee to launch and reenter, or otherwise land, any of a designated family of RLVs within authorized parameters, including launch sites and trajectories, transporting specified classes of payloads to any reentry site or other location designated in the license.[123] An operator license for RLV missions is valid for a two-year renewable term.[124] Licenses can be suspended when a launch or reentry has resulted in a serious or fatal injury to crew or SFP.[125] License authorization includes pre- and post- flight ground operations.[126]

To obtain a launch vehicle license an applicant must:

(1) Undertake a pre-application consultation with the FAA,[127]

(2) Provide information and satisfy a Public Safety Review,

(3) Demonstrate compliance with Human Space Flight Regulations,[128]

(4) Provide information for an Environmental Impact Review and satisfy Environmental Impact requirements,[129]

(5) Provide information for Maximum Probable Loss (MPL) analysis and satisfy financial responsibility requirements, and

(6) Receive approval from an Interagency Policy Review.

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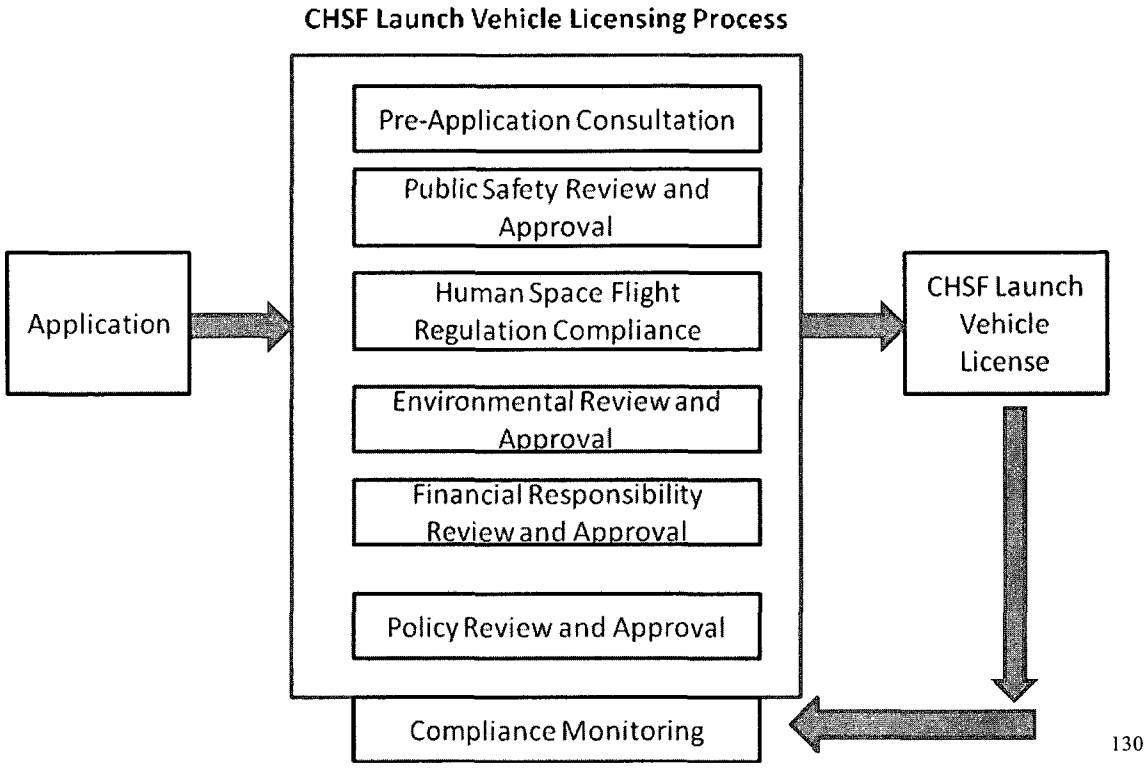
[121] *Commercial Space Transportation Regulations,* 14 C.F.R. §431.3(a)(2008).
[122] *Ibid.*
[123] *Commercial Space Transportation Regulations,* 14 C.F.R. §431.3(b)(2008).
[124] *Ibid.*
[125] *Commercial Space Launch Activities*, 49 U.S.C. §70107(d)(2008).
[126] *Commercial Space Transportation Regulations,* 14 C.F.R. §431.31 - §431.50 (2008).
[127] *Commercial Space Transportation Regulations,* 14 C.F.R. §413.5(a) (2008).
[128] *Commercial Space Transportation Regulations,* 14 C.F.R. §431.8 (2008).
[129] *Commercial Space Transportation Regulations,* 14 C.F.R. §437.21(b)(2008).

The flowchart below demonstrates the license application process for launch vehicles intended to carry crew or SFP.



[130]

B1.b.i. Pre-Application Consultation

Applicants are required to consult with the FAA-AST before submitting an application. During this consultation the FAA-AST discusses the application process, identifies possible regulatory issues and issues relevant to the FAA's licensing decision, and helps the applicant make any changes to the proposed application that are less likely to result in significant delay or costs to the applicant.[131]

B1.b.ii. Public Safety Review and Approval

[130] This chart was created by the author on April 22nd, 2008.
[131] *Commercial Space Transportation Regulations,* 14 C.F.R. §413.5 (2008).

The FAA-AST conducts a safety review and approval of vehicle licenses to ensure the proposed vehicle launch and reentry will not jeopardize the public health and safety.[132] Applicants must provide the FAA-AST with documentation pertaining to safety organization, mishap investigation, communications plan, mission readiness, mission rules/procedures/contingency plans/checklists, and acceptable launch vehicle mission risk.[133]

B1.b.iii. Human Space Flight Regulation Compliance

Applicants proposing to conduct launch vehicle missions with flight crew or SFP on board must demonstrate compliance with *Human Space Flight Requirements for Crew and Space Flight Participants.*[134]

B1.b.iv. Environmental Review and Approval

The National Environmental Policy Act (NEPA) requires all federal agencies, including the FAA, to issue a detailed statement for every major federal action significantly affecting the quality of the human environmental.[135] The decision to license launch vehicles is a major federal action under NEPA and the FAA-AST is responsible for analyzing the environmental impacts of the proposed spaceport and complying with NEPA requirements.[136] Applicants must provide information as requested by the FAA-

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[132] *Commercial Space Transportation Regulations,* 14 C.F.R. §431.1 (2008).
[133] *Commercial Space Transportation Regulations,* 14 C.F.R. §431.31 - §431.47 (2008).
[134] *Commercial Space Transportation Regulations,* 14 C.F.R. §431.8 (2008).
[135] *National Environmental Policy Act,* 42 U.S.C. §4332(c) (2008).
[136] *Commercial Space Transportation Regulations,* 14 C.F.R. §415.201 & §431.93 (2008). See also *National Environmental Policy Act Regulations,* 40 C.F.R. 1508.18 (2008).

AST to conduct an analysis of the environmental impact associated with the proposed license.[137]

FAA Order 1050.1E implements FAA policy and procedures for compliance with NEPA.[138] NEPA analysis can be accomplished through various forms of environmental documentation depending on the size and type of proposed action.[139] Such documentation can be a Categorical Exclusion (CATEX), an Environmental Assessment (EA), or an Environmental Impact Statement (EIS).[140]

B1.b.v. Financial Responsibility Review and Approval

Applicants must obtain liability insurance or demonstrate financial responsibility in amount to compensate for the maximum probable loss (MPL) from claims by a third party for death, bodily injury, or property damage or loss resulting from an activity carried out under the license and for claims by the United States government against a person for damage or loss to government property resulting from an activity carried out under the license.[141]

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[137] *Commercial Space Transportation Regulations,* 14 C.F.R. §415.201 & §431.93 (2008). See also *National Environmental Policy Act Regulations*, 40 C.F.R. 1508.18 (2008).

[138] U.S. Department of Transportation FAA National Policy on Environmental Impacts Order 1050.1E at AEE-200 (2004), online: < http://www.faa.gov/regulations_policies/orders_notices/media/ALL1050-1E.pdf> (Accessed March 28th, 2008) .

[139] Directly quoting *FAA-AST Guidelines For Compliance With The National Environmental Policy Act and Related Environmental Review Statutes for the Licensing of Commercial Launches and Launch Sites* (2001) at 6, online: < http://www.faa.gov/about/office_org/headquarters_offices/ast/licenses_permits/media/epa5dks.pdf> (accessed March 26th, 2008).

[140] Directly quoting *FAA-AST Guidelines For Compliance With The National Environmental Policy Act and Related Environmental Review Statutes for the Licensing of Commercial Launches and Launch Sites* (2001) at 6, online: < http://www.faa.gov/about/office_org/headquarters_offices/ast/licenses_permits/media/epa5dks.pdf> (accessed March 26th, 2008).

[141] *Commercial Space Transportation Regulations,* 14 C.F.R. §431.81 (2008). See also *Commercial Space Launch Activities*, 49 U.S.C. §70112(a) (2008).

B1.b.vi. Policy Review and Approval

The FAA-AST conducts an interagency review of a license application to assess whether it presents any issues, other than those addressed in the safety review, that would adversely affect U.S. national security or foreign policy interests, would jeopardize public health and safety of property, or would not be consistent with the international obligations of the United States.[142]

B1.b.vii. Compliance Monitoring

The FAA monitors licenses to ensure compliance with the Act, Regulations, and license terms and conditions. To that end, CHSF operators must allow federal officers or employees or other individuals authorized the FAA-AST to observe any activity associated with the licensed operation of the CHSF launch vehicle.[143] In the event of non-compliance, the FAA-AST has the authority to suspend or revoke licenses,[144] issue emergency orders,[145] and impose civil penalties.[146]

B1.c. Experimental Vehicle Permit Licensing Process

Prior to the enactment of The Commercial Space Launch Amendments Act of 2004 (CSLAA-2004) the SOT could only issue licenses for launch vehicle operations.

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[142] *Commercial Space Launch Activities*, 49 U.S.C. §70116 (2008). See also *FAA-AST Launch/Reentry Site License Policy Review and Approval* online: FAA-AST <http://www.faa.gov/about/office_org/headquarters_offices/ast/licenses_permits/launch_site/policy/> (Accessed March 23, 2008)

[143] *Commercial Space Transportation Regulations,* 14 C.F.R. §420.29 & §405.1(2008). See also *Commercial Space Launch Activities*, 49 U.S.C. §70106 (2008).

[144] *Commercial Space Transportation Regulations,* 14 C.F.R. §405.3 (2008). See also *Commercial Space Launch Activities*, 49 U.S.C. §70107(c) (2008).

[145] *Commercial Space Transportation Regulations,* 14 C.F.R. §405.5 (2008). See also *Commercial Space Launch Activities*, 49 U.S.C. §70108 (2008).

[146] *Commercial Space Transportation Regulations,* 14 C.F.R. §405.7 (2008). See also *Commercial Space Launch Activities*, 49 U.S.C. §70115 (2008).

Under the CSLAA-2004, the SOT can issue experimental permits rather than licenses for the launch of and reentry of reusable suborbital rockets. The purpose of experimental permits is to encourage the development human space flight vehicles while still protecting the public health and safety, safety of property, and national security and foreign policy interests of the United States. The balance of these competing policy concerns is achieved by restricting the activities a permittee can undertake while lessening the regulatory burden on permit applicants and permittees.

Permits can only be issued for reusable suborbital rockets (either manned or unmanned) that will be launched or reentered solely for (1) conducting research and development to test new design concepts, new equipment, or new operating techniques; (2) showing compliance with requirements as part of the process for obtaining a license; or (3) crew training prior to obtaining a license for a launch or reentry using the design of the rocket for which the permit would be issued.[147] A permit is not a prerequisite for a license but is useful for testing the vehicle and obtaining data necessary for a successful license application.[148]

Permits authorize unlimited number of launches and reentries for a particular suborbital rocket design and modifications may be made without changing the design to an extent that would invalidate the permit.[149] A permit authorizes unlimited number of launches or reentries and permits are valid for one year and renewable.[150] Permits are non-transferrable,[151] and no person may operate a reusable suborbital rocket under a

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[147] *Commercial Space Launch Activities*, 49 U.S.C. §70105a(d) (2008).
[148] *Final Rule on Experimental Permits for Reusable Suborbital Rockets* 72 Fed.Reg. 17001 (2007) at 17003 (codified 14 C.F.R. Ch.701).
[149] *Commercial Space Transportation Regulations,* 14 C.F.R. §437.21 (d)(2008).
[150] *Final Rule on Experimental Permits for Reusable Suborbital Rockets* 72 Fed.Reg. 17001 (2007) at 17003(d)(3) (codified 14 C.F.R. §437.9 and §437.11).
[151] *Commercial Space Launch Activities*, 49 U.S.C. §70105a(f) (2008).

permit for carriage of any property or human being for compensation.[152] Unlike licenses, permits cannot be suspended when a launch or reentry has resulted in a serious or fatal injury of human being aboard the vehicle.[153] Permit authorization includes pre- and post-flight ground operations.[154]

To obtain a permit an applicant must:

(1) Undertake a pre-application consultation with the FAA,[155]

(2) Provide a Program Description, Flight Test Plan, and Operational Safety Documentation and satisfy a safety review, [156]

(3) Demonstrate Compliance with applicable Human Space Flight Regulations,[157]

(4) Provide information for an Environmental Impact Review and satisfy Environmental Impact requirements,[158]

(5) Provide information for Maximum Probable Loss (MPL) analysis and satisfy financial responsibility requirements,[159]

(6) Provide any additional analyses, information, or agreements the FAA deems necessary to protect public health and safety, safety of property, and national security and foreign policy interests of the United States, and[160]

(7) Pass an FAA inspection of the reusable suborbital rocket (to determine the suborbital rocket is built as represented in the permit application).[161]

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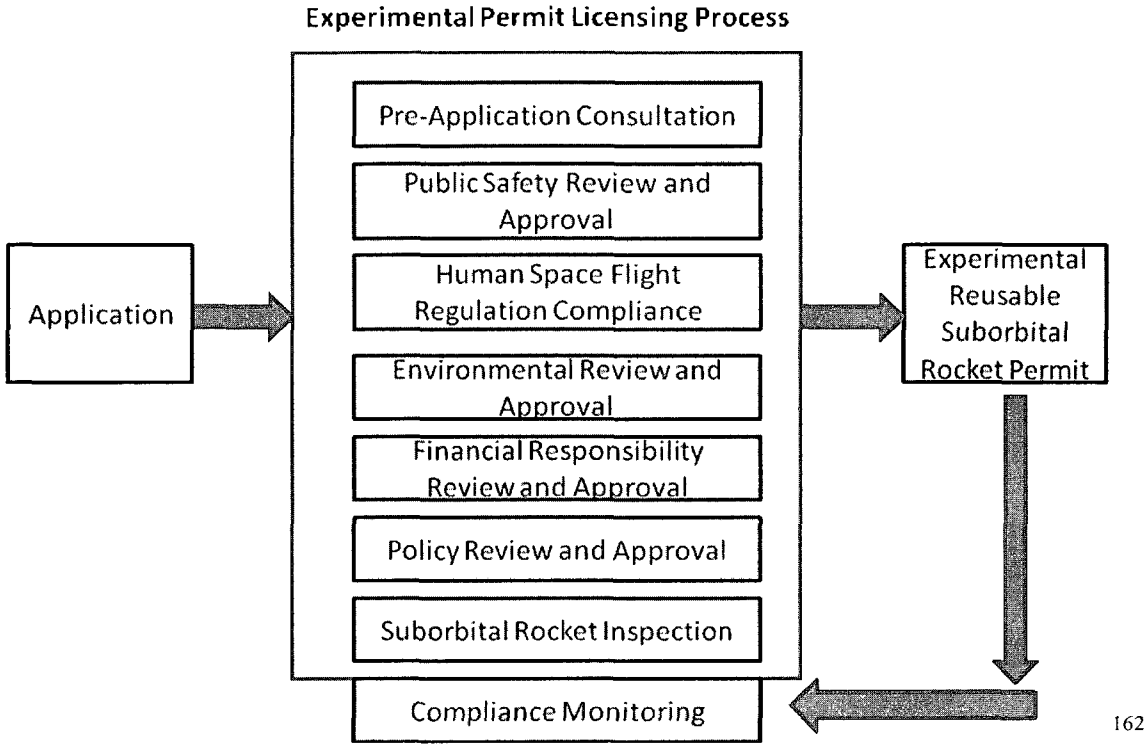
[152] *Commercial Space Launch Activities*, 49 U.S.C. §70105a(h) (2008).
[153] *Commercial Space Launch Activities*, 49 U.S.C. §70107(d)(3)(2008).
[154] *Final Rule on Experimental Permits for Reusable Suborbital Rockets* 72 Fed.Reg. 17001 (2007) at 17005(d)(8) (codified at 14 C.F.R. §437.53). "Pre-flight" operations begins when a permittee prepares a reusable suborbital rocket for flight at a launch site in the United States and "post-flight" operations end when the reusable suborbital rocket is returned to a safe condition after flight.
[155] *Commercial Space Transportation Regulations,* 14 C.F.R. §413.5(a) (2008).
[156] *Commercial Space Transportation Regulations,* 14 C.F.R. §437.21(a) (2008).
[157] *Commercial Space Transportation Regulations,* 14 C.F.R. §437.21 (b)(3) (2008).
[158] *Commercial Space Transportation Regulations,* 14 C.F.R. §437.21 (b)(2008).
[159] *Commercial Space Transportation Regulations,* 14 C.F.R. §437.21 (b)(2) (2008).
[160] *Commercial Space Transportation Regulations,* 14 C.F.R. §437.21 (e)(2008).

The flowchart below demonstrates the permit application process for experimental reusable suborbital rockets.



[162]

B1.c.i. The term Reusable Suborbital Rocket as defined in the Act and Regulations

A suborbital rocket is a "vehicle, rocket-propelled in whole or in part, intended for flight on a suborbital trajectory, and the thrust of which is greater than its lift for the majority of the rocket-powered portion of its ascent."[163] A suborbital trajectory is "the intentional flight path of a launch vehicle, reentry vehicle, or any portion thereof, whose vacuum instantaneous impact point (the location on Earth where a vehicle would impact

[161] *Commercial Space Transportation Regulations,* 14 C.F.R. §437.21 (d)(2008).
[162] This chart was created by the author on April 22nd, 2008.
[163] *Commercial Space Launch Activities*, 49 U.S.C. §70101(a)(19) (2008).

if it were to fail, calculated in the absence of atmosphere drag effects) does not leave the surface of the earth."[164]

While the term "reusable suborbital rocket" is not defined in the CSLAA-2004, the term "reusable launch vehicle" is defined as "a launch vehicle that is designed to return to Earth substantially intact and therefore may be launched more than one time or that contains vehicle stages that may be recovered by a launch operator for future use in the operation of a substantially similar launch vehicle."[165] Therefore, a reusable suborbital rocket is a suborbital rocket that meets the criteria established for reusable launch vehicles.

By focusing on the degree of lift generated by the non-aerodynamic lift of a vehicle this definition has achieved a useful legislative goal of including a broad array of possible suborbital vehicles into the regulatory structure of the CLSAA-2004. Ensuring the definition of suborbital vehicles encompasses a variety of vehicle types is a priority given the rapid state of suborbital vehicle technological development and the desire of the United States to place these vehicles within the regulatory regime of the Federal Aviation Administration Office of Commercial Space Transportation (FAA-AST) as opposed to the FAA civil aviation licensing regime of experimental airworthiness certificates.[166]

B1.c.ii. Comparison between Launch/Reentry Vehicle Licenses and Experimental Launch Permits

[164] *Commercial Space Launch Activities*, 49 U.S.C. §70102(20) (2008).
[165] *Commercial Space Transportation Regulations,* 14 C.F.R. §401.5 (2008).
[166] *Final Rule on Experimental Permits for Reusable Suborbital Rockets* 72 Fed.Reg. 17001 (2007) at 17003(d) (referring to 49 U.S.C. 70102(19)).

The following are important distinctions between vehicle licenses and experimental launch permits:

1) The FAA must determine whether to issue an experimental permit within 120 days of receiving an application. For a license, it is 180 days.[167]
2) Under a permit, a reusable suborbital rocket may not be operated to carry property or human passengers for compensation or hire.[168]
3) Damages arising from a permitted launch or reentry are not eligible for provisional indemnification as provided in the Act. Damages caused by licensed activities are eligible for provisional indemnification.[169]
4) A permit authorizes an unlimited number of launches or reentries for a particular reusable suborbital rocket design. A license can authorize an unlimited number of launches but is not statutorily mandated to do so.[170]
5) Under a permit, a launch operator is not required to demonstrate that the risk from a launch falls below specified quantitative criteria for collective and individual risk. Under a license, a launch operator must.[171]
6) Under a permit, a launch operator is not required to have a separate safety organization or specific safety personnel. Under a license, a launch operator must.[172]

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[167] Quoting the FAA-AST publication, *2008 Commercial Space Transportation Developments and Concepts: Vehicles, Technologies, and Spaceports,* at 69 (2008).
[168] Paraphrasing the FAA-AST publication, *2008 Commercial Space Transportation Developments and Concepts: Vehicles, Technologies, and Spaceports,* at 69 (2008).
[169] *Ibid.*
[170] *Ibid.*
[171] Quoting the FAA-AST publication, *2008 Commercial Space Transportation Developments and Concepts: Vehicles, Technologies, and Spaceports,* at 69 (2008).
[172] *Ibid.*

7) Unlike licenses, permits cannot be suspended when a launch or reentry has resulted in a serious or fatal injury of human being aboard the vehicle.[173]

8) Permits are non-transferrable.[174]

Comparison Chart for Vehicle Licenses and Experimental Permits

	License	Permit
Determination	180 Days	120 Days
CHSF	Allowed	Prohibited
Indemnification	Eligible	Not Eligible
Unlimited Launches	Discretion	Mandatory
Risk Demonstration	Required	Not Required
Safety Organization	Required	Not Required
Transferable	Allowed	Prohibited
Crew/SFP Injury Fatal or Serious Injury Suspension	Allowed	Not Applicable

[175]

B1.d. Hybrid Vehicle Regulation

Launch vehicles (e.g. reusable suborbital rockets) may "use traditional aviation technology and components, including wings, for lift and glide capability, as well as rocket propulsion for thrust to maintain their trajectories."[176] Such vehicles may be deemed aircraft require other FAA authorization, specifically "an experimental airworthiness certificate (EAC), as a condition of a launch license, to operate in the National Airspace (NAS)."[177]

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[173] *Commercial Space Launch Activities*, 49 U.S.C. §70107(d)(3)(2008).
[174] *Commercial Space Launch Activities*, 49 U.S.C. §70105a(f) (2008).
[175] This chart was created by the author on April 22nd, 2008.
[176] *Commercial Space Transportation: Suborbital Rocket Launch Notice,* 68 Fed.Reg. 59977 (October 20th, 2003).
[177] *Ibid.*

The FAA differentiates launch vehicles from aircraft by assessing thrust verses lift during powered flight,[178] "as opposed to mere altitude, mere presence of wings or other indicia."[179] Vehicles that are rocket-propelled in whole or in part and the thrust of which is greater than its lift for the majority of the rocket-powered portion of its ascent are space vehicles.[180]

By focusing on the degree of lift generated by the non-aerodynamic lift of a vehicle, a broad array of possible suborbital vehicles is placed within the regulatory structure of the Act and limits the likelihood of CHSF launch vehicles being subject to multiple licensing regimes.[181]

B2. Human Space Flight Requirements for Crew and Space Flight Participants ('HSF Requirements')

The FAA-AST has promulgated a series of regulations governing crew and SFP. These regulations are entitled the HSF Requirements and are codified in the *Commercial Space Transportation Regulations*.[182] HSF Requirements should be examined in two sections; 'Crew Requirements'[183] and 'SFP Requirements'.[184] The HSF Requirements

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[178] *Commercial Space Transportation: Suborbital Rocket Launch Notice,* 68 Fed.Reg. 59977 (October 20th, 2003) at 59981 .
[179] Timothy Hughes & Esta Rosenburg, "Space Travel Law (And Politics): The Evolution of the Commercial Space Launch Amendments Act of 2004" (2005) 31(2) J. Space L. 12 at 30.
[180] *Commercial Space Launch Activities*, 49 U.S.C. §70101(a)(19) (2008).
[181] *Final Rule on Experimental Permits for Reusable Suborbital Rockets* 72 Fed.Reg. 17001 (2007) at 17003(d) (referring to 49 U.S.C. 70102(19)).
[182] 14 C.F.R. §460.1-§460.53 (2008).
[183] 14 C.F.R.§460.1 – §460.19 (2008).
[184] 14 C.F.R. §460.41 - §460.53 (2008).

only apply to licensed launch and reentry vehicles.[185] Suborbital rockets operating with experimental permits are subject to different rules.[186]

Regulations pertaining to informed consent, cross-waivers of liability, and risk disclosure are examined and assessed in greater detail *infra* in Chapter III: Tort Liability.

B2.a. Authority to Issue HSF Requirements

FAA-AST authority to issue HSF Requirements derives from two distinct sources. First, the DOT has been mandated to promulgate certain regulations relating to crew and SFP. Specifically, the DOT is tasked with issuing regulations for crew training, crew medical standards, crew vehicle and mission risk notification, SFP vehicle and mission risk notification, SFP written informed consent, and SFP training requirements.

The second source of authority is implied authority established through an interpretation of the DOT's mandate to protect the public as including the authority to promulgate regulations relating to vehicle design features for the purpose of protecting the crew as an integral part of the flight safety system.[187] The DOT is prohibited from restricting or prohibiting launch vehicle design features and operating practices until the year 2012 unless a serious or fatal injury occurred to crew or SFP, or an event during flight posed a high risk of causing a serious of fatal injury to crew or SFP.[188] The HSF Requirements includes provisions requiring vehicle design features and operating practices relating to environmental controls, life support systems, smoke detection, and fire suppression. Some commentators have argued these regulations are a violation of

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[185] *Final Rule on Human Space Flight Requirements for Crew and Space Flight Participants,* 71 Fed.Reg. 75616 (December 15th, 2006).
[186] *Ibid.*
[187] *Ibid.* at 75618.
[188] *Commercial Space Launch Activities*, 49 U.S.C. §70105(c) (2008).

DOT Congressional mandated authority.[189] The FAA-AST maintains the position that under the Act, the FAA has the authority to implement design and operation requirements to protect the crew because they are part of the flight safety system that protects the general public.[190]

In both instances, DOT authority to issue regulations governing the design or operation of launch vehicle to protect the health and safety of crew and SPF is highly curtailed.[191] This limitation of DOT authority is derived from a philosophical view that the commercial human space flight industry is highly vulnerable to premature or ill-conceived regulations.[192]

B2.b. Purpose

The purpose of the HSF Requirements is to satisfy Congressionally mandated policy and regulatory goals. Congressional intent is for regulatory standards governing commercial human space flight to evolve as the CHSF industry matures so that "regulations neither stifle technology development nor expose crew or space flight participants to avoidable risks as the public comes to expect greater safety for crew and SFP from the industry."[193] The HSF Requirements reflect this regulatory approach by regulating crew and SFP only to the extent required to protect the public safety and to fulfill mandated notification and informed consent requirements.

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[189] *Final Rule on Human Space Flight Requirements for Crew and Space Flight Participants,* 71 Fed.Reg. 75616 (December 15th, 2006) at 75618.
[190] *Ibid.* at 75618.
[191] *Commercial Space Launch Activities*, 49 U.S.C. §70101et seq. (2008). Timothy Hughes & Esta Rosenburg, "Space Travel Law (And Politics): The Evolution of the Commercial Space Launch Amendments Act of 2004" (2005) 31(2) J. Space L. 12 at 44.
[192] Timothy Hughes & Esta Rosenburg, "Space Travel Law (And Politics): The Evolution of the Commercial Space Launch Amendments Act of 2004" (2005) 31(2) J. Space L. 12 at 46.
[193] *Commercial Space Launch Activities*, 49 U.S.C. §70101(a)(15) (2008).

B2.c. Performance Standards

Due to the infantile nature of the CHSF operations and the many unknowns this endeavor possesses, the HSF Requirements have adopted a performance based standard for crew/SFP qualifications, training, and medical standards. Performance based standards require a demonstration of skills and ability commensurate with the task or objective to be fulfilled. In some instances performance based standards are supported by a secondary certification standard.

B2.d. Crew Requirements

Launch and Reentry vehicles flying with a crew on board or employing a remote operator of a vehicle with a human on board must comply with the Crew Requirements.[194] In addition, vehicle license applicants proposing to have flight crew or employ a remote operator of a vehicle with a human being on board must satisfy and comply with the Crew Requirements.[195]

"Crew" is defined as "any employee or independent contractor of a licensee, transferee, or permittee, or of a contractor or subcontractor of a licensee, transferee, or permittee, who performs activities in the course of that employment or contract directly related to the launch, reentry, or other operation of or in a launch vehicle or reentry vehicle that carriers human beings."[196] A crew consists of flight crew[197] and any remote

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[194] *Commercial Space Transportation Regulations,* 14 C.F.R. §460.1 (2008).
[195] *Ibid.*
[196] *Commercial Space Transportation Regulations,* 14 C.F.R. §401.5 (2008).
[197] *Commercial Space Transportation Regulations,* 14 C.F.R. §401.5 (2008). Flight crew is defined as "any crew on board a vehicle during launch or reentry."

operators.[198] Crews on board carrier aircraft are not treated as crew under the HSF Requirements.[199] No SFP may act as a pilot or remote operator of a launch or reentry vehicle.[200]

Launch and Reentry vehicle pilots[201] and remote operators[202] are subject to both performance based and certification based standards. Pilots and remote operators are required to possess aeronautical experience and skills necessary to pilot and control the vehicle that will operate in the NAS.[203] Pilots and remote operators must also carry an FAA pilot certificate with an instrument rating.[204] All crew must train on how to carry out his or her role on board or on the ground so that the vehicle will not harm the public.[205] Pilots and remote operators must also receive vehicle and mission-specific training for each phase of flight.[206]

All crew members with a safety-critical role are required to possess and carry an FAA second-class airman medical certificate.[207] The FAA is also establishing a

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[198] *Commercial Space Transportation Regulations,* 14 C.F.R. §401.5 (2008).
[199] *Final Rule on Human Space Flight Requirements for Crew and Space Flight Participants,* 71 Fed.Reg. 75616 at 75168 (December 15th, 2006). A carrier aircraft is an aircraft that assists a vehicle in space launch. For example, Scaled Composites' SpaceShipOne was air-launched from a White-Knight carrier aircraft. Carrier aircraft crews are not subject to FAA HSF Requirements other than those required by the FAA aviation requirements.
[200] *Final Rule on Human Space Flight Requirements for Crew and Space Flight Participants,* 71 Fed.Reg. 75616 (December 15th, 2006) at 75618.
[201] *Commercial Space Transportation Regulations,* 14 C.F.R. §401.5 (2008). Pilot is defined as "a flight crew member who has the ability to control, in real time, a launch or reentry vehicle flight path."
[202] *Commercial Space Transportation Regulations,* 14 C.F.R. §401.5 (2008). Remote operator is defined as either a reentry operator or launch operator. Operators are persons who conduct or will conduct the launch or reentry of a launch vehicle.
[203] *Commercial Space Transportation Regulations,* 14 C.F.R. §460.5(c)(2) (2008).
[204] *Commercial Space Transportation Regulations,* 14 C.F.R. §460.5(c)(1) (2008).
Also see *Final Rule on Human Space Flight Requirements for Crew and Space Flight Participants,* 71 Fed.Reg. 75616 at 75620 (December 15th, 2006); where the FAA has stated that "for a remote operator, the FAA will allow an operator demonstrate that something other than a pilot certificate provides an equivalent level of safety."
[205] *Commercial Space Transportation Regulations,* 14 C.F.R. §460.5(a)(1) (2008).
[206] *Commercial Space Transportation Regulations,* 14 C.F.R. §460.5(a)(3) (2008).
[207] *Commercial Space Transportation Regulations,* 14 C.F.R. §460.5(e) (2008). Note that the medical certificate must have been issue no more than 12 months prior to the month of launch and reentry.

performance medical standard that requires the flight crew to demonstrate an ability to withstand the stresses of space flight sufficiently so that the vehicle will not harm the public.[208]

CHSF operators must notify all crew members, in writing, that the launch or reentry vehicle is not certified by the U.S. Government as safe for carrying flight crew or SFP.[209] This notification must be provided prior to employing someone as crew.[210]

B2.e. SFP Requirements

Until the eight years after enactment of the CLSAA-2004, the DOT has no authority to issue regulations "governing the design or operation of launch vehicle to protect the health and safety of crew and SFP" except for "restricting or prohibiting design features or operating practices" that have resulted in a serious or fatal injury or contributed to an unplanned event that posed a high risk of causing serious or fatal injury to crew or SFP.[211] Crew Requirements somewhat circumvent this limitation by incorporating crew safety as a part of the flight safety system designed to protect the general public. Comparatively, SFP Requirements are sparse because extending DOT regulatory authority over SFP to protect the general public is of limited use. As a result,

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[208] See *Final Rule on Human Space Flight Requirements for Crew and Space Flight Participants,* 71 Fed.Reg. 75616 (December 15th, 2006) at 75621. This standard is not yet set. The FAA has suggested that this performance standard may be more stringent that a first-class medical certificate for pilots because of the extreme stresses experienced in space flight.

[209] *Commercial Space Transportation Regulations,* 14 C.F.R. §460.9 (2008).

[210] *Commercial Space Transportation Regulations,* 14 C.F.R. §460.9 (2008) states that if the employee is already employed by the operator, they must be notified as soon as possible and prior to any launch in which that person will serve as crew.

[211] *Commercial Space Launch Activities,* 49 U.S.C. §70105 (2008). Also see Timothy Hughes & Esta Rosenburg, "Space Travel Law (And Politics): The Evolution of the Commercial Space Launch Amendments Act of 2004" (2005) 31(2) J. Space L. 12 at 44.

the DOT has no authority to protect the health and safety of SFP and only limited authority to ensure SFP receive training and information regarding space flight risks.

The SFP Requirements apply to all applicants for a license or permit who propose to have a SFP on board a vehicle, all operators licensed or permitted who have a SFP on board, and all SFP engaged in an activity authorized under the Act. SFP is defined as "any individual, who is not crew, carried aboard a launch vehicle or reentry vehicle."[212]

SFP Requirements obligate CHSF operators to inform SFP for each mission, in writing, about the risk of the launch and reentry, including the safety record of the launch or reentry vehicle type.[213] In addition, all SFP must provide written informed consent before flight that identifies the specific launch vehicle the consent covers, states the SFP understand the risk, and that their participation on board the vehicle is voluntary.[214] There are no requirements for SFP to obtain physical examination prior to flight and mandatory SFP training is limited to responding to emergency situations.[215]

B2.f. Human Factors

HSF requirements also impose some vehicle design and operational standard based on human factors. An operator must take the precautions necessary to account for human factors that can affect a crew's ability to perform safety-critical roles, including the design and layout of displays and controls, mission planning, restraint or stowage of

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[212] *Commercial Space Transportation Regulations,* 14 C.F.R. §401.5 (2008).
[213] This disclosure must include the known hazards and risks that could result in a serious injury, death, disability, or total or partial loss of physical and mental function, that there are hazards that are not known, that participation may result in death, serious injury, or total or partial loss of physical or mental function, and a numerous other disclosures as required by 14 C.F.R. §460.5 (2008).
[214] *Commercial Space Transportation Regulations,* 14 C.F.R. §465.45(f) (2008).
[215] *Commercial Space Transportation Regulations,* 14 C.F.R. §460.51 (2008) . Also see 71 FR 75616 at 75626 (stating "Because the FAA requires an applicant proposing to conduct a launch or reentry with a SFP on board to demonstrate compliance with this section, the FAA will review the adequacy of the operator's training plan, which may include testing, during the license or permit process.")

all individuals and objects in the vehicle, and operation of the vehicle so that flight crew can withstand any physical stress factors.[216]

B2.g. DOT Authority to Protect Health and Safety of Crew and SFP

On December 23rd, 2112, the DOT regulatory authority will extend to the design or operation of a launch vehicle to protect the health and safety of crew and space flight participants.[217] Currently, this authority is limited to restricting or prohibiting design features that resulted in a serious or fatal injury to crew of SFP or a high risk event of such injury.[218] In 2112, this limitation will be removed, and the resulting extension of DOT regulatory authority will significantly alter the current balance of regulatory authority. If the DOT does exercise this new grant of authority, it should be exercised with restraint. The DOT will need to consider the how far the industry has matured, the level of safety the public expects, the evolving standards of the commercial space flight industry, and whether exercising this regulatory authority will stifle the technological development of CHSF. Although it is difficult to predict the future, the current development of CHSF does not indicate that by 2112 the industry will have matured to the point to justify regulation of the design or operation of a launch vehicle that did not result in fatal or serious injury to crew or SFP or high risk event of such injury. Congress should consider amending the Act to postpone the extension of DOT regulatory authority. Amending the Act to postpone DOT regulatory authority need not modify provisions

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[216] *Commercial Space Transportation Regulations,* 14 C.F.R. §460.15 (2008).
[217] *Commercial Space Launch Activities*, 49 U.S.C. §70105(c) (2008).
[218] *Commercial Space Launch Activities*, 49 U.S.C. §70105(c) (2008). As discussed *infra,* the FAA-AST also has authority to regulate design or operation of a launch vehicle to protect the health and safety of the crew and SFP before 23rd December, 2112 in accordance with §70105(c) provisions regarding a serious or fatal injury to crew or SFP or a high-risk event of such injury.

currently in force granting DOT authority to regulate design operation of a launch vehicle in the event of a serious or fatal injury to crew of SFP or a high-risk event of such injury.[219]

B2.h. Assessment of HSF Requirements

The HSF Requirements are designed to protect the general public, not crew or SFP. Crew and SFP are afforded only the privilege of risk disclosure and safety regulations limited to the extent necessary to protect the general public. Some have criticized these safety standards as an "industry wish list" amounting to nothing more than a "tombstone mentality" of not regulating until there are fatalities.[220]

While this view does have some validity, it is premised on the notion that a SFP is a passenger in a similar fashion to a passenger engaged in public transportation (e.g. aviation, maritime, or automobile). The failure with this argument is that Congress has legislated CHSF *not* as a mode of highly regulated transportation, but as an adventure travel experience.[221] Congress recognizes that the commercial human space flight industry is highly vulnerable to premature or ill-conceived regulations.[222] By prohibiting DOT authority over crew and SFP safety until 2012 or until an incident leads to death, fatal injury, or poses a high risk of death or fatal injury, Congress has provided the CHSF breathing room to develop technology and designs. At the same time, mandatory

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[219] *Commercial Space Launch Activities*, 49 U.S.C. §70105(c) (2008). As discussed *infra,* the FAA-AST also has authority to regulate design or operation of a launch vehicle to protect the health and safety of the crew and SFP before 23rd December, 2112 in accordance with §70105(c) provisions regarding a serious or fatal injury to crew or SFP or a high-risk event of such injury.

[220] Timothy Hughes & Esta Rosenburg, "Space Travel Law (And Politics): The Evolution of the Commercial Space Launch Amendments Act of 2004" (2005) 31(2) J. Space L. 12 at 47; (Quoting U.S. Congressional Rep. Oberstar).

[221] Tracey Knutson, "What is "Informed Consent" (2007) 33 J. Space. Law 105 at 109.

[222] Timothy Hughes & Esta Rosenburg, "Space Travel Law (And Politics): The Evolution of the Commercial Space Launch Amendments Act of 2004" (2005) 31(2) J. Space L. 12 at 46.

information disclosures ensure that SFP are aware of the risks they are incurring and that their flight is not a highly regulated mode of transportation but an unproven risky adventure. Ultimately, crew, SFP, and the CHSF industry will be highly regulated; but until that time it is appropriate to protect the innocent public. This logic achieves the stated policy goal to protect the public while promulgating regulations that can evolve as the industry develop and that neither stifles technology development nor exposes crew or SFP to avoidable risks as the public comes to expect greater safety for crew and SFP from the industry.[223]

C. U.S. National Space and Space Transportation Policy

National Space Policy and Space Transportation Directives are executive policy instruments understood as a statement of goals or objectives which the President sets and pursues.[224] Whether these directives have the force of law is a matter of legal debate and depends upon such factor as the President's authority to issue them, their conflict with Constitutional or statutory provisions, and their promulgation in accordance with prescribed procedure.[225] This paper will not examine the legality of presidential directives. Instead, the directives are examined as statements of policy that are meant to be implemented by the Executive branch in accordance with the law. To that end, these directives provide context for the implementation of law and regulations governing commercial human space flight activities.

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[223] *Commercial Space Launch Activities*, 49 U.S.C. §70101(a)(15) (2008).
[224] U.S., Congressional Research Service, prepared by Harold C. Relyea, *Presidential Directives: Background and Overview*, (updated August 9th, 2007, Order Code 98-611) at 2.
[225] Paraphrasing U.S., Congressional Research Service, prepared by Harold C. Relyea, *Presidential Directives: Background and Overview*, (updated August 9th, 2007, Order Code 98-611) at 2.

On August 31st, 2006, President George W. Bush authorized a new U.S. National Space Policy Directive ('National Directive') that establishes overarching national policy that governs the conduct of U.S. space activities.[226] While the National Directive covers a variety of space related activities, our interest lies in the Commercial Space Guidelines.[227] The Commercial Space Guidelines requires Executive departments and agencies to maintain a timely and responsive regulatory environment for licensing commercial space activities,[228] and to ensure that U.S. Government space activities, technology and infrastructures are made available for private use on a reimbursable, non-interference basis to the maximum practical extent, consistent with national security.[229]

These guidelines have two practical impacts. First, the FAA-AST is compelled to process commercial launch licenses in a timely manner. This is important because FAA-AST licensing activities impose direct and indirect costs on CHSF operators. Second, federal technology and infrastructure are made available for private use and could be utilized by the CHSF industry.

The U.S. Space Transportation Policy Directive ('Transportation Directive') establishes "national policy, guidelines, and implementation actions for U.S. space

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[226] U.S., White House, *U.S. National Space Policy Unclassified /NSC-49*, (Issued on August 31st, 2006) available online: < http://www.licensing.noaa.gov/USNationalSpacePolicy_083106.pdf> (accessed March 19, 2008).

[227] Section 7 of the U.S., White House, *U.S. National Space Policy Unclassified /NSC-49*, (Issued on August 31st, 2006) available online:< http://www.licensing.noaa.gov/USNationalSpacePolicy_083106.pdf> (accessed March 19, 2008) is named "commercial space guidelines."

[228] Section 7 of the U.S., White House, *U.S. National Space Policy Unclassified /NSC-49*, (Issued on August 31st, 2006) available online:< http://www.licensing.noaa.gov/USNationalSpacePolicy_083106.pdf> (accessed March 19, 2008) states: "Maintain a timely and responsive regulatory environment for licensing commercial space activities and pursue commercial space objectives without the use of direct federal subsidies, consistent with the regulatory and other authorities of the Secretaries of Commerce and Transportation and the Chairman of the Federal Communications Commission."

[229] Section 7 of the U.S., White House, *U.S. National Space Policy Unclassified /NSC-49*, (Issued on August 31st, 2006) available online:< http://www.licensing.noaa.gov/USNationalSpacePolicy_083106.pdf> (accessed March 19, 2008) states: "Ensure that United States Government space activities, technology, and infrastructure are made available for private use on a reimbursable, non-interference basis to the maximum practical extent, consistent with national security."

transportation programs and activities to ensure the Nation's ability to maintain access to and use space for U.S. national and homeland security, and civil, scientific, and commercial purposes."[230] The Transportation Directive contains three provisions of special importance to CHSF industry.

First, the Transportation Directive elucidates that access to federal space launch bases and ranges, and other government facilities and services, for commercial purposes is to be provided in a *stable, predictable,* and *at-cost basis* (as defined in 14 U.S.C. §70101 et seq.).[231] As a result, CHSF operations co-located on federal ranges receive the benefit of federal space infrastructure and personal at an at-cost basis. Second, the Directive encourages private sector and state and local government investment and participation in the development and improvement of space infrastructure.[232] Given the relative strength of the federal government as compared to state and local governments, implementing a policy of encouragement instead of dissuasion supports state and local participation in CHSF infrastructure development. Third, commercially available U.S. space transportation products and services are to be purchased to the maximum extent possible, consistent with mission requirements and applicable law.[233] This policy may be particularly helpful to the CHSF industry once the industry has an established capacity to deliver suborbital and orbital passengers and cargo, providing an additional market for CHSF and related launch services.

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[230] U.S., White House, *U.S. Space Transportation Policy Fact Sheet*, (Issued on January 6th, 2005) available online: < http://corport.hq.nasa.gov/launch_services/Space_Transportation_Policy.pdf> (accessed March 19, 2008).
[231] *Ibid.* at Section IV(1)(f).
[232] *Ibid.* at Section IV(1)(g).
[233] *Ibid.* at Section IV(1)(a).

D. Chapter Summary and Conclusions

The Act, Regulations, and Directives are the primary law and regulation governing U.S. CHSF. Only the DOT has authority to license *CHSF vehicle operations*, including the carriage of persons for remuneration, and all CHSF operations must receive a DOT license before conducting operations. The Act, Regulations, and Directives are not the *sole* federal law governing *CHSF activities*, and other federal agencies share regulatory authority with the DOT.

The CLSAA-2004, incorporated into the Act, was ground-breaking legislation that established a licensing and regulatory regime from which the U.S. CHSF industry could develop. This regime attempts to achieve a balance between protecting the public interests and facilitating CHSF industrial development.[234] This is an admirable public policy goal that Congress should continue to pursue.

Congress has created an innovative bifurcated regulatory regime for CHSF that authorizes the DOT to promulgate regulations to protect the general public, but limits their regulatory authority to impose standard on human space flight to protect crew and SFP. Congress has wisely taken the position that regulations governing crew and SFP are required to evolve as the industry matures so that regulations neither "stifle technological development nor expose crew or SFP to avoidable risks as the public comes to expect greater safety for crew and SFP from the industry."[235]

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[234] See *Commercial Space Launch Activities*, 49 U.S.C. §70101(a)(7) (2008). Also see *Commercial Space Launch Activities*, 49 U.S.C. §70103 (2008). The Act enumerates the sometimes competing policy goals of (1) ensuring compliance with the international obligations of the United States and (2) protecting the public health and safety, safety of property, and national security and foreign policy interests of the United States while (3) facilitating and encouraging the development of the CHSF industry.

[235] *Commercial Space Launch Activities*, 49 U.S.C. §70101(a)(15).

To date, several CHSF experimental permits have been issued but no CHSF vehicles have been licensed.[236] It is anticipated CHSF vehicle licenses will be issued in the near future. Until vehicle licenses are issued and the CHSF industry has time to apply the licensing regulatory regime in practice, it will be difficult to conclude whether the current regime is sufficient to serve the needs of both the United States and her domestic human space transportation industry.

It is important for the CHSF vehicle licensing regime to be assessed as one-part of a larger federal regulatory regime applicable to CHSF. As the CHSF industry develops and experience with the U.S. regulatory regime is gained, it is likely regulatory issues outside CHSF licensing, such as ITARs and FCC licenses, will have an impact on licensed CHSF operations. As greater experience is gained with the CHSF licensing regime, solutions should be developed that resolve regulatory deficiencies both inside and outside of the CHSF vehicle licensing regime.

Some authors have argued that the current regulatory framework impedes the development of the commercial space industry and therefore advocate "deregulation."[237] A concept often misunderstood, "deregulation" is the removal of government regulations and restrictions, especially to permit free markets and competition.[238] The impetus of deregulation is generally to allow prices to be determined by market forces.

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[236] *FAA-AST Launch Data and Vehicles*, online: FAA-AST < http://www.faa.gov/about/office_org/headquarters_offices/ast/launch_data/> (Accessed 2 June 2008).

[237] See Charity Rybabinkin, "Let there be Flight: It's time to reform the Regulation of commercial Space Travel" (2004) 69 J. Air L. & Com. 101 at 133. Rybabinkin wrote: "Existing FAA/AST regulations of RLV licensing – while not without purpose – impede the development of the commercial space industry, prompting many to advocate deregulation. An unfettered, or least less burdensome, RLV regulatory regime would enable the U.S. to increase its market share in the commercial space launch industry. In contract, existing RLV regulations will undoubtedly facilitate the continued foreign domination of the commercial space market for the very simple reason that they limit U.S. companies' ability to compete with foreign companies." Rybabinkin then concludes that "RLV regulation must be reformed to resemble the aviation regime if the commercial space travel industry is to ever make it off the launch pad."

[238] *Black's Law Dictionary*, 8th ed., *s.v.* "deregulation".

"Deregulation" does not mean "*no regulation.*" On the contrary, deregulation is often accompanied by an opening up of competitive markets that may require *additional law and regulations* to ensure fair competition, commercial development, consumer safety, environmental safety, product safety and other government interests.[239]

"Deregulation" of CHSF is not necessary because the Act and Regulations do not impose price fixing measures on the CHSF industry nor do they *prima facie* exclude new market participants. While exclusion may occur when potential market participants are unable to commit the capital resources necessary receive licenses and ensure regulatory compliance, this exclusion is not unique to CHSF. *Regulatory reform* to facilitate and promote the commercial space industry, as opposed to *deregulation* of the industry, will be required as the Act, Regulations, and Directives are applied in practice and experience reveals impediments to federal policy objectives. For the time being, Congress should maintain a watchful eye over the development of the CHSF industry and the impact of the CHSF vehicle licensing regime. Regulatory reform can only be achieved after practical experience has identified deficiencies in the CHSF licensing regime.

[239] For example, one can look at the "deregulation" of the telecommunications industry in the United States since the 1970s.

CHAPTER III. U.S. Tort Liability Law and Legal Risk Management in the event of a CHSF Vehicle Accident

In the following chapter, U.S. tort liability law within the paradigm of a potential CHSF vehicle accident is examined and assessed. Given the extensive nature of tort law this section focuses on negligence, strict liability for third party damage, and products liability as it relates to CHSF operators, pilots/crew, SFP, and vehicle manufacturers. Analogies are drawn from aviation and adventure sports/tourism for assessment of potential causes of action, defendants, plaintiffs and applicable standards of care. The role of U.S. state law and recent state legislative initiatives regarding tort liability are examined and assessed. Whether strict liability for third party damage should be imposed on CHSF operators is evaluated. Reciprocal cross-waivers of liability and informed consent provisions established by the Act and Regulations are discussed within the context of tort defense. CHSF operators, pilots/crew, SFP, and vehicle manufacturers are advised to protect against economic loss attributable to likely tort liability resulting from a CHSF vehicle accident. Finally, proposals for legal reform in the area of CHSF tort liability are given.

In this chapter, the potential CHSF vehicle accident is presumed to have occurred in the United States on a flight that departs and arrives from points within the United States. The reason for this presumption is to limit the scope of analysis to U.S domestic tort law. At the end of this chapter, issues relating to international accidents and international law are addressed.

A. The Challenge of CHSF Liability Assessment

The major challenge when assessing potential liability for persons and entities involved in CHSF is the categorization of respective parties' legal duties. Commercial human space flight exhibits functional characteristics of commercial aviation, commercial space launches, adventure sports, and tourism. Legal precedent exists in these respective fields that establish legal duties, standards of care, immunities, and defenses for involved parties. The difficulty for CHSF is predicting how courts will interpret current federal and state statutory law and common law and how the law will be applied in litigation arising from a CHSF accident. The CHSF industry is still in a stage of embryonic development. CHSF vehicles have not yet carried paying passengers. Federal law provides minimum guidance on liability, essentially not legislating in the area of CHSF tort liability. As a result, parties involved in CHSF must do their best to formulate potential risk by drawing parallels to other established industries and deduce the potential universe of liability.

B. General Overview: Torts

A tort is a "civil wrong, other that a breach of contract, for which a remedy may be obtained, usually in the form of damages; a breach of duty that the law imposes on persons who stand in particular relation to one another."[240] "Tort law has three primary functions of goals: (1) compensating persons sustaining a loss or harm as a result of another's conduct; (2) placing the cost of that compensation on those who, in justice, ought to bear it, but only on such persons; and (3) preventing future losses and harms."[241]

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[240] *Black's Law Dictionary,* 8th ed., *s.v.* "tort".
[241] Edward Kionka, *Torts*, 3d ed., (St.Paul Minnesota: West Publishing, 1999) at 5.

Modern tort liability cases are classified into intentional torts, property torts, dignitary torts, economic torts, nuisance, negligence, and strict liability torts.

C. Causes of Action and Potential Defendants

In the event of a CHSF vehicle accident, U.S. commercial aviation litigation provides a model upon which to assess potential tort liability risks.[242] In general, litigation of commercial aviation accidents in the United States that result in injury to either passengers or third parties focus on two causes of action: negligence acts and defective products. Typical aviation accident litigation includes claims of negligence against air carriers, pilots, and manufacturers.[243] In some cases ATC negligence is also alleged.[244] Products liability claims are primarily filed against aircraft manufacturers and manufacturers or suppliers of component parts.[245] Based on the U.S. aviation litigation model, one can predict that negligence lawsuits will arise against CHSF operators, pilots/crew, and ATC and that product liability claims will arise against CHSF vehicle manufacturers and component parts manufacturers or suppliers.

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[242] See Doug Griffith, "The Liability Atmosphere: Awaiting the Commercial Human Spaceflight Industry" (Conference Presentation presented to the Transforming Space 2007, Los Angeles, California, 6th November 2007) [unpublished], powerpoint presentation available online at < http://www.californiaspaceauthority.org/conference2007/images/presentations/071106-1530-Griffith.pdf> (Accessed May 12, 2008). In his presentation, Mr.Griffith comments that state tort law governing CHSF vehicle accidents may be derived largely from aircraft accident cases, focusing on negligence and product liability.

[243] See Windle Turley, *Aviation Litigation,* (Colorado Spring, Colorado: McGraw-Hill, 1986) at 58-134 for an overview of liability for certain defendants.

[244] *Eastern Airlines v. Union Trust*, 221 F2d 62 (D.C. Circuit 1955). Also see Windle Turley, *Aviation Litigation,* (Colorado Spring, Colorado: McGraw-Hill, 1986) at 98.

[245] Windle Turley, *Aviation Litigation,* (Colorado Spring, Colorado: McGraw-Hill, 1986) at 60. Mr.Turley notes that "the majority of recently reported aviation accident cases involve strict liability claims against the aircraft manufacturer. To a lesser extent, strict liability actions are also maintained against the manufacturer or supplier of aircraft component parts, and in some instances, against the manufacturer or supplier of accessory items not incorporated in the aircraft."

In the common law courts of the United States, commercial air carriers, air taxi operators, and most charter services are categorized as common carriers.[246] Common carrier has been defined as "one who engages in the transportation of persons or things from place to place for hire, and who holds himself out to the public as ready and willing to serve the public, indifferently, in the particular line in which he is engaged."[247] U.S. courts have held common carriers are held to a higher degree of care *and/or* a higher degree of negligence to their passengers.[248] Courts that hold common carriers subject to a higher degree of care impose upon a common carrier a duty to their passengers of "the highest degree of care consistent with the mode of conveyance used and the practical operation of its business."[249] Some courts "rather than (or in addition to) making common carriers liable for failure to exercise the 'highest degree of care,' hold them liable for slight negligence."[250] Slight negligence is the failure to exercise great care, a higher degree of negligence.[251] Practically these distinctions have little impact.[252]

Whether or not CHSF vehicle operators are held to be common carriers is a question of fact. To impose common carrier status, courts will need to hold that a CHSF operator "holds itself out to the public as offering to transport freight or passengers for a fee."[253] While CHSF operators have offered their services to the general public,[254] at this

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[246] See Windle Turley, *Aviation Litigation,* (Colorado Spring, Colorado: McGraw-Hill, 1986) at 83. "Airlines, air taxi operators, and most charter services are considered common carriers. As such, they have a duty to exercise the highest degree of care for the safety of their passengers, although this duty falls short of making the common carrier an insurer of its passengers' safety."

[247] Paul S. Dempsey & Michael Milde, *International Air Carrier Liability: The Montreal Convention of 1999* (Montreal: McGill University Institute of Air and Space Law, 2005) at 9.

[248] *Ibid.* at 10. Also see, Edward Kionka, *Torts*, 2d ed., (St.Paul Minnesota: West Publishing, 1991) at 98-101.

[249] Edward Kionka, *Torts*, 2d ed., (St.Paul Minnesota: West Publishing, 1991) at 98-101.

[250] *Ibid.*

[251] *Ibid.*

[252] *Ibid.*

[253] *Black's Law Dictionary,* 8th ed., *s.v.* "common carrier".

[254] *Virgin Galactic* has advertised their CHSF services to the general public.

point in the development of CHSF it is highly unlikely a court will hold CHSF operators as offering transportation to passengers. Instead, courts will most likely hold CHSF operators are offering a tourism or adventure experience. CHSF operators are not offering point-to-point transportation service. They advertise the experience of going into outer space and market CHSF as an adventure flight. Federal law, specifically the Act and Regulations, treats SFP as participants and not passengers, indicative of the status of CHSF *not* as a mode of transportation but instead as an adventure experience.

As CHSF operations evolve, it is possible CHSF operators may be deemed common carriers. Freight operations undertaken by CHSF operators to LEO or point-to-point terrestrial may be the first fact scenario under which CHSF operators are held as common carriers. In addition, when CHSF operators begin offering point-to-point transportation services, either to terrestrial locations or orbiting spacecraft, a stronger argument will exist for imposing common carrier status on CHSF operators.

In commercial aviation accident litigation, passengers are generally not defendants to a lawsuit unless evidence exists that the passenger undertook reckless or intentional conduct that is casually related to the plaintiffs' alleged injury. While it is possible that aviation passengers could be sued on the basis of a negligence claim, it is highly unlikely that a passenger could cause an aviation accident based solely on their negligence. Commercial aviation passengers are passive parties, excluded from participation in the operation of the aircraft, and absent intentional or reckless conduct, very unlikely able to cause serious injury to fellow passengers and crew or damage to the aircraft.

In contrast to commercial aviation passengers, SFP may be able to undertake actions during the operation of the CHSF vehicle that will expose them to negligence tort liability. Potential SFP negligence liability can be considered as similar to negligence liability imposed on participants in the adventure sports/tourism context.[255] In adventure sports/tourism, participants are actively involved in the undertaking and persons participating in adventure sport/tourism activities have the duty to act like a reasonably prudent person in whatever circumstance presented.[256] Failure of adventure sport/tourism participants to fulfill this duty may result in negligence liability for the participant. Similarly, a SFP has a duty to exercise the standard of care as a reasonably prudent person would have exercised in a similar situation. Failure to exercise this duty is a negligent act and could result in SFP negligence liability to fellow participants, pilot/crew, operators, and third parties. Liability exposure will depend on the nature of SFP participation. The standard of care for SFP will depend on how the courts interpret the relationships and duties between the SFP and the pilot, crew, and CHSF operators, the nature of the activity undertaken, relevant state and federal law, and public policy. A significant factor to consider is that the Act and Regulations treats SFP as participants and not passengers, affording them only the protection of informed consent and training sufficient to protect the innocent public.[257]

It also important to note that unlike most commercial aviation passengers, SFP are paying relatively large sums of money for their flight and most likely are high-net-worth

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[255] See Tracey Knutson, "What is "Informed Consent" (2007) 33 J. Space. Law 105. Ms.Knutson's article provides an excellent examination of CLSAA informed consent provision and SFP liability, drawing parallels with the adventure travel industry.

[256] *Ibid.* at 110.

[257] *Commercial Space Launch Activities*, 49 U.S.C. §70101 et seq. (2008).

individuals with the capacity to pay a civil judgment rendered in the plaintiff's favor.[258] This capacity to pay provides an incentive for plaintiffs to include SFP as defendants and argue SFP liability.

D. Potential Plaintiffs

The universe of potential plaintiffs in CHSF vehicle accident cases is larger than in civil aviation. In addition to terrestrial third party plaintiffs (i.e. persons and property on the ground and aircraft in flight) and first party plaintiffs (i.e. SFP, crew, pilots, their survivors and beneficiaries), CHSF operations pose a risk of injury to outer space and high-altitude objects and personnel.[259]

CHSF vehicle operations are scheduled to begin operation in high-altitude suborbital trajectories and have the potential to soon begin operations in low earth orbit (LEO). These operations pose a risk to new technologies that are coming online such as HAVPs, HAUAVs, and other high-altitude projects, as well as LEO operations. As high-altitude and LEO applications develop, the potential universe of plaintiffs will increase.

With regards to terrestrial third parties, the likelihood of third party injury in the event of a CHSF vehicle accident is related to the size of the vehicle, the vehicle materials/composites, flight paths, and the altitude at which the vehicle operates. Current CHSF vehicles are relatively small when compared to modern commercial jet aircraft. This smaller size should lower the risk factor of injury to terrestrial third parties; however as CHSF vehicles become larger, the risk of third party injury will correspondingly

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[258] Peter B de Selding, "Swedish Authorities Look to Ease Way for Virgin Galactic" *Space News* (7 April, 2008) 16.

[259] In the immediate future, CHSF operations are only planned to be conducted as suborbital flights. As CHSF technology develops, CHSF will be conducted in orbit and in other locations that pose a risk to space objects and personal.

increase. CHSF vehicles will operate at higher altitudes than commercial aircraft, potentially expanding the footprint of falling debris (but also potentially removing the footprint if the altitude and trajectory allows for atmospheric burnout). CHSF vehicles will be operating in an environment that requires different materials/composites than in civil aviation and the technologies employed may be a factor in assessing terrestrial third party risk, from a material strength/survivability and environmental standpoint.

E. The Role of State Law: Tort law and Immunity Legislation

In the event of an accident involving a CHSF vehicle, negligence and products liability will be the primary tortuous legal basis on which causes of action are undertaken. These forms of tort liability are primarily governed by state law and "despite the traditionally federal character of spaceflight activity, liability for human spaceflight accidents will be determined by a given state's tort law."[260]

State law poses a unique challenge when assessing and managing liability risk; depending on the jurisdiction in which the claim is litigated different legal standards will apply to determine standards of care and enforceability of contracts.

Federal legislation has not been enacted to preempt state tort law in the field of CHSF. While states are prohibited from having laws inconsistent with federal law, the Act specifically grants states the authority to implement law in addition to or more stringent than a requirement of, or regulation prescribed under, the Act.[261]

States have enacted or proposed legislation (sometimes called "commercial space initiatives") designed to facilitate the development of commercial space activities in their

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[260] *Supra* note 242.
[261] *Commercial Space Launch Activities*, 49 U.S.C. §70117 (2008).

respective jurisdictions. One aspect of commercial space initiatives are liability and immunity provisions that shield entities engaged in commercial space activities from certain types of tort liability.

In 2007, Virginia became the first state to enact legislation providing conditional immunity to CHSF operators. The *Virginia Spaceflight Liability and Immunity Act* (Spaceflight Act) shields FAA-AST licensed entities, including CHSF operators, from liability arising out of human space flight activities.[262] Specifically, the Spaceflight Act prohibits human space flight participants (SFP as defined in the Act, 49 U.S.C. §70102), their representatives, heirs, administrators, executors, assignees, next of kin, estate, or any other person bringing a claim on behalf of the SFP from maintaining an action or recovery from a licensed entities for injury resulting from the risk of spaceflight activities.[263] Entities may not avail themselves of this immunity if they commit an act or omission that constitutes gross negligence evidencing willful or wanton disregard for the safety of the SFP, and that act or omission proximately caused a SFP injury; or the entity intentionally causes a SFP injury.[264]

The Spaceflight Act immunity is provisional on the SFP being informed of the risk of spaceflight activities as required under federal law, the Act, and Regulations.[265] The requirement to inform SFP of risk is the codification of the common law principles associated with the duty to warn in adventure sports.[266] A challenge for spaceflight operators will be determining what should be explained to SFP in order to fulfill their

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[262] U.S., H.B. 3184, §8.01-227.8 & §8.01-227.9, *Spaceflight and Immunity Act*, 2007 Reconvened Session, Virginia, 2007 (enacted).
[263] *Ibid.*
[264] *Ibid.*
[265] *Ibid.*
[266] Tracey Knutson, "What is "Informed Consent" (2007) 33 J. Space. Law 105 at 113.

legal duties under statute and common law.[267] The Spaceflight Act provides some guidance, giving an example "warning statement" that at a minimum (and in addition to any language required by federal law) would fulfill the Spaceflight Act's requirement of informing SFP of spaceflight risks.[268]

While writing this thesis, the Florida legislature approved the *Spaceflight Informed Consent Bill* (Florida Immunity Act). The *Florida Immunity Bill* provides conditional liability immunity for CHSF operators for injury or death resulting from the inherent risks of spaceflight and is structured similar to Virginia's Spaceflight Act.[269] If signed into law by the Governor of Florida, Florida will become the second state to enact legislation that provides conditional tort liability immunity for CHSF operators.

Recent state legislative initiatives indicate states are willing to take the lead in facilitating the development of commercial human space flight by providing some measure of liability protection for operators. While state initiatives do provide protection, they should be viewed as temporary measures that only partially remedy the issue of CHSF operator liability. If one takes the position that CHSF operators would benefit from harmonization and standardization of relevant law and that said harmonization and standardization would facilitate the development of the industry, then state law initiatives are insufficient. State law initiatives apply only in the jurisdiction of the state where enacted. Depending on the jurisdiction where litigation is filed and choice of law provisions (contractual, statutory, or common law), state immunity legislation may or

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[267] *Ibid.* at 113.
[268] U.S., H.B. 3184 §8.01-227.10, *Spaceflight and Immunity Act*, 2007 Reconvened Session, Virginia, 2007 (enacted).
[269] U.S., S.B. 2438, *Spaceflight Informed Consent Bill,* 2007-08, Reg.Sess., Florida, 2008 (pending signature of Governor for enactment as of May 13, 2008). Also see Patrick Peterson, "Florida helps Space Industry" *Florida Today* (5 May, 2008), online: Florida Today < http://www.floridatoday.com/apps/pbcs.dll/article?AID=/20080505/NEWS02/80505001/1007/news02> (Last Accessed May 13, 2008).

may not be applicable. As a result, CHSF operators still face a multiplicity of possible legal standards and liability exposure. For the time being, CHSF operators should be aware of state initiatives and conduct operations in jurisdictions with favorable state laws. At the same time, CHSF operators should contract with SFP for preferred choice-of-law provisions.

F. Imposing Strict Liability on CHSF Vehicle Operator for Damage Caused to 3rd Parties on the Ground, in the Air or in Outer Space

A negligence tort is "a tort committed by failure to observe the standard of care required by law under the circumstances."[270] Liability for negligent conduct is premised on the idea that "all persons are under a duty to conduct themselves in all of their diverse activities so as not to create unreasonable risks of physical harm to others."[271] The components of a cause of action for negligence are *Duty, Breach of Duty, Causation,* and *Damages*.[272] Like all persons, CHSF vehicle operators are tasked with a general duty of care not to commit a negligent act (i.e. a duty to exercise the standard of care as a reasonably prudent person would have exercised in a similar situation).[273]

In addition to negligence, courts sometimes impose strict liability. Strict liability is "liability that does not depend on actual negligence or intent to harm, but that is based on the breach of an absolute duty to make something safe."[274] Absent statutory rules, whether CHSF vehicle operators are subject to strict liability for damage caused by a

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[270] *Black's Law Dictionary,* 8th ed., *s.v.* "negligent tort".
[271] Edward Kionka, *Torts*, 3d ed., (St.Paul Minnesota: West Publishing, 1999) at 5.
[272] *Ibid.* at 55.
[273] *Black's Law Dictionary,* 8th ed., *s.v.* "negligence".
[274] *Black's Law Dictionary,* 8th ed., *s.v.* "strict liability".

CHSF vehicle to 3rd parties on the ground, in the air or in outer space will be a point of litigation decided by the courts.

To date, there are no court cases directly applicable to CHSF vehicle operations. Legal precedent in the fields of aviation and rocketry provide insight on likely judicial interpretations of law and policy because CHSF vehicles exhibit functional characteristics of both aviation and rocketry. In cases involving ground damage caused by aircraft and rockets, courts have ruled on the applicability of strict liability standards. These cases, read in conjunction with the 2nd and 3rd (Final Draft) Restatement of Torts, provide a basis upon which to infer whether courts should apply strict liability to CHSF operators for damage caused to 3rd parties on the ground, in the air or in outer space.

i. On the Ground

Tort liability standards for ground damage from aircraft have evolved over time. Initially, operating an aircraft was deemed to be an abnormally dangerous activity and therefore strict liability was imposed.[275] During the 1950's and 1960's, courts began to hold that "in light of the technical progress achieved in the design, construction, operation and maintenance of aircraft generally, that flying could no longer be deemed an ultra-hazardous activity, requiring the imposition of absolute liability for any damage or injury caused in the course thereof."[276] These holdings represented a departure from the

[275] *Restatement (Second) of Torts* §520A (1976).

[276] *Larmicia Wood et al., v. United Air Lines, Inc.,, et al.,* 223 N.Y.S.2d 692 (1961) at 697. Also see Windle Turley, *Aviation Litigation,* (Colorado Spring, Colorado: McGraw-Hill, 1986) at 54: "Aviation in general, however, is no longer itself considered an ultra-hazardous activity rendering carriers strictly liable for all accident, although he Restatement indicates that pilots and owners are strictly liable under this theory for ground damage based by aviation accidents."

imposition of strict liability based on a theory of aviation no longer being an abnormally dangerous activity.

The Restatement (Second) Torts imposes strict liability for operators of aircraft for physical harm to land, person, or chattels on the ground caused by the ascent, descent or flight of an aircraft, or by the dropping or falling of an object from the aircraft.[277] The Restatement (Second) Torts takes the position that "while the safety record is greatly improved it cannot be said that the danger of ground damage has been so eliminated or reduced that the ordinary rules of negligence law should be applied."[278] Since the adoption of the Restatement (Second) Torts, courts continued to move towards a negligence standard of liability for ground damage caused by aircraft.[279] The Restatement (Third Final-Draft) Torts recognizes that "aviation does not fit the formal Restatement criteria for abnormally dangerous activity" and leaves open the question whether or not strict or negligence liability should be imposed for ground damage.[280] The Restatement (Third Final-Draft) does present the defendant's control over the instrumentality of harm as an alternative rationale for the imposition of strict liability "impressively applicable in aviation ground-damage cases."[281]

Case law involving ground damage from rockets is limited. There are two cases, both from the 1960's, in which the plaintiffs brought tort actions for compensation due to the effect of rocket engine testing.[282] The damage caused by the rocket engine tests was

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[277] *Supra* note 275.
[278] *Restatement (Second) of Torts* §520A (1976).
[279] *Crosby v. Cox Aircraft Co.*, 746 P.2d 1198 (Wash. 1987) at 1202.
[280] *Restatement (Third) of Torts* §20 cmt. k (*Final Draft No.1,* April 6, 2005).
[281] *Ibid.*
[282] See *Magnus Berg, Hans Carlson, et al., v. Reaction Motors Division, Thiokol Chemical Corp.*, 37 N.J. 396; 181 A.2d 487 (Sup.Ct. 1962). Also see *Raymond Phil Smith et al., v. Lockhead Propulsion Company*, 247 Cal. App 2nd 774; 56 Cal. Rptr. 128 (App.Ct 1967).

analogized to damage resulting from blasting.[283] In both cases the courts held the defendants strictly liable on a theory that the activity undertaken was ultra-hazardous (i.e. abnormally dangerous) and that public policy concerns required the imposition of strict liability for trespass.[284]

Parties in favor strict liability for ground damage caused by CHSF vehicle operations can draw several analogies in support of their position. First, the historical development of aviation demonstrates an evolution from the imposition of strict liability to the imposition of negligence as the industry matured, underlying technology developed, and the likelihood of airplane crash occurring absent tortuous conduct lessoned.[285] Similarly, CHSF is a new industry without sufficient flight experience to establish a basis on which to estimate risk to the uninvolved public or determine the likelihood of a vehicle crash absent tortuous conduct and whose technology is in the developmental stages. Second, CHSF vehicles are in the exclusive control of the operators, an argument presented in favor of strict liability for ground damage caused by airplanes that is equally valid when applied to CHSF vehicles.[286] Third, an argument exists that CHSF launch/reentry/and suborbital flight operations meet the criteria of an abnormally dangerous activity and hence should be subject to strict liability. Restatement (Second) Torts §520 provides six criteria to determine whether an activity is abnormally dangerous: (1) existence of high degree of risk of some harm to the person, land or

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[283] *Ibid.*
[284] *Ibid.*
[285] See *Restatement (Third) of Torts* §20 cmt. k (*Final Draft No.1,* April 6, 2005); noting that: Almost all airplane crashes occur because of tortious conduct -- the negligence of the airline, the negligence of federal airtraffic control, or a defective product supplied by the aircraft manufacturer. Indeed, in cases brought on behalf of airline passengers, liability is rarely contested. A quite small (yet ultimately unquantifiable) percentage of all airplane crashes happen utterly without negligence or tortious conduct."
[286] See *Restatement (Third) of Torts* §20 cmt. k (*Final Draft No.1,* April 6, 2005); stating: "Nevertheless, as Comment *f* has emphasized, one rationale for strict liability relates to the defendant's exclusive control over the instrumentality of harm, and this rationale is impressively applicable in aviation ground-damage cases."

chattels of others; (2) likelihood that the harm that results from it will be great; (c) inability to eliminate the risk by the exercise of reasonable care; (d) extent to which the activity is not a matter of common usage; (e) inappropriateness of the activity to the place where it is carried on; and (f) extent to which its value to the community is outweighed by its dangerous attributes.[287] CHSF does exhibit several of the characteristics listed in §520. CHSF is not yet of common usage,[288] does pose a risk of some harm that cannot be eliminated by the exercise of reasonable care,[289] and it is likely that the harm that results from CHSF vehicle accident will be great.[290] Points of contention are how "high" the degree of risk is, the appropriateness of the activity to the place where carried on, and the extent to which its value to the community is outweighed by its dangerous attributes.

Parties in favor of negligence for ground damage can present a doctrinal argument that strict liability for vehicle operators is no longer of significance.[291] This argument presumes that similar to aviation accidents, most CHSF accidents will be caused by negligence or defective products. The problem is that CHSF has not had time to establish a history of accidents that supports this presumption. Initially, the cause of CHSF

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[287] *Restatement (Second) of Torts* §520 (1976). But see *Restatement (Third) of Torts* §20 (*Final Draft No.1,* April 6, 2005) which provides two criteria to determine whether an activity is abnormally dangers: (1) the activity creates a foreseeable highly significant risk of physical harm even when reasonable care is exercised by all actors; (2) and the activity is not one of common usage.

[288] The *Restatement (Second) of Torts* §520 comment *i* (1976) defines common states: "An activity is of common usage if it is customarily carried on by the great mass of mankind or by many people in the community." Also see *Crosby v. Cox Aircraft Co.,* 746 P.2d 1198 (Wash. 1987) at 1207; adopting the definition of *Restatement (Second) of Torts §520* comment *i* (1976).

[289] No matter how much reasonable care is taken, there is always a risk of a vehicle causing damage on the ground to innocent third parties.

[290] If a CHSF vehicle or component part does cause harm to a structure or person, it is likely to be significant given the altitude and velocities that CHSF vehicles will operate. Simple trespass on land without damaging persons, structures, or the economic value of the land is possible, but not likely. The best case scenario for a CHSF accident is for it to occur over an uninhabited location with no economic activity on the land. The wrost case scenario is for a CHSF accident to occur over a city or populated area.

[291] *Restatement (Third) of Torts* §20 cmt. k (*Final Draft No.1,* April 6, 2005).

accidents may remain unknown or may not be the result of negligence or defective products.

Courts should rule in favor of imposing strict liability against licensed vehicle operators for ground damage caused by CHSF vehicles. CHSF vehicle safety, reliability, technology, and regulation have not yet reached the level of development achieved in modern civil aviation; thereby negating an argument in favor of adopting modern aviation negligence standards while supporting the position that CHSF is abnormally dangerous. CHSF is a unique and rare undertaking and it may be several decades before CHSF has evolved to the point of common usage. The imposition of strict liability for abnormally dangerous activities is "designed largely to protect innocent third parties and innocent bystanders" and uninvolved parties on the ground have no control over the CHSF vehicle and no means to prevent or mitigate the harm. [292] As Dean Prosser aptly stated: "The problem [of imposing strict liability] is dealt with as one of allocating a more or less inevitable loss to be charged against a complex and dangerous civilization, and liability is placed upon the party best able to shoulder it,"[293] and in relation to innocent third parties on the ground, CHSF vehicle operators are in a better position to prevent and absorb loss.

ii. In the Air

Aircraft operators owe a duty of ordinary care to other aircraft that includes compliance with FAA regulations, adherence to filed flight plans, operating at the proper altitude and speed, keeping proper lookout, and yielding the right of way.[294] Failure to

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[292] *Restatement (Third) of Torts* §24 cmt. a (*Final Draft No.1,* April 6, 2005).
[293] *Raymond Phil Smith et al., v. Lockhead Propulsion Company*, 247 Cal. App 2nd 774; 56 Cal. Rptr. 128 (App.Ct 1967) at 785 quoting Prosser, *Law of Torts*, 2d ed. (1955) at 318.
[294] Windle Turley, *Aviation Litigation,* (Colorado Spring, Colorado: McGraw-Hill, 1986) at 85.

observe this standard of care is a negligent act.[295] Similarly, CHSF vehicle operators, like all persons, are under a duty to exercise the standard of care as a reasonably prudent person would have exercised in a similar situation.[296] One can analogize from aviation that CHSF vehicle operators owe a duty of care to all other vehicles in the air that includes compliance with FAA and FAA-AST regulations, adherence to filed flight plans, etc., and that failure to observe this standard of care is a negligent act.

In addition to negligence, courts could impose strict liability on CHSF vehicle operators for damage caused to other vehicles in the air. The most likely rational for imposition of strict liability is that CHSF is an abnormally dangerous activity no different than a rocket test firing and just as damage caused on the ground is subject to strict liability, so should damage caused in the air.[297] However there is a distinction that can be drawn between the imposition of strict liability on CHSF and rocket activities for damage on the ground as opposed to damage in the air. Unlike injured parties on the ground, aircraft (and other vehicles in the air) and their passengers can be said to have assumed a degree of risk that accompanies all air travel. This assumption of risk includes risks inherent in operating an aircraft in airspace that is accessible to CHSF vehicles. Therefore CHSF vehicle operators should not be held to strict liability, but instead should be subject to the duty of ordinary care owed to all other vehicles operating in the air.[298]

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[295] *Black's Law Dictionary,* 8th ed., *s.v.* "negligent tort".
[296] *Black's Law Dictionary,* 8th ed., *s.v.* "negligence".
[297] *Supra* note 282.
[298] The duty owed to all other vehicles operating in the air should not be confused with the duty owed to passengers and/or participants. If CHSF operators are held to be common carriers either a higher degree of care or higher duty of care will be imposed on CHSF operators towards their passengers but *not towards* other vehicles operating in the same airspace. Regardless of whether CHSF operators are held to be common carriers, there is a general duty not to commit negligent acts that cause injury to other vehicles in the air. The question is whether courts will impose an escalated duty of care on CHSF vehicles towards aircraft operating in the same air space.

There is also an inconsistency of applying strict liability to CHSF vehicles for damage caused to aircraft in flight but not to aircraft for damage caused to CHSF vehicles in flight. If courts do impose strict liability on CHSF, they will be distinguishing aircraft from CHSF vehicles and imposing different standards of care within the same spatial region (i.e. airspace). Ruling as such, the courts will also inadvertently conclude as to whether CHSF vehicles are aircraft or spacecraft and as such whether they should be subject to the same standards of tort liability. The precedent established by ruling in favor of strict liability for CHSF vehicles would have implications in other legal arenas grappling with the issue of whether CHSF vehicles should be categorized as aircraft or spacecraft and thereby subject to the legal norms respectively applicable. This is because underlying the question of strict liability is a question of whether CHSF should be subject to the legal norms of aviation or outer space. Courts should be reluctant to set a precedent at this time, instead supporting a negligence standard on the basis of equity for all vehicles operating in airspace, regardless of whether they are air or spacecraft, and reserving the issue of strict liability to federal and state legislatures.

iii. In Outer Space

CHSF vehicle operators, like all persons in space or all persons who place an object in space, are under a duty to exercise the standard of care as a reasonably prudent person would have exercised in a similar situation.[299] Failure of CHSF vehicle operators to exercise reasonable care for activities in outer space will expose them to potential negligence tort liability.

[299] *Black's Law Dictionary,* 8th ed., *s.v.* "negligence".

This duty of reasonable care is not affected by the *Liability Convention.*[300] The *Liability Convention* provides an alternative method for resolution of liability for damage caused by space objects that allows States which suffer damage, or whose natural or juridical persons suffer damage, to present to a launching State a claim for compensation such damage.[301] But the *Convention* does not impose domestic tort liability standards and does not preclude individuals from pursuing remedies in domestic courts.[302] Individuals are allowed to file negligent tort claims in U.S. domestic courts for damage caused by CHSF vehicles to objects or persons in outer space, subject to the laws of the United States.

The doctrine of res ipsa loquitur provides that "in some circumstances the mere fact of an accident's occurrence raises an inference of negligence so as to establish a prima facie case."[303] "The doctrine implies that the court does not know, and cannot find out, what actually happened in the individual case. Instead, the finding of likely negligence is derived from knowledge of the causes of the type or category of accident involved."[304] CHSF vehicle accidents in outer space are an appropriate type of accident for the doctrine of res ipsa loquitur to be invoked, which shifts the burden of proof on the negligence issue to the defendants.

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[300] *Convention on International Liability for Damage Caused by Space Objects* (Also known as the *'Liability Convention'*), March 29, 1972, 961 U.N.T.S. 187.
[301] Article VII of the *Convention on International Liability for Damage Caused by Space Objects* (Also known as the *'Liability Convention'*), March 29, 1972, 961 U.N.T.S. 187.
[302] The intent of the Liability Treaty is to provide a legal mechanism for States to claim damages. Nothing in the treaty prohibits individuals from pursuing domestic remedy. This interpretation of the Treaty is consistent with the text of the *Treaty,* the travaux preparatories of the Treaty, historical context, and general rules of international law.
[303] *Black's Law Dictionary,* 8th ed., *s.v.* "res ipsa loquitur".
[304] *Black's Law Dictionary,* 8th ed., *s.v.* "res ipsa loquitur" quoting *Restatement (Third) of Torts* §17 cmt. a (Tentative Draft No.1, 2001).

The environment of outer space and our current ability to operate in outer space prevents accident 'site' investigation and debris recovery. As a matter of fact, 'site' investigation is impossible unless the accident occurred on a celestial body.[305] To further complicate matters, only limited capabilities exist to track space objects. Most, if not all evidence related to an outer space CHSF vehicle accident will be in terrestrial recordings and data. Given the limited capacity of plaintiffs to conduct an investigation of CHSF vehicle accidents in outer space, courts will most likely rely heavily on the doctrine of res ipsa loquitur.

Courts should not impose strict liability on CHSF vehicle operators for damage caused to objects in outer space. First, strict liability applied only to CHSF vehicles and not to other objects/vehicles in outer space is fundamentally inequitable. While CHSF vehicles pose a threat to other objects in space, that threat is not significantly greater than any other object in space. There is nothing abnormally dangerous about CHSF vehicle activities as compared to other space activities. Simply imposing strict liability on CHSF vehicles for damage caused to space object *cart blanc* is without equitable basis.

Second, strict liability is not necessary to ensure those harmed are compensated. In the event of a collision between a CHSF vehicle and a space object, the facts can be assessed to determine who, if any, was a negligent party. Space objects may be negligently piloted, derelict, or otherwise malfunction as to cause a collision with a CHSF vehicle. In the absence of direct evidence, negligence can be inferred from known

[305] Under general rules of physics, in outer space the momentum of objects will carry them over a period of time to in a particular direction to a different location relative to the point earlier in time. The result is that the 'site' of the accident is only a spatial reference point at a specific period of time, time in the past that we do not have the ability, at this point in human development, to travel to.

orbital parameters, satellite registries, and other "knowledge of type or category of accident involved."[306]

Third, the *Liability Convention* applies liability for damage to space objects or persons on board of a space object only if the damage is due to fault.[307] While the *Convention* is not applicable to domestic tort claims, the courts should still consider that one of the *Convention's* stated purposes is "full and equitable measure of compensation to victims."[308] By refusing to impose strict or absolute liability, the *Convention* implicitly found the imposition of strict liability for damage to objects in outer space as inequitable.

Imposition of strict liability for damage caused to persons *not* onboard a space object can be distinguished from persons onboard. Public policy arguments in favor of imposing strict liability for damage caused to persons in outer space (i.e. on a space walk) but not onboard a space object include the relative vulnerability of persons in outer space and utmost importance of protecting human life and preventing future accidents. Of course, strict liability is not absolute. If a person intentionally collides with a CHSF vehicle or commits an act of gross negligence, courts may refuse to impose strict liability on vehicle operators.

The potential liability for damage caused to space objects is significant. As CHSF and other commercial space activities develop, CHSF vehicles will eventually begin conducting operations near or at space objects. Once CHSF vehicles are operated near or at space objects, there will be a corresponding increase in the probability of a collision occurring between CHSF vehicles and space objects. This higher probability also results

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[306] *Supra* note 304.
[307] Article III *Convention on International Liability for Damage Caused by Space Objects* (Also known as the *'Liability Convention'*), March 29, 1972, 961 U.N.T.S. 187.
[308] Preamble to the *Convention on International Liability for Damage Caused by Space Objects* (Also known as the *'Liability Convention'*), March 29, 1972, 961 U.N.T.S. 187.

in higher risks of loss, a serious concern for the insurance industry that may impact the cost of insurance policies. One can imagine the cost of damages for the destruction of an orbiting space hotel and death of all its inhabitants could be in the hundreds of millions, in not billions of dollars. Law and policy makers should begin today to assess the issue of tort liability because once significant commercial space activities are undertaken the issue of tort liability for damage caused on the ground, in the air and in outer space will be of critical importance.

G. Federal Law: The Act's Risk Sharing Regime

The Act establishes a risk sharing regime that provides protections for the federal government and licensed operators (as well as their contractors and subcontractors), but not space flight participants.[309] SFP are specifically excluded from the definition of 'customer,' and not listed in the definition of 'contractor or subcontractor.'[310] As a result, SFP are not placed within the mandatory cross-waiver provisions, insurance, and indemnification provisions applicable to customers, contractors, or subcontractors of CHSF licensed operators. The exclusion of SFP demonstrates Congressional intent to "allow[s] individuals to undertake space flight at their own physical and financial risk."[311]

The government is in the envious position of receiving the protection of mandatory cross-waiver of claims from operators (their customers and contractors and subcontractors), crew, and SFP under which each party to the waivers agrees to be

[309] See generally *Commercial Space Launch Activities*, 49 U.S.C. §70112 & §70113 (2008).
[310] *Commercial Space Transportation Regulations,* 14 C.F.R. §430.3 (2008).
[311] Timothy Hughes & Esta Rosenburg, "Space Travel Law (And Politics): The Evolution of the Commercial Space Launch Amendments Act of 2004" (2005) 31(2) J. Space L. 12 at 59.

responsible for property damage or loss it sustain, or for personal injury to, death of, or property damage or loss sustained by its owns employees or by SFP.[312] Licensed operators also receive the benefit of mandatory cross-waivers, but those protections are not mandated as applicable to SFP.[313] The Act's silence on mandatory cross-waiver provisions between licensed operators and SFP does allow for contractual agreements that shift the risk of loss from SFP to operators.[314]

The Act has a three-tier financial responsibility risk sharing mechanism that provides financial protection for licensed operators but *not* for SFP. First, operators are required to carry liability insurance or demonstrate financial responsibility to compensate for MPL[315] from claims of third parties and claims from the U.S. government for damage or loss of property from an activity carried out under the license.[316] Second, conditioned on Congressional budget approval, the federal government accepts risks of loss above mandatory insurance or demonstration of financial responsibility up to $1,500,000,000 (adjusted for inflation from January 1st, 1989).[317] Third, above $1,500,000,000 (AFI 1989) licensed operators are financially response.[318]

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[312] *Commercial Space Launch Activities*, 49 U.S.C. §70112(b) (2008).
[313] *Ibid.*
[314] *Supra* note 311 at 59, stating: "Absent enforceable private contractual arrangements between a space flight participant and the vehicle operator (licensee) holding the participant harmless and indemnified by the operator, ineligibility may provide to be a substantial deterrent to an individual, particularly a wealth one with "deep pockets," in deciding whether to engage in space flight."
[315] *Commercial Space Transportation Regulations,* 14 C.F.R. §430.3 (2008). MPL is defined as "The greatest dollar amount of loss for bodily injury or property damage that is reasonably expected to result from a licensed or permitted activity; (1) Losses to third parties, excluding Government personnel and other launch or reentry participants' employees involved in licensed or permitted activities, that are reasonably expected to result from a licensed or permitted activity are those that have a probability of occurrence of no less than one in ten million; (2) Losses to Government property and Government personnel involved in licensed or permitted activities that are reasonably expected to result from licensed or permitted activities are those that have a probability of occurrence of no less than one in one hundred thousand."
[316] *Commercial Space Launch Activities*, 49 U.S.C. §70112 (2008).
[317] *Commercial Space Launch Activities*, 49 U.S.C. §70113 (2008). The Act states that "to the extent provided in advance in an appropriation law or to the extent additional legislative authority is enacted providing paying claims in a compensation plan submitted under subsection (d) of this section, the Secretary of Transportation shall provide for the payment by the united States Government of a successful

While the Act provides a mechanism for Congressional approval and funding of a compensation plan, it does not *require* Congress to indemnify. This decision is ultimately left to the discretion of Congress as to whether she will exercise her spending power to that end. While this indemnification provision is a strong public statement of support for the CHSF industry and may be comforting, operators and insurers should beware that in the event of a catastrophic accident, their indemnification is not guaranteed by the Act but instead will depend on the political will of Congress and the President.

The Act does not provide conditional indemnification of successful claims by third party litigants against SFP and does not mandate licensed operators place SFP under the protection of insurance policies. [319] As a result, if SFP want protection against personal liability, they must secure their own insurance, either through operator policies or through an independent SFP insurance policy.[320] Even if SFP attempt to secure insurance, it is unclear whether the insurance industry will be willing to insure individual SFP and if so to what amount and at what premium. Exclusion of SFP from federal catastrophic indemnification exposes SFP to unlimited liability and potentially raises insurance liability premiums. Operators can rely on provisional catastrophic indemnification provisions, receiving what is in essence a federal subsidy for catastrophic liability insurance, but SFP are provided only the protection they can afford to purchase or negotiate.

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claims (including reasonable litigation or settlement expenses) of a third party against a licensee or transferee under this chapter, a contractor, subcontractor, or customer of the licensee or transferee, or a contractor or subcontractor of a customer, but not against a space flight participant, resulting from an activity carried out under the license issued or transferred under this chapter for death, bodily injury, or property damage or loss resulting from an activity under the license."

[318] *Commercial Space Launch Activities*, 49 U.S.C. §70113 (2008).

[319] *Ibid.*

[320] *Supra* note 311 at 59, stating: "Significantly, nothing prevents a licensee or operator from adding individual space flight participants as additional insured under its liability policy. In fact, a smart consumer might demand it and a smart operator might offer it as a competitive advantage."

H. SFP Informed Consent: A Need to Clarify the Concept and Application to CHSF

Consent is legally effective assent and is "an affirmative defense to assault, battery, and related torts, as well as such torts as defamation, invasion of privacy, conversion, and trespass."[321] Informed consent is a term traditionally applied within the context of professional negligence cases, in particular medical malpractice, and "is a person's agreement to allow something to happen, made with full knowledge of the risks involved and the alternatives."[322] "What makes informed consent unique is that something is done to the participant by another party (usually the medical provider) with the participant's consent."[323] Informed consent is sometimes used in an adventure sports/tourism context when assessing whether professional guides are negligent for failing to disclosure information to clients regarding risks associated with different choices available.[324]

The Act and Regulations §460.45 mandate CHSF vehicle operators inform each SFP in writing about the risk of the launch and reentry, including the safety record of the vehicle type *before receiving compensation or agreeing to fly* a SFP.[325] *For each mission*, operators must inform SFP, in writing, of the known hazards and risks that could result in serious injury, death, disability or total or partial loss of physical and mental function and disclose that participation may result in these hazards and risks.[326] Operators

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[321] *Black's Law Dictionary,* 8th ed., *s.v.* "consent".
[322] *Black's Law Dictionary,* 8th ed., *s.v.* "informed consent".
[323] *Supra* note 266 at 110.
[324] Ross Cloutier *et al., Legal Liability and Risk Management in Adventure Tourism,* (Kamloops, Canada: Bhudak Consultants, 2000) at 18.
[325] *Commercial Space Transportation Regulations,* 14 C.F.R. §460.45 (2008).
[326] *Commercial Space Transportation Regulations,* 14 C.F.R. §460.45 (2008).

must also disclose that there are unknown hazards, that the U.S. Government has not certified the CHSF vehicle as safe for carrying crew of SFP, and provide a safety record of all launch and reentry vehicles that have carried one or more persons aboard.[327] These disclosure requirements have been named by commentators the "informed consent" provisions of the CLSAA-2004.[328]

The fulfillment of CLSAA-2004 informed consent requirements will *not* serve as enforceable release and waiver contracts or satisfy requirements for common law defenses associated with assumption of risk simply because the term "implied consent" has been adopted in parlance. The legal effect of CHSF operator compliance with CLSAA-2004 "implied consent" provisions as either contractual or common law tort defenses will be determined under applicable state law.

I. Vicarious Liability

Vicarious liability is "liability that a supervisory party (such as an employer) bears for the actionable conduct of a subordinate or associate (such as an employee) based on the relationship between the two parties."[329] "The vicarious liability of an employer for torts committed by employees should not be confused with the liability an employer has for his own torts. An employer whose employee commits a tort may be liable in his own right for negligence in hiring or supervising the employee."[330]

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[327] *Commercial Space Transportation Regulations,* 14 C.F.R. §460.45 (2008).
[328] *Supra* note 266 at 106. Also see *Supra* note 311 at 51.
[329] *Black's Law Dictionary,* 8th ed., *s.v.* "vicarious liability".
[330] *Black's Law Dictionary,* 8th ed., *s.v.* "vicarious liability" quoting Kenneth S. Abraham, *The Forms and Functions of Tort Law* 166 (2002).

When a CHSF vehicle pilot[331] or crew member is an agent of the CHSF operators and is acting with the scope of authority or employment at the time of an accident, the pilot and/or crew liability can be imputed to the CHSF operator through the doctrine of respondent superior.[332]

J. Products Liability

CHSF vehicle and component parts manufacturers may be subject to products liability claims. Product liability claims can be based on a theory of negligence, strict liability, or breach of warranty.[333]

In the event of a CHSF vehicle accident, persons (SFP and third parties) who suffer injury or death may sue vehicle manufacturers under a theory of negligence or strict liability. To successfully litigate a strict products liability claim, plaintiffs must prove that (1) the goods were unreasonably dangerous and that (2) the seller was in the business of selling goods, (3) the goods were defective when they were in the seller's hands, (4) the defect caused the plaintiff's injury, and (5) the product expected to and did reach the consumer without substantial change in condition.[334] A product is defective when, at the time of sale or distribution, it contains a manufacturing defect, is defective in design, or is defective because of inadequate instructions or warnings.[335]

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[331] *Commercial Space Launch Activities*, 49 U.S.C. §70102(2) (2008). Note that the CLSAA definition of CHSF "crew" includes pilots.
[332] *Supra* note at 118. Explaining that in commercial aviation "where a pilot is an agent or employee acting within the scope of authority or employment at the time of an accident, the pilot's liability can be imputed to the pilot's principal or employer, frequently an air carrier or the government, through the doctrine of respondent superior. Also see *Black's Law Dictionary,* 8th ed., *s.v.* "respondeat superior".
[333] *Black's Law Dictionary,* 8th ed., *s.v.* "products liability".
[334] *Black's Law Dictionary,* 8th ed., *s.v.* "strict products liability".
[335] *Restatement (Third) of Torts: Product Liability* §2 (1998).

Claims of defective design will likely be difficult to maintain given the infantile state of CHSF vehicle manufacturing. Products are defective in design when the foreseeable risks of harm posed by the product could have been reduced or avoided by the adoption of a reasonable alternative design by the seller or other distributor, or a predecessor in the commercial chain of distribution, and the omission of the alternative design renders the product not reasonably safe.[336] The difficulty for plaintiffs is to propose "reasonable alternative designs" for an industry that has yet to establish design standards, in which vehicle manufacturers are developing a variety of vehicles with an array of functionalist characteristics, and for which no federal or state law provides vehicle design guidance beyond the limited regulations relating to vehicle design features for the purpose of protecting the crew as an integral part of the flight safety system.[337]

Breach of warranty and other actions initiated by CHSF vehicle operators against vehicle manufacturers are subject to the Act's mandatory reciprocal cross-waiver provisions.[338] Under these provisions, the manufacturers and operators agree to reciprocal cross-waivers under which each party agrees to be responsible for property damage or loss it sustains. [339] In addition, each party agrees to be responsible for personal injury to, death of, or property damage or loss sustained by its own employees resulting from an activity carried out under the applicable license.[340] SFP are specifically excluded from the mandatory cross-waiver provisions.[341] This exclusion leaves open the possibility of

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[336] *Ibid.*
[337] *Final Rule on Human Space Flight Requirements for Crew and Space Flight Participants,* 71 Fed.Reg. 75618 (December 15th, 2006).
[338] This is because CHSF vehicle and component parts manufacturers fall within the mandatory reciprocal cross-waiver definition of contractors and subcontractors. See *Commercial Space Transportation Regulations,* 14 C.F.R. §430.3 (2008).
[339] *Commercial Space Launch Activities*, 49 U.S.C. §70112(b) (2008).
[340] *Ibid.*
[341] *Ibid.*

CHSF operators suing manufacturers for indemnification of damages paid to injured SFP. Manufacturers may also be sued for indemnification of damages paid to injured third parties. The Act does not prohibit manufacturers and operators from contracting for obligations associated with third party claims in the event of a CHSF vehicle accident.

K. Protecting Against Economic Loss Attributed to Tort Liability Resulting from a CHSF Vehicle Accident

Limiting and mitigating risk of exposure to tort liability is critical for the success of the CHSF industry. Operators, employees, and manufacturers need a predictable liability regime that limits potential loss in order to facilitate the industrial, financial, and operational development of CHSF. Liability without mitigation, defense, or insurance could bankrupt the CHSF industry and expose industry participants to personal liability. SFP, the customers of the CHSF industry, may also be subject to tort litigation and need protection against this exposure.

In order to protect against economic loss attributed to tort liability exposure, prior to the accident operators, pilots/crew, SFP and manufacturers will want to implement risk mitigation measures designed to limit their respective tort liability exposures. Risk mitigation measures include liability insurance, waiver and releases, and other agreements that shift risk of loss. In some instances, these parties' respective interests will align and allow for collaborative risk mitigation measures. In other instances, their interests will conflict and they will attempt to shift risk liability to each other.

L. Proposals for Reform

A unified tort legal regime is needed to facilitate investment and growth. State law currently governs tort liability standards, enforceability of risk allocation agreements, releases and waivers, and various other elements of tort liability law. As a result, applicable law will depend on host of unknown variables including where an accident occurred, where the case is litigated, and choice of law provisions. Federal legislation is needed that supersedes state liability law and creates a predictable liability regime for the commercial space industry. This legislation should establish standards for assumption of risks and waivers of liability, exclude SFP from joint and several liability for CHSF operator negligence, and resolve whether damage caused on the ground, in the air and in outer space is subject to strict liability. As an alternative, a tort liability regime could be achieved through the creation of a uniform model code subject to state-by-state adoption. The disadvantage of this alternative option is that true uniformity will not be achieved because states will still modify the model code to best serve state interests.

SFP should be advised of the financial risks of CHSF and take steps to protect against potential tort liability. The current system grants SFP a wide degree of freedom to mitigate potential liability by choosing whether they participate in CHSF, obtain liability insurance, and/or contract with CHSF operators to shift liability risks. While SFP have a freedom to mitigate potential liability, they are also exposed to unlimited liability without provisional federal indemnification.

CHSF operators should take heed of potential SFP liability for their own business success and the success of this fledgling industry. Let us not forget it is the SFP that are providing the demand for the industry. CHSF operators should consider voluntarily including SFP on their insurance policies, contracting for risk shifting and assumptions of

risk in an open and transparent manner, and minimizing the operational risk of SFP negligence causing injury to third parties. How the CHSF industry conducts itself at this point in development will set the stage for the next round of legislation and regulations. By taking proactive voluntary steps to protect the interests of SFP, the industry will be promoting an image of self responsibility.

Liability insurance may be difficult to obtain at economically feasible rates for operators, crew/pilots, manufacturers, SFP, and/or other members of the CHSF industry. If the liability insurance market is not able to provide insurance at economically feasible rates, then Congress and/or state legislatures should consider publicly subsidizing insurance rates. Publicly subsidized insurance can be instituted with tax-based policies in the form of tax credits or deduction to underwrite the purchase of insurance.[342]

Congress and state legislatures should also postpone the termination of indemnification and immunity legislation. The indemnification provisions under the Act only apply to complete and valid applications received no later than December 31, 2009.[343] The *Virginia Spaceflight Liability and Immunity Act* (Spaceflight Act) expires on July 1st, 2013.[344]

M. Issue of International Accidents and Related Questions of International Law

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[342] J.A. Vedda, *Study of the Liability Risk-Sharing Regime in the United States for Commercial Space Transportation,* prepared for FAA as mandated by the CLSAA-2004 to study the U.S. government's risk sharing of third-party liability in 49 U.S.C. §170113, (1st August 2006) at 32. Public Release authorized. Available online the FAA-AST website at: < http://www2.faa.gov/about/office_org/headquarters_offices/ast/reports_studies/media/Risk_Study(final).pdf> (Accessed June 1st, 2008).

[343] *Commercial Space Launch Activities*, 49 U.S.C. §70113(f) (2008).

[344] U.S., H.B. 3184, §8.01-227.8 & §8.01-227.9, *Spaceflight and Immunity Act*, 2007 Reconvened Session, Virginia, 2007 (enacted).

This focus of this chapter is U.S. tort liability law in the event of a CHSF vehicle accident that occurs in the United States on a flight that departs and arrives from points within the United States. However it is important to remark that legal complexities and challenges will arise if a U.S. licensed CHSF vehicle has an accident outside the territory of the United States, involves non-U.S. nationals, or occurs while a CHSF vehicle is engaged in what is deemed international carriage of passengers for the purposes of private international air law. Similar to the multiplicity of U.S. domestic tort jurisdictions resulting from the non-harmonized system of U.S. tort law, there is no harmonization of international law or the law between foreign sovereigns to govern CHSF tort liability, unless international air law agreements governing tort liability are deemed applicable to CHSF vehicles.[345]

Until legal harmonization is achieved at both the domestic and international level, the CHSF industry will be subject to a multiplicity of jurisdictions with varying legal

[345] The primary multilateral international air law agreements governing tort liability are the *Warsaw Convention* and the *Montreal Convention 1999*. These conventions apply to all "international carriage of persons, baggage or cargo performed by aircraft for reward" or "gratuitous carriage by aircraft performed by an air transport undertaking[0]." Before a CHSF can be deemed subject to these Conventions, first the CHSF vehicle must be deemed an *aircraft* performing *international carriage*. International carriage for the purposes of these Conventions is defined as "any carriage in which, according to the agreement between the parties, the place of departure and the place of destination, whether or not there be a break in the carriage or a transshipment, are situated either within the territories of two States Parties, or within the territory of a single State Party if there is an agreed stopping place within the territory of another State, even if that State is not a State Party. Carriage between two points within the territory of a single State Party without an agreed stopping place within the territory of another State is not international carriage for the purposes of this Convention." The term *aircraft* is not defined in the instruments of international public or private air law, but only defined in the annexes promulgated by ICAO in accordance with the *Convention on International Civil Aviation*. Ultimately, whether or not *Warsaw Convention, Montreal Convention 1999,* and the *Convention on International Civil Aviation* will be deemed applicable to CHSF is a political question. Legally, the term 'aircraft' will need to be interpreted or defined to include CHSF. This is an open question that has yet to be resolved. For a more detailed analysis of ICAO's jurisdiction over CHSF, as well as the impact of concurrent-conflicting international regimes applicable to CHSF, see Paul S. Dempsey and Michael C. Mineiro, "The Intersection of Air and Space Law: ICAO's Role in Regulating Safety and Navigation in Suborbital Aerospace Transportation," unpublished manuscript but scheduled to be presented and published to the IAASS in Rome October 21-23, 2008.

standards, unable to predict and mitigate tort liability risks with a high degree of precision.

N. Chapter Summary and Conclusions

Federal law provides minimum guidance on CHSF tort liability, essentially not legislating in the area. CHSF tort liability is therefore primarily governed by state law, with litigants subject to a multiplicity of jurisdictions without unified standards. As a result, parties involved in CHSF must do their best to formulate potential risk by drawing parallels to other established industries such as aviation and adventure sports/tourism. Interested parties should undertake legal risk mitigation measures that minimize exposure and protect against tort liability.

In the long term, the CHSF industry will require a unified tort liability regime, on both a national and international level, to facilitate investment and growth while promoting predictability and equitable compensation for accident victims. On the national level, this regime should be established through Congressional legislation premised on authority granted under the commerce clause of the U.S. Constitution. Internationally, nation-states should begin to discuss in a cooperative manner multilateral approaches for a private international CHSF regime that governs passengers, cargo, and 3rd party ground, air and space damage, with the ultimate goal of drafting and entering into force a multilateral private international CHSF tort liability treaty regime similar to

the international private air law regime of the *Warsaw Convention*[346] and *Rome Convention.*[347]

[346] *Convention for the Unification of Certain Rules Relating to International Carriage by Air*, 12 October 1929.
[347] *Convention on Damage Caused by Foreign Aircraft to Third Parties on the Surface*, 7 October 1952, ICAO Doc. 7364.

CONCLUSION

Commercial human space transportation offers unheralded opportunities for economic and social development and the nation that first establishes a successful CHSF industry will reap the economic benefits of industrial leadership.

The U.S. has established a CHSF vehicle licensing regime to ensure compliance with the international obligations of the United States, protect the public health and safety, safety of property, and national security and foreign policy interests of the United States, and facilitate and encouraging the development of the CHSF industry.

It is too early to tell whether the CHSF vehicle licensing regime will both fulfill the public interest and national security goals of the United States and facilitate the development of her domestic human space transportation industry. As the licensing regime is applied in practice, Congress and the CHSF industry should work cooperatively to identify deficiencies in the licensing regime and promulgate solutions that support the CHSF industry without undermining other stated public policy goals. In addition to the licensing regime, it is likely regulatory hurdles, such as ITARs or FCC licensing, will present significant challenges to the CHSF industry.

Serious deficiencies exist in the tort liability context. The U.S. regulatory regime is not unified and does not provide a predictable and efficient tort liability regime. State law is the primary driver in tort liability law, and as a result CHSF operators, pilots/crew, manufacturers, and SFP have a difficult time mitigating or protecting against potential tort liability in the event of CHSF vehicle accident. Congress should legislative a federal CHSF tort liability regime tort that supersedes state liability law and creates a predictable liability regime for the commercial space industry.

In part due to the CLSAA-2004 and CHSF vehicle licensing regime, the United States is leading the world in CHSF development. Several corporations are testing launch vehicles, operating experimental suborbital rockets, generating revenues through flight deposits, conducting medical and physical tests on SFP in preparation for space flight, and preparing to apply for CHSF launch vehicle licenses. This is valuable momentum and the U.S. will reap the benefits of these initial investments. However the U.S. cannot presume that the CHSF industry will continue to develop and invest in the United States. As the human space flight industry grows, other Nation-States will promulgate their own CHSF vehicle licensing regulatory regime and compete with the U.S. for CHSF industrial development. To ensure its leadership position in CHSF, the U.S. should provide her U.S. domestic CHSF industry with a procedurally and substantively efficient licensing regime and a unified CHSF tort liability regime.

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