

**AN EXAMINATION OF FUTURE COMMERCIAL  
LAUNCH MARKETS AND FAA'S  
LAUNCH INDEMNIFICATION PROGRAM**

---

---

**HEARING**  
BEFORE THE  
SUBCOMMITTEE ON SPACE AND AERONAUTICS  
COMMITTEE ON SCIENCE, SPACE, AND  
TECHNOLOGY  
HOUSE OF REPRESENTATIVES  
ONE HUNDRED TWELFTH CONGRESS  
SECOND SESSION

WEDNESDAY, JUNE 6, 2012

**Serial No. 112-87**

Printed for the use of the Committee on Science, Space, and Technology



Available via the World Wide Web: <http://science.house.gov>

U.S. GOVERNMENT PRINTING OFFICE

74-724PDF

WASHINGTON : 2012

---

For sale by the Superintendent of Documents, U.S. Government Printing Office  
Internet: [bookstore.gpo.gov](http://bookstore.gpo.gov) Phone: toll free (866) 512-1800; DC area (202) 512-1800  
Fax: (202) 512-2104 Mail: Stop IDCC, Washington, DC 20402-0001

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

HON. RALPH M. HALL, Texas, *Chair*

F. JAMES SENSENBRENNER, JR., Wisconsin	EDDIE BERNICE JOHNSON, Texas
LAMAR S. SMITH, Texas	JERRY F. COSTELLO, Illinois
DANA ROHRABACHER, California	LYNN C. WOOLSEY, California
ROSCOE G. BARTLETT, Maryland	ZOE LOFGREN, California
FRANK D. LUCAS, Oklahoma	BRAD MILLER, North Carolina
JUDY BIGGERT, Illinois	DANIEL LIPINSKI, Illinois
W. TODD AKIN, Missouri	DONNA F. EDWARDS, Maryland
RANDY NEUGEBAUER, Texas	BEN R. LUJAN, New Mexico
MICHAEL T. McCAUL, Texas	PAUL D. TONKO, New York
PAUL C. BROUN, Georgia	JERRY McNERNEY, California
SANDY ADAMS, Florida	TERRI A. SEWELL, Alabama
BENJAMIN QUAYLE, Arizona	FREDERICA S. WILSON, Florida
CHARLES J. "CHUCK" FLEISCHMANN, Tennessee	HANSEN CLARKE, Michigan
E. SCOTT RIGELL, Virginia	SUZANNE BONAMICI, Oregon
STEVEN M. PALAZZO, Mississippi	VACANCY
MO BROOKS, Alabama	VACANCY
ANDY HARRIS, Maryland	VACANCY
RANDY HULTGREN, Illinois	
CHIP CRAVAACK, Minnesota	
LARRY BUCSHON, Indiana	
DAN BENISHEK, Michigan	
VACANCY	

---

SUBCOMMITTEE ON SPACE AND AERONAUTICS

HON. STEVEN M. PALAZZO, Mississippi, *Chair*

F. JAMES SENSENBRENNER JR., Wisconsin	JERRY F. COSTELLO, Illinois
LAMAR S. SMITH, Texas	TERRI A. SEWELL, Alabama
DANA ROHRABACHER, California	DONNA F. EDWARDS, Maryland
FRANK D. LUCAS, Oklahoma	FREDERICA S. WILSON, Florida
W. TODD AKIN, Missouri	HANSEN CLARKE, Michigan
MICHAEL T. McCAUL, Texas	VACANCY
SANDY ADAMS, Florida	VACANCY
E. SCOTT RIGELL, Virginia	EDDIE BERNICE JOHNSON, Texas
MO BROOKS, Alabama	
RALPH M. HALL, Texas	

# CONTENTS

Wednesday, June 6, 2012

Witness List .....	Page 2
Hearing Charter .....	3

## Opening Statements

Statement by Representative Steven M. Palazzo, Chair, Subcommittee on Space and Aeronautics, Committee on Science, Space, and Technology, U.S. House of Representatives .....	10
Written Statement .....	11
Statement by Representative Jerry F. Costello, Ranking Minority Member, Subcommittee on Space and Aeronautics, Committee on Science, Space, and Technology, U.S. House of Representatives .....	12
Written Statement .....	13

## Witnesses:

Dr. George Nield, Associate Administrator for the Office of Commercial Space Transportation, FAA .....	14
Oral Statement .....	14
Written Statement .....	16
Ms. Alicia Cackley, Director of Financial Markets and Community Investment Team, Government Accountability Office .....	22
Oral Statement .....	22
Written Statement .....	24
Mr. Frank Slazer, Vice President, Space Systems, Aerospace Industries Asso- ciation .....	57
Oral Statement .....	57
Written Statement .....	60
Ms. Alison Alfors, Vice President, Defense and Intelligenece, DigitalGlobe Inc. .....	69
Oral Statement .....	69
Written Statement .....	71
Discussion .....	74

## Appendix 1: Answers to Post-Hearing Questions

Dr. George Nield, Associate Administrator for the Office of Commercial Space Transportation, FAA .....	90
Ms. Alicia Cackley, Director of Financial Markets and Community Investment Team, Government Accountability Office .....	99
Mr. Frank Slazer, Vice President, Space Systems, Aerospace Industries Asso- ciation .....	104
Ms. Alison Alfors, Vice President, Defense and Intelligenece, DigitalGlobe Inc. .	107



**AN EXAMINATION OF FUTURE COMMERCIAL  
LAUNCH MARKETS AND FAA'S  
LAUNCH INDEMNIFICATION PROGRAM**

---

**WEDNESDAY, JUNE 6, 2012**

HOUSE OF REPRESENTATIVES,  
SUBCOMMITTEE ON SPACE AND AERONAUTICS,  
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY,  
*Washington, DC.*

The Subcommittee met, pursuant to call, at 10:04 a.m., in Room 2318 of the Rayburn House Office Building, Hon. Steven Palazzo [Chairman of the Subcommittee] presiding.

RALPH M. HALL, TEXAS  
CHAIRMAN

EDDIE BERNICE JOHNSON, TEXAS  
RANKING MEMBER

U.S. HOUSE OF REPRESENTATIVES  
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

2321 RAYBURN HOUSE OFFICE BUILDING  
WASHINGTON, DC 20515-6301  
(202) 225-6371  
[www.science.house.gov](http://www.science.house.gov)

*An Examination of Future Commercial Launch Markets & FAA's Launch  
Indemnification Program*

Wednesday, June 6, 2012  
10:00 a.m. to 12:00 p.m.  
2318 Rayburn House Office Building

Witnesses

- **Dr. George Nield**, Associate Administrator for the Office of Commercial Space Transportation, FAA;
- 
- **Ms. Alicia Cackley**, Director of Financial Markets and Community Investment Team, Government Accountability Office;
- 
- **Mr. Frank Slazer**, Vice President, Space Systems, Aerospace Industries Association;
- 
- **Ms. Alison Alfors**, Vice President, Defense and Intelligence, DigitalGlobe Inc.



SUBCOMMITTEE ON SPACE AND AERONAUTICS  
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY  
U.S. HOUSE OF REPRESENTATIVES

*An Examination of Future Commercial Launch Markets & FAA's Launch  
Indemnification Program*

Wednesday, June 6, 2012

10:00 a.m. – 12:00 p.m.  
2318 Rayburn House Office Building

**Purpose**

The FAA's Office of Commercial Space Transportation (AST) manages a federally-sponsored liability risk-sharing regime (commonly referred to as "indemnification") for third party loss (injury or property damage to the uninvolved public) during launch and reentry of a licensed commercial launch system. The current authorization for indemnification expires December 31, 2012. The hearing will review FAA's management of the program and discuss future commercial launch markets.

**Witnesses**

- **Dr. George Nield**, Associate Administrator for the Office of Commercial Space Transportation, FAA;
- **Ms. Alicia Cackley**, Director of Financial Markets and Community Investment Team, Government Accountability Office;
- **Mr. Frank Slazer**, Vice President, Space Systems, Aerospace Industries Association;
- **Ms. Alison Alfors**, Vice President, Defense and Intelligence, DigitalGlobe Inc.

**Commercial Space Launch and Reentry "Indemnification" Summary**

- All commercial launches licensed by the FAA are required to purchase third party liability insurance up to a Maximum Probable Loss (MPL) value calculated by the FAA.
- U.S. government indemnification only covers a portion of third party liability claims in the event of a catastrophic loss during launch or reentry activity.
- No federal payments, which are subject to Congressional appropriations, have ever been required.
- Indemnification **does not** cover spaceflight participants, crew or payloads.
- Similar to the launch indemnification regimes of other space-faring nations.

**Background**

On May 22, Space Exploration Technology Inc. (SpaceX) launched the first commercial space mission to the International Space Station (ISS). While the mission is notable for the destination, the first commercial space launch took place in 1989 when Space Services Inc. launched the CONSORT-1 satellite from the White Sands Missile Range in New Mexico on a Starfire suborbital rocket. Later that year, the McDonnell Douglas Space Systems Company conducted the first commercial orbital mission when it launched a Delta II rocket from the Cape Canaveral Air Force Base carrying the British Satellite Broadcasting-R1 (BSB-R1), a British television direct broadcasting satellite known as Marcopolo 1.

The commercialization of space transportation began in the 1980s. At that time, President Ronald Reagan designated the Department of Transportation (DOT) as the lead agency to regulate the emerging commercial space transportation sector. President Reagan highlighted the commercialization of space transportation in the 1984 State of the Union address;

*The Department of Transportation will help an expendable launch services industry to get off the ground. We'll soon implement a number of executive initiatives, develop proposals to ease regulatory constraints, and, with NASA's help, promote private sector investment in space.<sup>1</sup>*

Later that year, Congress passed the Commercial Space Launch Act (P.L. 98-575) which directed the DOT to establish the insurance requirements that a commercial entity would need to protect against risk to the public (uninvolved third parties) and U.S. government property. With passage of the law, the DOT began working on the appropriate structure for a liability insurance regime for this new industry.

During this time space launch was principally a government-sponsored activity. For instance, NASA would use indemnification authorities pertaining to national defense missions under Public Law 85-804 for the Space Shuttle program. However, prior to the Space Shuttle Challenger accident in 1986, the Space Shuttle was used on occasion to place commercial satellites into orbit (after the loss of the Challenger, U.S. policy directed NASA to transport almost exclusively government payloads on the Space Shuttle). This commercial arrangement also incorporated a risk-sharing scheme described below.

*NASA required shuttle payload customers to obtain the maximum liability insurance available at a reasonable premium, and NASA provided indemnification for any amount in excess of that coverage. Typically, \$500 million was required for a single payload, and*

---

<sup>1</sup> President Ronald Reagan, State of the Union Address, January 25, 1984

*multiple payload customers could combine their contributions to reach \$750 million in coverage<sup>2</sup>.*

Launch providers and the government had established liability policies during the era of serving principally government customers and a similar arrangement was needed to manage catastrophic risk with the introduction of commercial launch services. In the 1980s, the regulation of the commercial space launch industry was beginning to take shape and both industry and government officials proposed more definitive risk-sharing regimes.

### **Third-Party Liability Risk-Sharing Regime**

In 1988, Congress passed the Commercial Space Launch Act Amendments (P.L. 100-657) which established the current insurance requirements and tiered liability risk-sharing regime for FAA-licensed commercial space launches. The liability and insurance regime was originally modeled on the Price-Anderson Act that governs liability risk-sharing under the nuclear power industry.

The indemnification regime is comprised of a three tiered risk-sharing arrangement wherein both the U.S. government and the private sector would cover third party claims. However, the FAA calculates that the chance of loss exceeding the required insurance and thus resulting in potential United States government liability is lower than 1 in 10 million.<sup>3</sup>

#### **Tier 1: Maximum Probable Loss (MPL)-Based Insurance**

The commercial space launch provider is responsible for purchasing third party liability insurance based on a Maximum Probable Loss (MPL) value calculated by the FAA.

*The insurance covers third parties, including government personnel, for injury, loss, or damage, up to a statutory ceiling of \$500 million or the maximum available on the world market at reasonable cost. Insurance against damage to U.S. government property is also required, with a statutory limit of \$100 million or the maximum available on the world market at reasonable cost.<sup>4</sup>*

#### **Tier 2: Payments in excess of the MPL**

In what is commonly referred to as “indemnification,” should any successful third-party claim be in excess of the MPL-based insurance requirement, then the U.S. government is authorized to pay up to an additional \$1.5 billion (adjusted for post-1988 inflation – approximately \$2.7 billion today). The payment is not automatic and subject to Congressional appropriations.

<sup>2</sup> Study of the Liability Risk-Sharing Regime in the United States for Commercial Space Transportation, August 2006

<sup>3</sup> FAA/AST briefing to staff, May 14, 2012

<sup>4</sup> Study of the Liability Risk-Sharing Regime in the United States for Commercial Space Transportation, August 2006

*Such claims must be presented to the Congress by the President, upon the recommendation of the Secretary of Transportation, and the Congress must appropriate funds to pay the claim. For damage to government property, the U.S. government waives claims for property damage above the required insurance.<sup>5</sup>*

### **Tier 3: Payments above MPL-Based Insurance and Indemnification**

The commercial space launch provider (or legally liable party) is responsible for any claims in excess of the first two tiers of the regime.

#### Rationale

The rationale for the original establishment of this regime was partly due to the immature insurance market for the nascent commercial launch industry. As a result, the provision was set to expire after five years in what is commonly called a “sunset provision.” Congress and the administration were to reevaluate the need for this shared-risk approach once the launch industry and insurance markets had time to develop and mature.

However, U.S. industry views the regime as a key element for U.S. commercial competitiveness against foreign launch providers. According to the Aerospace Industry Association (AIA) issue paper titled, *Renew U.S. Commercial Space Launch Competitiveness*, U.S. launch providers must compete with international providers that all benefit from some form of government indemnification. The AIA paper states, “*in a competitive market with narrow returns, the loss of the risk management regime [indemnification] would cause U.S. companies to reconsider the risks and benefits of staying in the commercial launch business, suspend activity, and even exit the market.*”

The Commercial Space Launch Amendments Act of 2004 (P.L. 108-492) directed the FAA to conduct a study of the U.S. government’s risk sharing of third-party liability for commercial space launch providers. The study was completed in 2006 and concluded that the availability of liability insurance on the global market to cover Tier 1 requirements could disappear in the event of single catastrophic loss anywhere in the world. The 2006 study states:

*In such a circumstance, Tier II [indemnification] would become an essential backup to keep the U.S. launch industry alive until the insurance market recovers or other means are found to address liability risk-sharing.*

Since passage in 1988, the provision for the liability risk-sharing regime<sup>6</sup> has been extended by Congress in 1999, 2000, 2004 and 2009. The extensions were contained in the 1999 Department

<sup>5</sup> Study of the Liability Risk-Sharing Regime in the United States for Commercial Space Transportation, August 2006

<sup>6</sup> 51 USC Sec. 50915 Paying claims exceeding liability insurance and financial responsibility requirements

of Veterans Affairs and Housing and Urban Development and Independent Agencies Appropriations Act, the 2000 Commercial Space Transportation Competitiveness Act, the 2004 Commercial Space Launch Amendments Act and the 2009 Commercial Space Transportation Liability Regime Act.

#### Third-Party Liability and U.S. Treaty Obligations

While the third-party liability risk-sharing regime in the United States provides a level playing field for U.S. companies to compete in the international market it does not limit the U.S. government's international liability responsibilities that are prescribed in the Outer Space Treaty of 1967<sup>7</sup> and the Liability Convention of 1974.<sup>8</sup> The Outer Space Treaty states that each country conducting launches is internationally liable for damages within another country should there be an accident. The Liability Convention also assigns liability responsibility and payment of any compensation for losses to the "launching State." Should a commercial space launch from the United States result in damages within another country that exceeds the MPL-based insurance requirements, the U.S. government would be required to settle the claim whether indemnification were in place or not.

#### Commercial Space Launch Markets

The 2012 FAA forecast for commercial space launches in the U.S. shows a considerable increase in the amount of activity in the near future. As noted earlier, SpaceX has already conducted a successful commercial FAA-licensed launch and reentry mission to the ISS. Additionally, the Orbital Sciences Corporation is preparing its Antares rocket for two commercial launches this year, first a test flight and then a demonstration flight to the ISS. Under NASA's Commercial Resupply Services (CRS) contract, the two companies are currently scheduled to conduct twenty cargo launch missions to the ISS through 2016. As the ISS is to continue operations until at least 2020, NASA's CRS contract may be extended or re-competed before the current contract expires in 2016. It is anticipated that the cargo transportation demands for ISS could reach as many as twenty additional commercial launches between 2017 and 2020.

NASA's Commercial Crew Program is pursuing the development of commercial launch systems with the goal of establishing one or more companies to provide transportation services to and from the ISS for NASA astronauts. NASA anticipates purchasing crew transportation services as early as 2017. Commercial crew services could add as many as two additional commercial launches to the ISS per year in addition to the cargo missions. According to an FAA forecast, the combined commercial cargo and crew missions to the ISS could number up to fifty-six launches between 2012 and 2020.

---

<sup>7</sup> Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and other Celestial Bodies (Outer Space Treaty, 1967)

<sup>8</sup> Convention on International Liability for Damages Caused by Space Objects in Outer Space (Liability Convention, 1974)

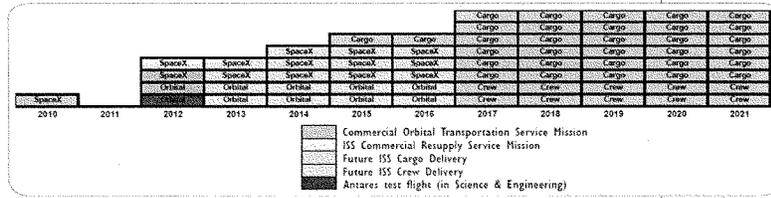


Figure 20. Forecast of COTS, CRS, and commercial crew missions

From 2012 to 2021, the FAA’s forecast predicts nearly 291 commercially procured launches in the global market in support of telecommunications, satellite imagery (remote sensing), cargo and crew transportation missions to the ISS, and science payloads. U.S. launch providers will need to remain competitive to win a significant portion of the future launch contracts over foreign competitors.

Table 1. Commercial Space Transportation Payload and Launch Forecasts

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total	Average
<b>Payloads</b>												
GSO Forecast (COMSTAC)	23	21	20	23	21	20	20	20	22	22	212	21.2
NGSO Forecast (FAA)	37	44	28	35	42	49	16	15	16	15	297	29.7
Total Satellites	60	65	48	58	63	69	36	35	38	37	509	50.9
<b>Launches</b>												
GSO Medium-to-Heavy	19	16	15	18	16	15	15	15	17	17	163	16.3
NGSO Medium-to-Heavy	10	12	13	15	12	16	11	10	11	10	120	12.0
NGSO Small	1	1	0	0	1	1	1	1	1	1	8	0.8
Total Launches	30	29	28	33	29	32	27	26	29	28	291	29.1

10

An emerging market for suborbital launch providers (space vehicles that launch into space but do not orbit the Earth) is also predicted to rapidly increase the number of commercial launches over the next decade. In the past, suborbital launches have primarily been in support of missile testing or scientific research conducted by the U.S. government using sounding rockets. The recent development of new commercial suborbital reusable launch vehicles (RLVs) may lead to a significant increase in commercially licensed launches. According to the FAA, suborbital RLV companies are anticipating launch demand for such areas as basic and applied research; aerospace technology test and demonstration; remote sensing; education; media and public relations; commercial human spaceflight; and point-to-point transportation.<sup>11</sup>

<sup>9</sup> FAA Commercial Space Transportation Forecasts, May 2012

<sup>10</sup> FAA Commercial Space Transportation Forecasts, May 2012

<sup>11</sup> The Reusable Suborbital Industry: A Renaissance in the Making, October 2011

Overarching Questions

- What benefit does the government reap from taking on a portion of launch risks through the current indemnification regime, and does the benefit outweigh the risks?
- Should the indemnification program be continued, and if so, what commercial markets should it serve? In addition to indemnifying traditional communications launches, how well suited is the risk-sharing regime to serve commercial cargo launches to ISS, commercial crew launches carrying astronauts to ISS, and space tourists on either orbital or sub-orbital launches?
- Under the current risk-sharing regime, is the government's risk exposure properly calculated, and is it appropriately weighted relative to insurance purchased from private markets?

Chairman PALAZZO. The Subcommittee on Space and Aeronautics will come to order. Good morning, and welcome to today's hearing entitled, "An Examination of Future Commercial Launch Markets and FAA's Launch Indemnification Program." In front of you are packets containing the written testimony, biographies, and truth in testimony disclosures for today's witness panel.

I recognize myself for five minutes for an opening statement.

I would like to begin by thanking our witnesses for taking time from their busy schedules to appear before us this morning and share their wisdom about the role of the Federal Aviation Administration's Launch Indemnification Program. I realize you and your staff devoted considerable time and effort preparing for this hearing, and I want you to know that your expertise will help inform this Committee and Congress during the coming months and years on this issue.

The Federal Aviation Administration's Launch Indemnification Program was created in the 1980s to provide a structured, risk-sharing regime to address third-party liability to protect the uninjured public and property. As part of its commercial licensing process, FAA requires launch companies to purchase third-party liability coverage from the insurance market at a level calculated by the agency to be the maximum probable loss.

As a consequence of these calculations, FAA's decision sets the threshold at which federal coverage begins, up to a maximum limit of \$2.7 billion. Since the program's inception, over 200 commercial license launches have been flown without one federal dollar being paid out in damages.

Today's hearing will examine whether federal launch indemnification is still required and if so, if the program is properly structured to serve existing and future markets. FAA's launch indemnification authority expires at the end of this calendar year, compelling Congress to consider the program's merits and the role it plays in the international launch marketplace and the necessity to pass legislation extending the program's authorization for future years.

Notwithstanding the high reliability of today's generation of launch vehicles, many industry experts advocate extending the Indemnification Program in part because of the inherent riskiness of launching payloads to orbit. Catastrophic launch failures are deemed to be a low probability event but understandably one that could result in extremely high damages. They also urge competitive, asserting that were the program to lapse, launch customers would shift their business to other space-faring nations offering some form of government-backed indemnification coverage.

Over the last 10 to 12 years the number of commercial launches in the United States has significantly declined to the point that last year there was not one licensed commercial launch, primarily as a result of pricing competition.

However, with the advent of NASA's Commercial Cargo Program, commercial launches from U.S. spaceports are expected to dramatically rise. Through 2016, FAA estimates that SpaceX and Orbital will launch 20 cargo resupply missions to the International Space Station, with an equal or greater number of cargo flights to be completed between 2016, and 2020.

Commercial crew flights to ISS are also a distinct possibility later this decade, adding two additional flights per year once service is established. The same forecast predicts around 230 additional commercially procured launches in the global marketplace by 2020, in support of telecommunications, satellite imagery, and science payloads. Domestic launch service providers will need to remain competitive to win a portion of this market.

It also bears mentioning that reentry events are also covered under indemnification, and while they have not been a regular feature of commercial launches to date, SpaceX's Dragon capsule is changing the equation, having flown two successful reentries with at least a dozen expected through 2016, and perhaps many more in the years beyond.

Commercial crew launches late this decade will also be a new form of commercial service, and while I anticipate those vehicles will have a very high reliability record, it bears asking the question, if launch vehicles carrying capsules with abort capabilities and associated failure detection systems changes the probability of launch aborts and whether this, in turn, will alter FAA's maximum probable loss calculation in any appreciable way.

Before closing, I want to digress for one minute to respond to an assertion made last week about SpaceX's commercial orbital transportation services demonstration flight to the International Space Station. Speaking before an audience in New York, John Holdren, Director of the White House Office of Science and Technology Policy, said about the SpaceX flight: "This represents an entirely new model for the American space program, one initiated by this Administration and one that despite the handwringing of naysayers who said it would never work, now promises to change forever the nature of U.S. space exploration and human spaceflight."

Mr. Holdren's statement is, at best, misleading. The Commercial Orbital Transportation Services Program was proposed by the Bush Administration in 2005, and authorized by Congress. The COTS contract that funded SpaceX mission was awarded in 2006. The Commercial Resupply Services contract won by SpaceX and Orbital was announced at the end of 2008. Let the record be clear.

I look forward to today's discussion, and I wish to, again, thank our witnesses for their presence.

[The prepared statement of Mr. Palazzo follows:]

PREPARED STATEMENT OF SUBCOMMITTEE CHAIRMAN STEVEN PALAZZO

I would like to begin by thanking our witnesses for taking time from their busy schedules to appear before us this morning and sharing their wisdom about the role of the Federal Aviation Administration's launch indemnification program. I realize you and your staff devoted considerable time and effort preparing for this hearing, and I want you to know that your expertise will help inform this Committee and Congress during the coming months and years on this issue.

The Federal Aviation Administration's launch indemnification program was created in the 1980s to provide a structured risk-sharing regime to address third-party liability to protect the uninvolved public and property. As part of its commercial licensing process, FAA requires launch companies to purchase third-party liability coverage from the insurance market at a level calculated by the agency to be the maximum probable loss. As a consequence of these calculations, FAA's decision sets the threshold at which federal coverage begins, up to a maximum limit of \$2.7 billion. Since the program's inception, over 200 commercial licensed launches have been flown without one federal dollar being paid out in damages.

Today's hearing will examine whether federal launch indemnification is still required, and if so, if the program is properly structured to serve existing and future markets. FAA's launch indemnification authority expires at the end of this calendar year, compelling Congress to consider the program's merits and the role it plays in the international launch marketplace, and the necessity to pass legislation extending the program's authorization for future years.

Notwithstanding the high reliability of today's generation of launch vehicles, many industry experts advocate extending the indemnification program, in part because of the inherent riskiness of launching payloads to orbit. Catastrophic launch failures are deemed to be a low-probability event, but understandably one that could result in extremely high damages. They also argue competitiveness, asserting that were the program to lapse, launch customers would shift their business to other space-faring nations offering some form of government-backed indemnification coverage.

Over the last 10 to 12 years, the number of commercial launches in the United States has significantly declined to the point that last year there was not one licensed commercial launch, primarily as a result of pricing competition. However, with the advent of NASA's commercial cargo program, commercial launches from U.S. spaceports are expected to dramatically rise. Through 2016, FAA estimates that SpaceX and Orbital will launch 20 cargo flights to be completed between 2016 and 2020. Commercial crew flights to ISS are also a distinct possibility later this decade, adding two additional flights per year once service is established. The same forecast predicts around 230 additional commercially procured launches in the global marketplace by 2020 in support of telecommunications, satellite imagery, and science payloads. Domestic launch services providers will need to remain competitive to win a portion of this market.

It also bears mentioning that reentry events are also covered under indemnification, and while they have not been a regular feature of commercial launches to date, SpaceX's Dragon capsule is changing the equation, having flown two successful reentries, with at least a dozen expected through 2016, and perhaps many more in the years beyond.

Commercial crew launches late this decade will also be a new form of commercial service, and while I anticipate those vehicles will have a very high reliability record, it bears asking the question if launch vehicles carrying capsules with abort capabilities and associated failure detection systems changes the probability of launch aborts, and whether this in turn will alter FAA's maximum probable loss calculation in any appreciable way.

I look forward to today's discussion, and wish to again thank our witnesses for their presence.

Chairman PALAZZO. I now recognize Mr. Costello for an opening statement.

Mr. COSTELLO. Mr. Chairman, thank you, and Mr. Chairman, I thank you for calling this hearing today. In March we had a similar hearing to examine the FAA's Office of Commercial Space Transportation Fiscal Year 2013 budget request. Also the Aviation Subcommittee of Transportation and Infrastructure, we have held a number of hearings concerning the future of NASA's human spaceflight programs, which I have chaired and Mr. Petri has chaired as well. I agree that it is important to continue to continue to focus on this issue in our Subcommittee, given the fact that the public needs a clear understanding of the risk involved with commercial space transportation, and it will need to be convinced that those risks are being effectively managed.

Mr. Chairman, I have additional comments, and I will place my statement in the record so that we can go forward and hear from the witnesses, so I look forward to hearing their testimony.

I thank you.

[The prepared statement of Mr. Costello follows:]

## PREPARED STATEMENT OF RANKING MEMBER JERRY F. COSTELLO

Good morning and thank you, Mr. Chairman, for calling this important hearing on the FAA's commercial space launch indemnification program.

In March, we had a similar hearing to examine the FAA's Office of Commercial Space Transportation Fiscal Year 2013 budget request. Also, in 2011, I chaired a hearing in the Aviation Subcommittee of the House Transportation and Infrastructure Committee which discussed the future of NASA's human spaceflight programs. I agree it is important to continue to focus on this issue in our Subcommittee, given the fact that the public needs a clear understanding of the risks involved with commercial space transportation, and it will need to be convinced those risks are being effectively managed.

Therefore, I want to thank the Chairman for his leadership on this issue and I also want to welcome our witnesses. I look forward to your testimony.

In 1988, Congress amended the *Commercial Space Launch Act* to establish a risk-based regime to address third-party losses associated with potential U.S. commercial space launch or reentry failures.

Since then, the U.S. commercial space launch industry has grown and changed. Just last week, a private U.S. company, Space Exploration Technologies—SpaceX—successfully demonstrated the potential for commercial cargo resupply of the International Space Station.

Another company, Orbital Sciences, plans to demonstrate the same transportation capability later this year. And in the coming years, suborbital spacecraft are anticipated to begin launching space tourists, followed potentially by commercial human space flights to low-Earth orbit.

Given that the sunset provision is set to expire at the end of the calendar year, Congress must decide whether or not to extend the current regime and, if so, whether changes are needed to it.

The provisions we are examining today were put into place more than two decades ago, and I think it is appropriate for us to review the impacts.

To that end, I hope to hear from the witnesses whether the intended effects of the provisions are being realized; if the existing indemnification regime is still appropriate given the maturity of the existing industry; the extent to which government indemnifications are needed to achieve optimal transparency and safety while not increasing taxpayer exposure to unnecessary risk.

Chairman PALAZZO. Thank you, Mr. Costello, and if there are Members who wish to submit additional opening statements, your statements will be added to the record at this point.

At this time I would like to introduce our panel of witnesses and then we will proceed to hear from each of them in order. Our first witness is Dr. George Nield, Associate Administrator for Commercial Space Transportation at the Federal Aviation Administration. He has over 30 years of aerospace experience with the Air Force, NASA, and in private industry. Dr. Nield came to FAA from the Orbital Sciences Corporation, where he served as senior scientist for the Advanced Programs Group.

Our second witness is Ms. Alicia Cackley, Director of Financial Markets and Community Investment Team with the Government Accountability Office. Ms. Cackley has been with GAO since 1990, and is a member of their Senior Executive Service responsible for directing program evaluations and policy analysis studies related to consumer protection, insurance, housing, and finance issues.

Our third witness is Mr. Frank Slazer, Vice President of Space Systems at the Aerospace Industries Association. Prior to taking his current position, Mr. Slazer worked in the aerospace industry for over 30 years with leading launch providers, including McDonnell Douglas, Boeing, United Launch Alliance, and Northrop Grumman.

And our final witness is Ms. Alison Alfers, Vice President of Defense and Intelligence, DigitalGlobe. Ms. Alfers previously served for five years as a General Counsel, and prior to joint DigitalGlobe

she served in executive positions with other private-sector firms, including as Vice President and General Counsel for Space Imaging Incorporated.

Welcome to you. As our witnesses should know, spoken testimony is limited to five minutes each. After all witnesses have spoken, Members of the Committee will have five minutes each to ask questions.

I now recognize our first witness, Dr. George Nield, to present his testimony.

**STATEMENT OF DR. GEORGE NIELD,  
ASSOCIATE ADMINISTRATOR FOR THE OFFICE  
OF COMMERCIAL SPACE TRANSPORTATION, FAA**

Mr. NIELD. Chairman Palazzo, Ranking Member Costello, and distinguished Members of the Subcommittee, good morning, and thank you for inviting me to speak with you today.

I would like to begin by offering the Administration's continued support for extending the Commercial Space Launch Act indemnification provision for commercial launch and reentry operators for five years beyond its current statutory expiration date of December 31, 2012. This support is in line with the Commercial Space Transportation Advisory Committee finding that extension of indemnification past December of this year is critical to the viability of the commercial launch industry in the U.S.

The Federal Aviation Administration's Office of Commercial Space Transportation licenses and permits commercial launches and reentries. As part of its licensing and permitting mission, the FAA administers financial responsibility and risk-sharing requirements for commercial launch and reentry operators.

Congress established the current system in 1988. It has maintained the regime's functionality and effectiveness over the past 24 years by enacting five extensions of the provision providing for conditional payment of excess claims subject to Congressional appropriation.

The success of the existing regime is demonstrated by the fact that during this period there have been 207 licensed launches, all completed without any fatalities, serious injuries, or significant property damage to the general public and without the need for any liability payments by the government or the taxpayer.

The current liability and risk-sharing regime consists of three tiers. Tier one includes the most probable risks which are taken on by the operator. The size of the first tier of risk is calculated by the FAA as the maximum probable loss, or MPL, that a launch or reentry could cause. The FAA's regulations define MPL to mean the greatest dollar amount of loss for bodily injury or property damage that is reasonably expected to result from a licensed or a permitted activity.

Under the Commercial Space Launch Act and FAA regulations, a launch operator must obtain insurance or otherwise demonstrate financial responsibility to cover the MPL. An operator's responsibility for the risk of maximum probable loss is limited by statute to no more than \$500 million for a potential third-party liability.

The second tier of risk consists of liability for losses exceeding the amount of insurance procured. The statute provides that Congress may appropriate up to \$1.5 billion adjusted for inflation to cover successful third-party claims against participants in a launch or reentry. The statute specifically states that claims against space flight participants are excluded from this authority.

The third and final tier of financial risk consists of liabilities for third-party claims above the \$1.5 billion. These risks are the least likely and, again, are assumed by the launch or reentry operator.

I believe that the current liability and risk-sharing regime is well suited to cover emerging activities such as commercial cargo and commercial crew, and both orbital and suborbital flights of reusable launch vehicles. Although the MPL methodology was specifically developed to accommodate unmanned, expendable launch vehicles, the methodology is still appropriate for suborbital or orbital flights involving human crew or space flight participants because the MPL is not an estimate of risk to crew or space flight participants, but rather to third parties, including members of the public and non-flying United States Government employees. Space flight participants and crew are not third parties.

The benefits of indemnification are many, both to industry and the United States government. As Congress itself recognized by statute, the development of the commercial space transportation industry enables the United States to retain its competitive position internationally, contributing to the national interest and economic well-being of the United States.

Extension of the indemnification provision would continue to enable industry to attract and maintain a customer base in the face of international competitors who offer more certain indemnification.

With the help and leadership of Congress, commercial space transportation will continue without the risk of significant financial setback, and the private space industry in the United States will continue to grow with new jobs, new technologies, and new innovations.

Again, I am grateful for this opportunity to speak before you today, and I am happy to answer any questions you may have.

[The prepared statement of Mr. Nield follows:]

STATEMENT OF DR. GEORGE C. NIELD, ASSOCIATE ADMINISTRATOR FOR  
COMMERCIAL SPACE TRANSPORTATION OF THE FEDERAL AVIATION  
ADMINISTRATION, BEFORE THE HOUSE COMMITTEE ON SCIENCE,  
SUBCOMMITTEE ON SPACE AND AERONAUTICS, ON FINANCIAL RESPONSIBILITY  
AND RISK-SHARING FOR COMMERCIAL SPACE TRANSPORTATION,  
JUNE 6, 2012.

Chairman Palazzo, Ranking Member Costello, and Distinguished Members of the  
Subcommittee:

Good morning. Thank you for inviting me to speak with you today.

I would like to begin by offering the Administration's support for extending the Commercial Space Launch Act, as amended, (CLSA) "indemnification" provision, 51 U.S.C. § 50915, for commercial launch and reentry operators for five years beyond its current statutory expiration date of December 31, 2012. This support is in line with the Commercial Space Transportation Advisory Committee (COMSTAC) finding that extension of indemnification past December of this year is "critical to the viability of the commercial launch industry in the US." COMSTAC issued a recommendation just four weeks ago reiterating its support.

The Federal Aviation Administration's (FAA) Office of Commercial Space Transportation licenses and permits commercial launches and reentries. As part of its licensing and permitting mission, the FAA administers financial responsibility and risk-sharing requirements for commercial launch and reentry operators. In doing so, the FAA calculates the required amount of financial responsibility to be satisfied by a licensee based on the maximum probable loss of the license applicant's proposed launch or reentry.

The financial responsibility and risk-sharing regime for launch activities became law in 1988 as part of the CSLA. The regime is a testament to continuous bipartisan efforts recognizing the need for developing a strong commercial launch industry to serve the United States Government and commercial interests. In 1998, Congress extended the regime to apply to reentry. Congress has maintained the regime's functionality and effectiveness over the past twenty-four years by enacting five extensions of the provision providing for the conditional payment of excess claims, subject to Congressional appropriation.

#### The Importance of Extending Indemnification

Should the indemnification provision expire, all other portions of the financial responsibility and risk-sharing framework would remain in force. Accordingly, the FAA would continue to be charged with licensing launches and reentries subject to minimum financial requirements. I urge the Committee members to assess the impacts on what would remain of the financial responsibility regime were this key element to be allowed to expire. The remaining statutory requirements would only provide license applicants with an amount of financial responsibility that represents the maximum probable loss without regard to maximum possible loss.

Demand for insurance to address maximum possible loss would lead to higher insurance costs. Insurance demand decreases capacity and raises premiums. Companies with fewer resources would struggle to manage risk, and investors would be discouraged from providing capital to companies with catastrophic risk exposure, further restricting access to capital and suppressing growth. A stable regulatory environment, including predictable, risk-based financial responsibility requirements and certainty in allocating risk, is critical to securing investor confidence and willingness to place capital at risk. Investors in new technology must regularly face asset-based risk, namely, the risk that a vehicle may be destroyed during launch because of mission failure or the requirements of public safety. In such an environment, investment capital is better directed to technology development than to managing risk arising out of liability exposure. Although the risk of facing catastrophic liability is strikingly low, it nonetheless exists. This is a regime which has never required any federal expenditure to cover losses. Under the FAA's calculations, the likelihood of any expenditures being required remains extremely low. Unless indemnification continues, the commercial industry must be prepared to absorb the financial risk of a catastrophic event, whether or not adequate insurance is available at affordable rates.

The current financial responsibility and risk-sharing framework was created with Congress recognizing the emergence of foreign launch services made competitive through government subsidies and preferential foreign national laws. Foreign launch service providers continue today to receive preferential treatment including government indemnification. The continuously emerging United States commercial launch industry requires a stable risk-sharing program with government indemnification in order to plan future operations and encourage investment. This will provide an environment favorable to industry growth amidst highly competitive foreign launch service providers, including those with access to indemnification.

Indemnification not only impacts the launch service provider, but also the customer that often makes decisions regarding launches several years out. Should uncertainty exist as to a customer's potential exposure to all possible risk as a participant in the launch, there is extra benefit for a customer to rely on a foreign provider that assures protection. A five year extension would contribute to a stable and predictable domestic market environment.

Fostering growth will produce public benefit in the form of national security, technological capacity, and national pride by enabling domestic access to space for government and commercial users and contributing to United States aerospace preeminence. These concepts were recognized by Congress when it enacted the current regime. More specifically, the continuation of indemnification benefits the public at large with protections against the most probable risk of liability.

#### Risk Management for FAA Authorized Launch and Reentry Under Current Law

In a nutshell, the utility of the regime arises out of its comprehensive inter-locking design that effectively assigns and balances the management of financial risk. This risk arises, in part, out of the Federal Government's potential liability for damages under international treaty. Additionally, potential catastrophic risk to the domestic commercial launch industry includes liability for third party loss exceeding that for which the industry can reasonably obtain

insurance. The regime is also effective in managing sources of tangential risk, including the risk of foreign competition to the private domestic industry and the financial risk of third parties.

By design, the financial responsibility and risk-sharing regime consists of three inter-locking risk apportionment mechanisms. In the first, the FAA requires an operator of a launch or reentry vehicle to purchase insurance or otherwise demonstrate financial responsibility covering the maximum probable losses that could be incurred by third parties or the United States Government (for property loss) as a result of its launch or reentry. The second consists of two parts: the Government's agreement not to hold launch participants liable for damages to its property in an amount exceeding the maximum probable loss based insurance requirement, and, more importantly for purposes of this discussion, the statutory process for the payment of excess claims, subject to Congressional appropriation. This is popularly referred to as "indemnification." The third is the requirement that all launch and reentry participants agree not to hold each other and the United States Government responsible for damage, with some exceptions, each may experience arising out of launch or reentry activities. The second mechanism's response to third party losses, indemnification, is at issue now.

When these three mechanisms are carried out together, as required by the CSLA before the FAA issues a license, the remaining risk of liability for damage is distributed into three tiers. Tier one includes the most probable risk, which is taken on by the operator. Tiers two and three include more remote risk.

#### Calculating and Distributing Financial Risk for Damage to Third Parties

Under the CSLA and FAA regulations<sup>1</sup>, a launch operator must obtain insurance or otherwise demonstrate financial responsibility to cover the maximum probable loss a launch or reentry could cause. The operator is responsible for damage to 1) third parties-- which Congress has defined as persons not involved in the launch or reentry--and 2) damage to United States Government property. Operators must maintain minimum levels of financial responsibility by insurance or otherwise in an amount that would cover the maximum probable loss calculated by the FAA. This risk may be covered by private insurance and it is how almost all licensees and permittees have historically managed risk for the MPL. An operator's responsibility for the risk of maximum probable loss is limited to no more than \$500 million for potential third party liability and no more than \$100 million for damage to government property. The insurance an operator obtains must name all launch participants as additional insureds, including the Government and its contractors and subcontractors, further ensuring that the Government does not have liability exposure to the risk associated with maximum probable loss.

The first tier of risk is calculated by the FAA as the maximum probable loss (MPL). The FAA's regulations define MPL to mean the greatest dollar amount of loss for bodily injury or property damage that is reasonably expected to result from a licensed or permitted activity. For United States Government property losses, the FAA has set a threshold of losses with a probability of occurrence of no less than one in one hundred thousand. For third party loss, the FAA has set a threshold of losses with a probability of occurrence of no less than one in ten million. This means that on average, there would be a chance that the Government might need to participate in

<sup>1</sup> See Financial Responsibility for Licensed and Permitted Activities, 14 C.F.R. pt. 440 (2012).

assuming loss for one in every hundred thousand or one in every ten million launches. On the other hand, the operator would be responsible for covering the most likely risk of loss up to the maximum probable loss (i.e., that with a probability of occurrence up to the threshold) with insurance.

In the early days of its program, when first employing its methodology, the FAA found that calculating the MPL using a threshold inclusive of risk with a higher probability of occurrence (e.g., a threshold of a one in one million chance as opposed to a one in ten million chance) resulted in determinations that insurance would not be necessary. Accordingly, the FAA relies on a threshold chance of occurrence of one in ten million for third party loss in order to prevent the United States Government from being exposed to the most likely risk, which includes potential liability for the first dollars of loss.

The methodology for calculating MPL, whether for United States Government property damage or third party loss, is similar: the FAA assesses the debris field resulting from a series of assumed failures along a launch or reentry trajectory, models the probability of failure of the activity, and ascertains the presence of property or potential casualties. MPL is expressed in dollar terms and is determined on a case-by-case basis after analysis of information provided by the license applicant. MPL calculations rely on historical data, including that of prior experiences with uncrewed expendable launch vehicles.

Calculating third party MPL requires the FAA to assess harm to persons and property not involved in the launch or reentry. The FAA accounts for the loss of property and life at the launch site as well as losses that could occur uprange and downrange due to debris. To calculate the MPL, the FAA uses a debris overlay method that estimates the inert debris field that would result in the event of breakup. The population density of areas exposed to launch or reentry hazards is factored into the calculation to produce a number of probable casualties due to debris impact. From the casualty amount, the FAA also calculates additional casualties from secondary effects including fires and collapsed buildings. The total direct and secondary casualties are then given a value of \$3 million each. The total cost of casualty is then increased by fifty percent to account for third party property damage from debris.

The second tier of risk consists of liability for losses exceeding the licensee's required financial responsibility for which it obtains insurance to cover maximum probable losses. For United States Government property, the Government waives claims for damages in excess of the insurance required to account for maximum probable loss under the reciprocal waivers of claims described below. Although liabilities have never exceeded financial responsibility, the statute provides that Congress may appropriate up to \$1.5 billion (adjusted for inflation after January 1, 1989) in excess of coverage assigned under MPL calculation to cover successful third party claims against participants in a launch or reentry. After inflation, the second tier is now capped at \$2.7 billion. The statute specifically states that claims against space flight participants are excluded from this authority. Were there to be an accident where damages exceeded the maximum probable loss coverage required by the FAA, the FAA could seek an appropriation from Congress.

The third and final tier of financial risk consists of liabilities for third party claims above the insured amount and \$1.5 billion (as adjusted for inflation, now \$2.7 billion). This risk is least likely to occur and is again assumed by the launch or reentry operator or other launch participants held liable.

#### Reciprocal Waivers of Claims

Finally, under the CSLA's risk-sharing requirements, launch and reentry participants, including a licensee or permittee, any customer, contractors and subcontractors are required to waive claims among themselves. Therefore, each party involved in a launch agrees not to bring claims against the other parties and is financially responsible for property damage or loss it sustains, or for death or injury to its own employees resulting from activities carried out under a license or permit. This eliminates the need for launch participants to obtain insurance covering these claims and, as a result, saves money and contributes to increased insurance capacity. Similarly, launch participants and the United States Government must waive claims against each other, their contractors and subcontractors. The Government only waives claims for damage to its property in excess of required insurance. Federal employees are not included in these waivers; the FAA considers them third parties, and losses to them are covered under third party financial responsibility.

#### The Suitability of the Financial Responsibility and Risk-sharing Regime

I believe that the current financial responsibility and risk-sharing regime is well suited to cover emerging activities such as commercial cargo and commercial crew, and orbital and sub-orbital flights. As mentioned previously, the MPL methodology is based on experience with unmanned expendable launch vehicles that included cargo, or what we call "payloads." When sub-orbital or orbital flight involves human crew or space flight participants, the methodology is not affected, because the MPL is not an estimate of risk to crew or space flight participants, but rather, to third parties, including members of the public and non-flying United States Government employees. Space flight participants and crew are not third parties.

Whether a launch is manned or unmanned should not affect the MPL methodology, but rather the result of MPL calculations. For example, if a vehicle were designed with higher reliability systems in order to protect persons on board, that superiority of design might also reduce the risk of mishaps that would affect third parties.

#### In Conclusion

The benefits of indemnification are many, both to industry and the United States Government. As Congress itself recognized by statute, the development of the commercial space transportation industry enables the United States to retain its competitive position internationally, contributing to the national interest and economic well-being of the United States. Extension of the indemnification provision would continue to enable industry to attract and maintain a customer base in the face of international competitors who offer more certain indemnification.

The US commercial space industry continues to achieve new milestones. Recently, SpaceX became the first private company to berth with the International Space Station and safely return cargo back to Earth. Soon, SpaceX and Boeing may both be transporting participants to Bigelow Aerospace's first private space station. These unprecedented acts come with equally unprecedented risk and financial investment for a private company. In a situation where nothing is certain, and because everything is new, continuing to address manageable risk through the conditional payment of excess claims is wise public policy for this country.

With the help and leadership of Congress, commercial space transportation will continue without untenable financial setback, and the private space industry in the United States will continue to grow with new jobs, new technologies, and new innovations. Again, I am grateful for this opportunity to speak before you today, and I am happy to answer any questions you may have.

Chairman PALAZZO. I now recognize Ms. Alicia Cackley for five minutes to present her testimony.

**STATEMENT OF MS. ALICIA CACKLEY,  
DIRECTOR OF FINANCIAL MARKETS AND  
COMMUNITY INVESTMENT TEAM,  
GOVERNMENT ACCOUNTABILITY OFFICE**

Ms. CACKLEY. Chairman Palazzo, Ranking Member Costello, and Members of the Subcommittee, I am pleased to be here today to talk about the Federal Aviation Administration's Launch Indemnification Program.

As you are aware, a catastrophic commercial launch accident could have a significant impact on the uninvolved public or third parties in the form of personal injuries or property damage. In anticipation of such an event, a launch company must purchase a fixed amount of insurance for each launch per calculation by the FAA. According to the Commercial Space Launch Act amendments of 1988, or CSLA, the Federal Government is then potentially liable for claims above that amount, up to an additional \$2.7 billion as adjusted for inflation and subject to Congressional appropriations.

In my statement today, I will discuss first, the comparison of the United States Government's indemnification policy to policies of other countries; second, the Federal Government's potential costs for indemnification; third, the ability and willingness of the insurance market to provide additional coverage; and finally, the effects of ending indemnification on the competitiveness of U.S. launch companies.

My statement is based on ongoing work that we are conducting at the request of this committee and the Senate Committee on Commerce, Science, and Transportation. We expect to issue a final report at a later date with recommendations as appropriate.

Turning to the comparison of the U.S. government's indemnification policy with those of other countries, our work to date indicates that the United States provides less indemnification for third-party losses than key competitors such as China, France, and Russia because those countries put no upper limit on the amount of their coverage, while in the U.S., coverage stops at about \$2.7 billion per launch.

In all these countries, however, including the U.S., these commitments to pay have never been tested because there has never been a third-party claim that exceeded the launch company's insurance and thus reach the level of government indemnification.

Looking at the potential cost to the Federal Government of indemnification for third-party losses it is currently unclear. Estimating probable losses from a rare catastrophic event is difficult, and insurance industry officials and risk modeling experts told us that FAA's method of calculating maximum probable loss is outdated, has not been reviewed by outside experts, and may not be sound. An inaccurate calculation that understates the amount of insurance a launch provider must obtain would increase the likelihood of cost to the Federal Government, whereas a calculation that

overstates the amount of insurance would decrease the likelihood of federal costs.

In addition, the planned growth in commercial launches, including manned launches, could increase the number of launches eligible for CSLA coverage and thus, potential costs for the Federal Government.

FAA officials said that their method for calculating maximum probable loss was reasonable and conservative, but they agreed that a review could be beneficial and that involvement of outside experts might be helpful for improving their methodology.

Overall, they said use of more sophisticated methodologies would have to be balanced with the additional cost to both FAA and the launch companies that would result from requiring and analyzing additional data.

With respect to the ability and willingness of the insurance market to provide additional third-party liability coverage, industry representatives we contacted told us the market is generally willing and able to provide up to \$500 million of coverage per launch. Because the amount of insurance FAA requires launch providers to obtain averages about \$99 million per launch and coverage available through CSLA is about \$2.7 billion above a launch's maximum probable loss, insurers could provide some of the coverage currently available through CSLA, mainly the difference between the maximum probable loss and the \$500 million the industry indicated was the most they might provide.

However, industry representatives cautioned that the amount and price of insurance that they might provide could change quickly if a large loss were to occur.

Finally, ending indemnification could potentially decrease U.S. competitiveness. This depends on many factors, so the actual effects are currently unknown. Launch companies and customers GAO contacted believed that ending federal indemnification could lead to higher costs for U.S. launch companies. If those costs are passed onto customers, U.S. launch companies could be even more expensive, and therefore, less competitive than their foreign counterparts.

However, it is unclear exactly how much the cost of third-party liability insurance coverage might increase in the absence of federal coverage, and while launch customers said that price and vehicle reliability were key factors in their choice of a launch company, it is also not clear whether the increase in insurance costs alone would be sufficient reason for a launch customer to choose a foreign launch company over a U.S. company.

Mr. Chairman, this concludes my prepared statement. I would be happy to respond to any questions you or Members of the Subcommittee may have.

[The prepared statement of Ms. Cackley follows:]

United States Government Accountability Office

**GAO**

Testimony  
Before the Subcommittee on Space, and  
Aeronautics, Committee on Science,  
Space, and Technology, House of  
Representatives

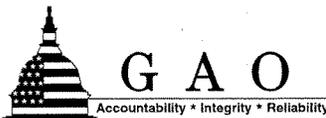
For Release on Delivery  
Expected at 10:00 a.m. EDT  
Wednesday, June 6, 2012

**COMMERCIAL SPACE  
LAUNCH ACT**

**Preliminary Information on  
Issues to Consider for  
Reauthorization**

Statement of Alicia Puente Cackley, Director  
Financial Markets and Community Investment

Gerald L. Dillingham, Ph.D., Director  
Physical Infrastructure



United States Government Accountability Office

**GAO**

Testimony  
Before the Subcommittee on Space, and  
Aeronautics, Committee on Science,  
Space, and Technology, House of  
Representatives

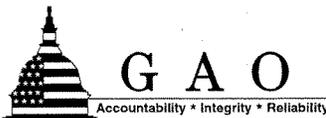
For Release on Delivery  
Expected at 10:00 a.m. EDT  
Wednesday, June 6, 2012

**COMMERCIAL SPACE  
LAUNCH ACT**

**Preliminary Information on  
Issues to Consider for  
Reauthorization**

Statement of Alicia Puente Cackley, Director  
Financial Markets and Community Investment

Gerald L. Dillingham, Ph.D., Director  
Physical Infrastructure





Highlights of GAO-12-767T, a testimony before the Subcommittee on Space and Aeronautics, Committee on Science, Space and Technology, House of Representatives

June 6, 2012

## COMMERCIAL SPACE LAUNCH ACT

### preliminary Information on Issues to Consider for Reauthorization

#### Why GAO Did This Study

A catastrophic commercial launch accident could result in injuries or property damage to the uninvolved public, or "third parties," in anticipation of such an event, a launch company must purchase a fixed amount of insurance for each launch, per calculation by FAA; the federal government is potentially liable for claims above that amount up to an additional \$1.5 billion, adjusted for inflation, subject to congressional appropriations. As of 2012, the inflation-adjusted amount is about \$2.7 billion. CSLA provides for this payment, called indemnification. The indemnification provision, unless reauthorized, expires this year.

This testimony provides preliminary information on, among other things, (1) a comparison of the U.S. government's indemnification policy to policies of other countries, (2) the federal government's potential costs for indemnification, (3) the ability and willingness of the insurance market to provide additional coverage, and (4) the effects of ending indemnification on the competitiveness of U.S. launch companies. This testimony is based on ongoing work that includes a review of FAA data and documents and relevant literature and interviews with officials from FAA, National Aeronautics and Space Administration, insurers, brokers, launch companies, launch customers, risk modelers, and experts.

#### What GAO Recommends

GAO is making no recommendations in this statement but anticipates doing so in its final report.

View GAO-12-767T. For more information, contact Alicia Puente Cackley at (202) 512-8878 or cackleya@gao.gov or Dr. Gerald L. Dillingham at (202) 512-2834 or dillingham@gao.gov.

#### What GAO Found

GAO's work to date work indicates the United States provides less indemnification for third party losses than China, France, and Russia, according to studies. These countries put no limit on the amount of government indemnification coverage currently available through the Commercial Space Launch Act Amendments of 1988 (CSLA) which is about \$2.7 billion per launch. These commitments to pay have never been tested because there has never been a third party claim that exceeded the launch company's insurance and thus reached the level of government indemnification.

The potential cost to the federal government of indemnification for third party losses is currently unclear. This is because it depends in part on the method used by the Federal Aviation Administration (FAA) to calculate the amount of insurance that launch companies must purchase, which may not be sound. FAA has used the same method since 1988 and has not updated crucial components, such as the cost of a casualty. Estimating probable losses from a rare catastrophic event is difficult, and insurance industry officials and risk modeling experts said that FAA's method is outdated. FAA, however, has not had outside experts or risk modelers review its appropriateness. An inaccurate calculation that understates the amount of insurance a launch provider must obtain would increase the likelihood of costs to the federal government, whereas a calculation that overstates the amount of insurance would decrease the likelihood of federal costs. FAA officials said that their method was reasonable and conservative, but they agreed that a review could be beneficial and that involvement of outside experts might be helpful for improving their methodology. Overall, they said use of more sophisticated methodologies would have to be balanced with the additional costs to both FAA and the launch companies that would result from requiring and analyzing additional data.

The insurance market is generally willing and able to provide up to \$500 million per launch as coverage for third party liability, according to industry representatives GAO contacted. Because the amount of insurance FAA requires launch providers to obtain averages about \$99 million per launch, and coverage available through CSLA is about \$2.7 billion above that, insurers could provide some of the coverage currently available through CSLA. However, the amount and price of insurance that could be provided could change quickly if a large loss were to occur, according to insurance industry representatives.

The actual effects on competition of eliminating CSLA indemnification are currently unknown. However, launch companies and customers GAO contacted believe that ending federal indemnification could lead to higher launch prices for U.S. launch companies, making them less competitive than foreign launch companies. Although the cost of third party liability insurance coverage for launch companies has been about 1 percent the dollar amount of coverage they purchased, how much this cost might increase in the absence of federal coverage is not clear. Launch customers said that price and vehicle reliability were key factors in their choice of a launch company. Launch companies reported that additional costs would be passed along to customers, but whether this increase alone would be sufficient reason for a launch customer to choose a foreign launch company over a U.S. company is also not clear.

---

Chairman Palazzo, Ranking Member Costello, and Members of the Subcommittee:

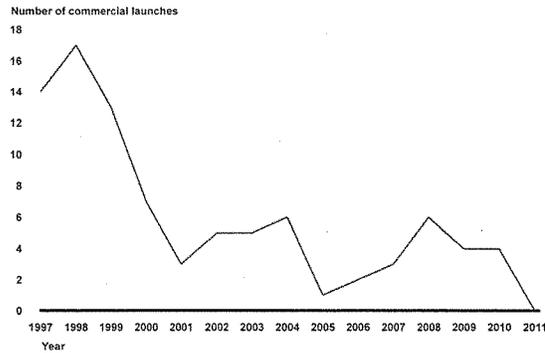
Thank you for the opportunity to testify today on commercial space launch indemnification as you consider the upcoming reauthorization of the federal coverage provided through the Commercial Space Launch Act Amendments of 1988 (CSLA).<sup>1</sup> This legislation made the federal government responsible, subject to an appropriation provided by Congress, for a portion of third party liability claims that arise from a catastrophic launch-related incident that results in injury or damage to uninvolved people or property.<sup>2</sup> The goal was to provide a competitive environment for the U.S. commercial space launch industry by providing, among other things, government indemnity while still minimizing the cost to taxpayers. As figure 1 shows, the number of U.S. commercial launches, which are licensed by the Federal Aviation Administration (FAA), has generally declined since its peak of 17 in 1998.

---

<sup>1</sup> Pub. L. No. 100-657.

<sup>2</sup> 51 USC 50915.

**Figure 1: Annual Number of Commercial U.S. Space Launches, 1997-2011**



Source: GAO analysis of FAA data.

Although the number of U.S. commercial space launches has fallen in recent years, it is reasonable to expect an increase in the years ahead. The National Aeronautics and Space Administration (NASA) plans to begin procuring commercial cargo transportation services to the International Space Station (ISS) in 2012 and intends to procure commercial manned launches to carry its astronauts to the ISS beginning in 2017.<sup>3</sup> A number of companies are developing new launch vehicles that could provide these orbital services. Other companies are developing suborbital vehicles that could carry passengers for space tourism flights.

<sup>3</sup>All commercial missions for NASA thus far have been demonstration missions conducted under Space Act agreements, which involve NASA providing significant funds to private industry partners to stimulate the development of large-scale commercial space transportation capabilities. NASA has procured transportation services to the ISS to begin later in 2012 through traditional contractual arrangements. For more information on Space Act agreements, please see GAO, *Key Controls NASA Employs to Guide Use and Management of Funded Space Act Agreements Are Generally Sufficient, but Some Could Be Strengthened and Clarified*, GAO-12-230R (Washington, D.C.: Nov. 17, 2011).

---

As you consider reauthorizing CSLA, our testimony today provides preliminary information on the following issues: (1) how the current U.S. commercial space launch indemnification policy compares to policies in other countries; (2) the federal government's potential costs under CSLA; (3) the extent to which the insurance market is able and willing to provide third party liability insurance at levels currently provided by CSLA; (4) the implications of commercial manned launches for the current federal indemnification policy, including the gaps, if any, that exist in that policy and the potential financial risks those gaps pose; and (5) what is known about the direct and indirect effects that ending indemnification would have on the competitiveness of U.S. commercial launch companies.

This statement is based on ongoing work we are conducting at the request of this committee and the Senate Committee on Commerce, Science, and Transportation; we expect to issue a final report later this year with recommendations, as appropriate. We reviewed launch data from FAA and performed a literature search. We also reviewed documents from and conducted interviews with insurance brokers and underwriters who provide commercial launch companies with coverage for third party liability, experts in commercial space launch liability issues and risk management, representatives from launch companies and customers, and officials from FAA and NASA. Additional information on our methodology is provided in appendix I.

We conducted this performance audit from November 2011 to June 2012 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

---

## Background

### U.S. Indemnification Policy

The 1988 amendments to CSLA established the current U.S. policy to provide federal payment, subject to appropriation—known as indemnification—for a portion of claims by third parties for injury, damage,

---

or loss that result from a commercial launch-related incident.<sup>4</sup> All FAA-licensed commercial launches and landings by U.S. companies, whether unmanned or manned and from the United States or overseas, are covered by federal indemnification for third party damages that result from the launch or landing.<sup>5</sup> Parties involved in launches—for example, passengers and crew—are not eligible for indemnification coverage.<sup>6</sup>

U.S. indemnification policy has a three-tier approach for sharing liability between the government and the private sector to cover third party claims:

- The first tier of coverage is the responsibility of the launch company and is handled under an insurance policy purchased by the launch company. As part of FAA's process for issuing a license for a commercial launch or landing, the agency determines the amount of third party liability insurance a launch company is required to purchase so the launch company can compensate third parties for any claims for damages that occur as a result of activities carried out under the license.<sup>7</sup> FAA calculates the insurance amount to reflect the maximum probable loss that is likely to occur because of an accident that results in third party damages, including deaths and injuries on the ground and damage to property from spacecraft debris.<sup>8</sup> <sup>9</sup> FAA uses a statistical approach to estimate expected losses based on estimated probabilities that a catastrophic incident could occur and the estimated costs of a catastrophic incident given the details of the

---

<sup>4</sup> Pub. L. No. 100-657.

<sup>5</sup> 51 USC 50914(a)(1)(A).

<sup>6</sup> A crew includes any employee who performs activities directly relating to the launch, reentry, or other operation relating to the vehicle that carries human beings. 51 USC 50902(2). A passenger—also called a spaceflight participant—is an individual who is not crew, carried aboard a launch vehicle or reentry vehicle. 51 USC 50902(17).

<sup>7</sup> 51 USC 50914.

<sup>8</sup> 51 USC 50914(c).

<sup>9</sup> FAA makes this determination for each space launch by reviewing the specific circumstances of the launch, including the planned launch vehicle, launch site, payload, flight path, and the potential casualties and fatalities that could result from varying types of launch failures at different points along that path. FAA estimates the total cost of estimated casualties from a launch failure and uses this information as the basis for determining property damage.

---

specific launch. This first tier of required insurance coverage is capped at a maximum of \$500 million for third party damages.<sup>10</sup>

- The second tier of coverage is provided by the U.S. government, and it covers any third party claims in excess of the specific first tier amount up to a limit of \$1.5 billion adjusted for post-1988 inflation; in 2012, the inflation-adjusted amount was approximately \$2.7 billion.<sup>11</sup> For the federal government to be liable for these claims, Congress would need to appropriate funds. This second tier of coverage will expire in December 2012 unless Congress reauthorizes it.<sup>12</sup> (The other two tiers have no expiration date.)
- The third tier of coverage is for third party claims in excess of the second tier—that is, the federal coverage of \$1.5 billion above the first tier, adjusted for inflation. Like the first tier, this third tier is the responsibility of the launch company, which may seek insurance above the required first tier amount for this coverage. Unlike the first tier, no insurance is required under federal law.

Another component of U.S. indemnification policy for commercial space launches is cross waivers. They provide that each party involved in a launch (such as the launch company, the spacecraft manufacturer, and the customer) agrees not to bring claims against the other parties and assumes financial responsibility for damage to its own property or loss or injury sustained by its own employees.<sup>13</sup> Cross waivers also do not have an expiration date.

According to FAA, no FAA-licensed commercial space launch since 1989 has resulted in casualties or substantial property damage to third parties. In the event of a third party claim that exceeded the launch provider's first-tier coverage, FAA would be involved in any negotiations, according to FAA officials, and the Secretary of Transportation must approve any settlement.<sup>14</sup>

---

<sup>10</sup> 51 USC 50914(a)(3)(A)(i).

<sup>11</sup> 51 USC 50915(a)(1).

<sup>12</sup> 51 USC 50915(f).

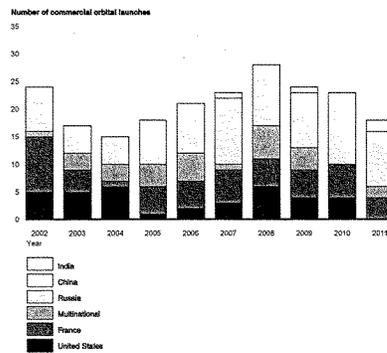
<sup>13</sup> 51 USC 50914(a)(4).

<sup>14</sup> 51 USC 50915(b)(3).

Global Commercial Space Launch Industry

From 2002 through 2011, U.S. companies conducted approximately 17 percent of commercial space launches worldwide, while Russia conducted 43 percent and France's launch company conducted 24 percent. Figure 2 shows the trend in number of commercial space launches over the last 10 years.

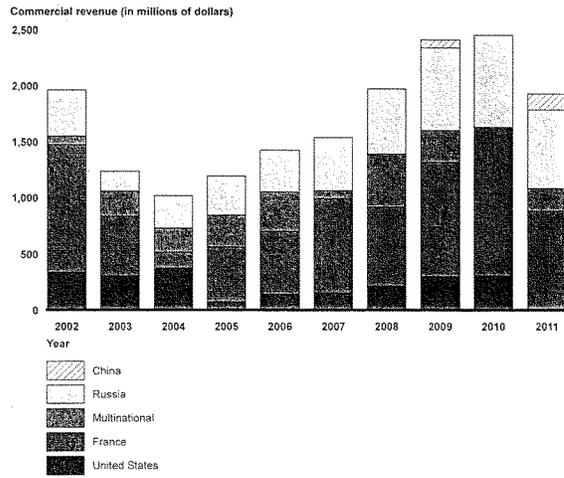
Figure 2: Number of Commercial Space Launches Worldwide, 2002-2011



Source: GAO analysis of FAA data.

Over the past several years Russian and French launches have generated the most revenues, followed by U.S. launches. In 8 of the last 10 years, U.S. commercial launch companies generated less revenue than launches in either Russia or France. U.S. companies generated no commercial launch revenue in 2011 because they conducted no launches. (See fig. 3.)

**Figure 3: Commercial Space Launch Revenues Worldwide, 2002-2011**



Source: GAO analysis of FAA data.  
Note: India is not included in this figure due to its small amount of revenues.

**The United States Provides Less Liability Coverage Than Foreign Competitors Due to a Cap on Government Indemnification**

Our work to date indicates that the United States provides less total third party liability coverage than China, France, or Russia—the primary countries that have conducted commercial space launches in the last 5 years—according to published reports.<sup>15</sup> These countries each have an indemnification regime in which the government states that it will assume a greater share of the risk compared to that of the United States because each country has a two-tiered system with no limit on the amount of government indemnification. By comparison, the United States caps government indemnification at \$1.5 billion adjusted for inflation beyond the first-tier insurance amount.<sup>16</sup> However, U.S. government coverage, in some cases, begins at a lower level than that of the other countries because U.S. coverage begins above the maximum probable loss, which averaged about \$99 million for active FAA launch and reentry licenses as of January 2012 and ranged from about \$23 million to \$267 million. The level at which government coverage begins for the other four countries ranged from \$79 million to \$300 million.

China, France, and Russia have a first tier of insurance coverage that a commercial launch company must obtain, similar to the United States. The second tier of government indemnification varies for these countries:

- The Chinese government provides indemnification for third party claims over \$100 million.
- The French government provides indemnification for third party claims over 60 million euros (about \$75 million as of May 2012).
- The Russian government provides indemnification for third party claims over \$80 million for the smaller Start launch vehicles and \$300 million for the larger Soyuz and Proton vehicles.<sup>17</sup>

For all these countries, their commitments to pay have never been tested. Globally, there has never been a third party claim for damages from a commercial space launch failure that reached second-tier coverage.

<sup>15</sup>In addition, India conducted one commercial space launch during this period, but we found conflicting information on the Indian government's indemnification coverage, and therefore we are not including it in this discussion.

<sup>16</sup> 51 USC 50915(a)(1)(B).

<sup>17</sup>The source for all the government amounts is Aerospace Corporation, *Study of the Liability Risk-Sharing Regime in the United States for Commercial Space Transportation* (El Segundo, Calif.: August 2006), or FAA, *Liability Risk-Sharing Regime for U.S. Commercial Space Transportation: Study and Analysis* (Washington, D.C.: April 2002).

---

Potential Cost of  
Indemnification by  
the Federal  
Government Depends  
on a Variety of  
Factors

Catastrophic Events and  
Congressional  
Appropriations

The federal government's potential costs under CSLA depend on (1) the occurrence of a catastrophic launch failure with third party claims that exceed the first tier of coverage and (2) Congress appropriating funds to cover the government's liability under the second tier of coverage. FAA officials stated that no FAA-licensed commercial space launches have resulted in casualties or substantial property damage to third parties. As a result, FAA believes that it is highly unlikely that there will be any costs to the federal government under CSLA. In the event that a catastrophic failure did occur, FAA's maximum probable loss calculation is intended to estimate the maximum losses likely to occur from a commercial space launch and determine the amount of third party losses against which launch companies must protect. In calculating maximum probable loss, FAA aims to include estimates of losses from events having greater than a 1 in 10 million chance of occurring, meaning that losses are very unlikely to exceed launch companies' private insurance and become potential costs for the government under CSLA.

Under CSLA, if a rare catastrophic event were to occur whose losses exceeded private insurance coverage, the government would be responsible for paying claims that exceeded FAA's maximum probable loss only if Congress provided appropriations for this purpose. Under CSLA, the federal government does not incur a legal liability unless an appropriation is made for this purpose.<sup>18</sup> Accordingly, an obligation would not be recorded in the federal budget unless and until such an appropriation is made. While an obligation is not incurred or recorded for

---

<sup>18</sup>CSLA requires the Secretary of Transportation to provide for the payment of specific types of successful third party claims to the extent provided in advance in an appropriation law or to the extent additional legislative authority is enacted providing for paying for claims in a compensation plan submitted to Congress by the President. 51 U.S.C. § 50915 (a)(1).

---

potential CSLA losses until an appropriation is provided, some insurance companies told us that they expect the government to pay losses that become eligible for coverage under CSLA.

---

**Maximum Probable Loss  
Soundness**

While it is very difficult to assess catastrophic failures that have low probabilities but potentially high losses, FAA's use of an appropriate process for determining the maximum probable loss is important because the maximum probable loss sets the point at which losses become potential costs to the government under CSLA. Our preliminary work identified several issues that raise questions about the soundness of FAA's maximum probable loss methodology:

- FAA uses a figure of \$3 million when estimating the cost of a single potential casualty—that includes either injury or death—which FAA officials said has not been updated since they began using it in 1988. Two insurers, as well as representatives of two companies that specialize in estimating damages from catastrophic events (modeling companies), said that this figure is likely understated. Because this number has not been adjusted for inflation or updated in other ways, it may not adequately represent the current cost of injury or death caused by commercial space launch failures. Having a reasonable casualty estimate can affect FAA's maximum probable loss calculation and could affect the potential cost to the government from third party claims.
- FAA's methodology for determining potential property damage from a commercial space launch starts with the total cost of casualties and adds a flat 50 percent to that cost as the estimate of property damage, rather than specifically analyzing the number and value of properties that could be affected in the event of a launch failure. One insurer and two risk modelers said that FAA's approach is unusual and generally not used to estimate potential losses from catastrophic events. For example, officials from both modeling companies noted that the more common approach is to model the property losses first and derive the casualty estimates from the estimated property losses. For example, if a property loss scenario involves the collapse of a building, that scenario would have a different casualty expectation than a scenario that did not involve such a collapse. One modeler stated that FAA's method might significantly understate the number of potential casualties, noting that an event that has a less than 1 in 10 million chance of occurring is likely to involve significantly more casualties than predicted under FAA's approach. Moreover, a 2007 FAA review

---

conducted with outside consultants said that this approach is not recommended because of observed instances where casualties were low yet forecasted property losses were very large.<sup>19</sup>

- More broadly, FAA's method does not incorporate what is known in the insurance industry as "catastrophe modeling." One modeler told us that catastrophe modeling has matured over the last 25 years—as a result of better data, more scientific research, and advances in computing—and has become standard practice in the insurance and reinsurance industries.<sup>20</sup> Catastrophe models consist of two components: a computer program that mathematically simulates the type of event being insured against and a highly detailed database of properties that could potentially be exposed to loss. Tens of thousands or more computer simulations are generated to create a distribution of potential losses and the simulated probability of different levels of loss.<sup>21</sup> In contrast, FAA's method involves estimating a single loss scenario.

FAA officials told us that they have considered the possibility of using a catastrophe model. However, they expressed concern about whether the more sophisticated approach would be more accurate, given the great uncertainty about the assumptions, such as the probability and size of potential damages, that must be made with any model. Also, industry experts told us that a significant cost factor in catastrophe modeling is creating and maintaining a detailed database of exposed properties. One expert told us that in order for FAA to do such modeling, it would need to purchase a property exposure database, which could cost hundreds of thousands of dollars. Experts also disagreed on how feasible it would be to mathematically model the potential damages associated with space launches. One expert thought such modeling would not be credible because the necessary knowledge of the factors that can influence a space launch is not at the same level as the more developed research for modeling hurricanes, for example. Another expert thought that it would be

---

<sup>19</sup>For more information on FAA's methodology, see J.D. Collins, C.P. Brinkman, and C.L. Carbon, ACTA Inc., and FAA, *Determination of Maximum Probable Loss* (2007).

<sup>20</sup>Reinsurance is essentially insurance for insurers—that is, companies buy coverage for all or a part of a policy's liability from other insurers in order to offset exposure.

<sup>21</sup>The probability distribution of losses is typically presented in what is known as an exceedance probability curve, which shows the probability of losses exceeding various levels.

---

possible to develop credible space launch simulation models. Another expert stated that such models have not been developed to date because of the government-provided indemnity coverage; this expert believed that if such coverage were the responsibility of the private sector, the necessary models might be developed.

FAA officials also said that they believe the maximum probable loss methodology is reasonable and produces conservative results for several reasons. First, FAA officials described a 2002 study on aviation casualty costs to support its use of a \$3 million casualty figure for its calculation. Use of a casualty estimate that is based on 2002 data, however, still raises questions about whether this figure is outdated, which could result in underestimating the cost of casualties. Second, to support basing the potential cost of property damage on the potential cost of casualties, FAA officials said that they have conducted internal analyses using alternative methodologies—including some that assessed property values in the vicinity of launches—and compared them to their current methodology. In each case, officials said that the current methodology produced higher, or more conservative, maximum probable losses. We were unable to review or verify these analyses, however, because FAA officials said that these analyses were done informally and were not documented.

FAA officials acknowledged that updating the \$3 million casualty figure and conducting analyses of potential property damage (rather than using a casualty cost adjustment factor of 50 percent) might produce more precise estimates of maximum probable losses. However, they said that because the probabilities assigned to such losses are still rough estimates, whether taking these actions would increase the accuracy of their maximum probable loss calculations is uncertain. Overall, they said, use of more sophisticated methodologies would have to be balanced with the additional costs to both FAA and the launch companies that would result from requiring and analyzing additional data. For example, a new methodology might require either FAA or the launch company to gather current property information, and might necessitate that FAA construct a statistical model for analyzing potential losses.

The same officials noted that they periodically evaluate their current maximum probable loss methodology, but acknowledged that they have not used outside experts or risk modelers for this purpose. They agreed that such a review could be beneficial, and that involvement of outside experts might be helpful for improving their maximum probable loss methodology. FAA's 2007 review of potential alternatives identified a number of criteria for a sound maximum probable loss methodology that

---

could be useful in such a review. These included, among other things, that the process use a valid risk analysis, be logical and lead to a rational conclusion, and avoid being overly conservative or under conservative. A sound maximum probable loss calculation can be beneficial to both the government and launch companies because it can help ensure that the government is not exposed to greater costs than intended (such as might occur through an understated maximum probable loss) and help ensure that launch companies are not required to purchase more insurance coverage than necessary (such as might occur through an overstated maximum probable loss).

---

**Current Private  
Market Capacity for  
Coverage Is Generally  
\$500 Million per  
Launch, but a Large  
Loss Could Decrease  
Capacity**

---

**Private Capacity**

Our preliminary work found that some insurers and brokers suggested that the maximum amount of private sector third party liability coverage the industry is currently willing to provide is generally around \$500 million per launch. This amount, or capacity, is determined by the amount of their own capital that individual insurers are willing to risk by selling this type of coverage. According to some insurers and brokers with whom we spoke, commercial space launch third party liability coverage is a specialized market involving a relatively small number of insurers that each assume a portion of the risk for each launch. One broker said that no launch company thus far has pursued private sector insurance protection above \$500 million. Two insurers said that there might be slightly more coverage available beyond \$500 million, and one said that up to \$1 billion per launch in liability coverage might be possible in the private insurance market.

The cost to launch companies for purchasing third party liability insurance, according to some brokers and one insurer, is approximately 1 percent or less of the total coverage amount. According to FAA data on commercial launches, the average maximum probable loss is about \$99

---

million. As a result, in the absence of CSLA indemnification, insurers could still provide some of the coverage currently available through the government under CSLA. For example, if the maximum probable loss for a launch is \$100 million and the insurance industry is willing to offer up to \$500 million in coverage, the private market could potentially provide \$400 million in additional coverage.

According to some insurers, brokers, and insurance experts with whom we spoke, there are a number of reasons why private sector insurers are generally unwilling to offer more third party liability coverage than \$500 million per launch.

- First, these brokers and insurers said that worldwide capacity for third party liability coverage is generally limited to \$500 million per launch, which some considered a significant amount of coverage and a challenging amount to put together—particularly given that the number of insurers in the space launch market is relatively small.
- Second, according to these same officials, insurers are unwilling to expose their capital above certain amounts for coverage that at least currently brings in small amounts of premium relative to the potential payouts for losses. For example, they said that losses from a catastrophic launch accident could exceed many years of third party liability policy premiums and jeopardize insurers' solvency.
- Third, according to some insurers and brokers with whom we spoke, to have sufficient capital to pay for losses above \$500 million per launch would require insurers to charge policy premiums that would likely be unaffordable for space launch companies.

---

#### Changes to Market Capacity

Our preliminary work also indicates that the current amount of private market capacity could change due to loss events and changing market conditions, according to some insurance industry participants. Some insurers and brokers said that a launch failure could affect the level and cost of coverage offered, and that a launch failure with significant losses could quickly raise insurance prices and reduce capacity, potentially below levels required by FAA's maximum probable loss calculation. However, one risk expert suggested that a space launch failure would likely cause liability insurance rates to rise and that this might encourage insurers and capital to enter the space launch market and cause liability insurance capacity to increase. According to FAA, insurers have paid no claims for U.S. commercial launches to date, but they have paid some relatively small third party claims for U.S. military and NASA launch failures. For example, according to an insurance broker, a U.S. Air Force launch failure in 2006 resulted in property damage of approximately \$30

million. According to NASA, the Space Shuttle Columbia accident in 2003 resulted in property damage of approximately \$1.2 million. Two brokers said that given the low number of launches and low probability of catastrophic events, total worldwide premiums for space liability coverage are approximately \$25 million annually, amounts insurers believe are adequate to cover expected losses. However, if a large loss occurs, according to two insurers, they would likely increase their estimates of the potential losses associated with all launches.

Under CSLA, launch companies must purchase coverage to meet FAA's maximum probable loss amount or purchase the maximum amount of coverage available in the world market at reasonable cost, as determined by FAA.<sup>22</sup> The potential cost to the government could increase if losses caused insurance prices to rise and insurance amounts available at reasonable cost to decrease. Some insurers and brokers also said that the amount of insurance the private market is willing to sell for third party liability coverage for space launches can also be affected by changes in other insurance markets. For example, large losses in aviation insurance or in reinsurance markets could decrease the amount of capital insurers would be willing to commit to launch events because losses in the other markets would decrease the total pools of capital available.

Alternatives for  
Addressing Space Launch  
Risk

Because launch failures and changing market conditions could change the amounts of coverage available in the private market, you have expressed interest in other possible ways of managing catastrophic risk. While we have not conducted specific work to analyze the feasibility of alternative approaches for providing coverage currently available through CSLA, FAA and others have looked at possible alternatives to CSLA indemnification and we have examined different methods for addressing the risk of catastrophic losses associated with natural disasters and acts of terrorism.<sup>23</sup> These events, like space launch failures, have a low

<sup>22</sup> 51 USC 50914(a)(3).

<sup>23</sup> See FAA, *Liability and Risk-Sharing Regime for U.S. Commercial Space Transportation: Study and Analysis*, and Aerospace Corporation, *Study of the Liability Risk-Sharing Regime in the United States for Commercial Space Transportation*. See also GAO, *Catastrophe Insurance Risks: The Role of Risk-Linked Securities and Factors Affecting Their Use*, GAO-02-941 (Washington, D.C.: Sept. 24, 2002); *Catastrophe Insurance Risks: The Role of Risk-Linked Securities*, GAO-03-195T (Washington, D.C.: Oct. 8, 2002); and GAO, *Natural Disasters: Public Policy Options for Changing the Federal Role in Natural Catastrophe Insurance*, GAO-08-7 (Washington, D.C.: Nov. 26, 2007).

---

probability of occurrence but potentially high losses. Some methods involve the private sector, including going beyond the traditional insurance industry, in providing coverage, and include the use of catastrophe bonds or tax incentives to insurers to develop catastrophe surplus funds. Other methods aid those at risk in setting aside funds to cover their own and possibly others' losses, such as through self-insurance or risk pools.<sup>24</sup> Still other methods, such as those used for flood and terrorism insurance, involve the government in either providing subsidized coverage or acting as a backstop to private insurers.<sup>25</sup>

Use of any such alternatives could be complex and would require a systematic consideration of their feasibility and appropriateness for third party liability insurance for space launches. For example, according to a broker and a risk expert, a lack of loss experience complicates possible ways of addressing commercial space launch third party liability risk, and according to another risk expert, any alternative approaches for managing this risk would need to consider key factors, including the

- number of commercial space launch companies and insurers and annual launches among which to spread risk and other associated costs;
- lack of launch and loss experience and its impact on predicting and measuring risk, particularly for catastrophic losses; and
- potential cost to private insurers, launch companies and their customers, and the federal government.

As such, alternatives could potentially require a significant amount of time to implement.

---

<sup>24</sup>See GAO, *Catastrophe Insurance Risks: Status of Efforts to Securitize Natural Catastrophe and Terrorism Risk*, GAO-03-1033 (Washington, D.C.: Sept. 24, 2003). Self-insurance occurs when an entity assumes the risk for its losses and can involve the formation of an insurance company solely for that purpose. Risk pooling occurs when two or more entities agree to set aside funds to help pay for the others' losses.

<sup>25</sup>See GAO, *Flood Insurance: FEMA's Rate-Setting Process Warrants Attention*, GAO-09-12 (Washington, D.C.: Oct. 31, 2008), and *Terrorism Insurance: Status of Efforts by Policyholders to Obtain Coverage*, GAO-08-1057 (Washington, D.C.: Sept. 15, 2008).

---

**Forecasted Increase  
in Manned Launches  
and Landings Could  
Increase the Potential  
Costs for the Federal  
Government, and  
Current Coverage Has  
a Gap**

---

**Issues and Implications  
Relating to Commercial  
Manned Launches**

Our preliminary work indicates the planned increase in manned commercial launches raises a number of issues that have implications for the federal government's indemnification policy for third party liability, according to insurance officials and experts with whom we spoke. NASA expects to begin procuring manned commercial launches to transport astronauts to the ISS in 2017. In addition, private companies are also developing space launch vehicles that could carry passengers for space tourism flights.

First, the number of launches and landings covered by federal indemnification will increase with NASA's planned manned launches if they are determined to be FAA-licensed commercial launches. NASA expects to procure from private launch companies 2 manned launches per year to the ISS from 2017 to 2020. NASA and FAA have not yet determined if those launches will be covered under NASA's procurement policy or FAA's licensing regulations.<sup>26</sup> In addition, the development of a space tourism industry may also increase the number of launches and landings covered by federal indemnification, but the timing of tourism

---

<sup>26</sup>NASA-contracted launches for NASA's science missions are not currently covered by CSLA; rather, NASA requires its launch contractors to obtain insurance coverage for third party losses. The amount of the insurance required by NASA is the maximum amount available in the commercial marketplace at reasonable cost, but does not exceed \$500 million for each launch. The facts and circumstances for claims in excess of this amount would be forwarded by NASA to the Congress for its consideration 51 U.S.C. § 20113 (m) (2). NASA-contracted launches for the Commercial Resupply Services to the ISS will be licensed by the FAA under CSLA, and will be covered by CSLA indemnification. NASA has not yet determined if its commercially procured manned launches to the ISS will be FAA licensed. If they become FAA licensed, then third party claims for those launches would be covered by the CSLA indemnification policy.

---

launches and landings is uncertain. Among the potential space tourism companies, Virgin Galactic is the closest to conducting suborbital, manned launches, according to FAA. Virgin Galactic forecasts launches starting in 2014 and, according to the company, 500 individuals have made deposits for the \$200,000 fare. However, Virgin Galactic has not yet applied to FAA for a launch license and its planned schedule for flights has experienced delays in the past.

According to insurance company officials with whom we spoke, the potential volume of manned launches for NASA and for space tourism could increase the overall amount of insurance coverage needed by launch companies, which could raise insurance costs, including those for third party liability.<sup>27</sup> By increasing the volume of launches, the probability of a catastrophe occurring is also increased and any accident that occurs could also increase future insurance costs, according to insurance company officials with whom we spoke. A catastrophic accident could also result in third party losses over the maximum probable loss, which would invoke federal indemnification.

Second, because newly developed manned launch vehicles have less launch history they are viewed by the insurance industry as more risky than "legacy" launch vehicles. Insurance company officials told us that launch vehicles such as United Launch Alliance's Atlas V, which launches satellites and may be used for future manned missions, is seen as less risky than new launch vehicles, such as SpaceX's Falcon 9, which could also be used for manned missions. As of May 2012, Atlas V has had over two dozen launches with a 100 percent launch success rate; Falcon 9 has had 3 successful launches. According to insurance company officials with whom we spoke, they expect to charge higher insurance premiums for newly developed launch vehicles than legacy launch vehicles given their different risk profiles. Insurance company officials' opinions varied as to when a launch vehicle is deemed reliable—from 5 to 10 successful launches. They also told us that whether vehicles are manned is secondary to the launch vehicle's history and the launch's trajectory—over water or land—in determining risk and the price and amount of third party liability coverage.

---

<sup>27</sup> Launch providers obtain insurance in addition to that for third party liability, including coverage of assets, such as the launch vehicle.

---

Third, having any people on board a space vehicle raises issues of informed consent and cross waivers, which could affect third party liability and the potential cost to the federal government. CSLA requires passengers and crew on spaceflights to be informed by the launch company of the risks involved and to sign a reciprocal waiver of claims (also called a cross waiver) with the federal government—which means that the party agrees not to seek claims against the federal government if an accident occurs.<sup>28</sup> CSLA also requires cross waivers among all involved parties in a launch.<sup>29</sup> Two key issues dealing with cross waivers include the estates of spaceflight passengers and crew and limits on liability for involved parties.

- The estates of spaceflight passengers and crew, which are considered third parties to a launch, are not covered by the informed consent and cross waiver of claims, according to two insurance companies and one legal expert. Although an insurance company said that it would be difficult for estates to seek damages in case of an accident, the legal expert said that the informed consent requirement does not address future litigation issues. Officials from two insurance companies and one expert told us that they expect spaceflight passengers to be high-income individuals, which could result in large insurance claims by estates of the passengers, as determination of the amount of claims is based on an individual's expected earning capacity over his or her lifetime.
- According to two insurance companies and two legal experts, requiring cross waivers among passengers, crew, the launch company, and other involved parties may not minimize potential third party claims as they would not place limitations on liability. An insurance company and a legal expert stated that, without a limitation on liability, insurance premiums for third party and other launch insurance coverage could increase as the same small number of insurance companies insures passengers, crew, launch vehicles, as well as third parties to a launch. According to FAA, putting a limitation on spaceflight passenger liability could foster the development of the commercial space launch industry through lower costs for insurance and liability exposure. Liability exposure and the related litigation

---

<sup>28</sup> 51 USC 50905(b)(5).

<sup>29</sup> 51 USC 50914(b)(1).

---

impose costs on industries and the limitation on liability shifts the risk to spaceflight passengers, who have been informed of the launch risks. If limitations on liability were set by federal legislation, it could conflict with state law because at least five states currently have their own space liability and indemnity laws limiting liability.<sup>30</sup> Launch and insurance companies believe that a limit or cap on passenger liability could decrease uncertainty and consequently decrease the price of insurance, according to a FAA task force report.<sup>31</sup>

As previously discussed, the potential cost to the government depends on the accuracy of the maximum probable loss calculation, which assesses a launch's risk. If the calculation is understated, then the government's exposure to liability is higher. Thus, whether the launch vehicle is newly developed or manned, the effect on the government's potential cost for third party claims is still based on how accurately the maximum probable loss calculation assesses launch risks. FAA officials told us that they intend to use the same maximum probable loss assessment method for manned launches as they currently do with unmanned launches.

---

#### Gap in Federal Indemnification

Officials from the insurance industry and space launch companies and an expert told us that a gap in federal indemnification is the lack of coverage of on-orbit activities—that is, activities not related to launch or reentry, such as docking with the ISS and relocating a satellite from one orbit to another orbit—but they did not agree on the need to close this gap. FAA licenses commercial launches and reentries, but does not license on-orbit activities. Federal indemnification only applies to FAA-licensed space activities. NASA's commercial manned launches to the ISS will involve on-orbit activities, including docking with the ISS, will be subject to the cross waivers of liability required by agreements with participating countries. This cross waiver is not applicable when CSLA is applicable, such as during a licensed launch or reentry, and it does not address liability for damage to non-ISS parties such as other orbiting spacecraft. Claims between NASA and the launch company are not affected by the ISS cross waiver and are historically addressed as a contractual agreement. In addition, Virgin Galactic operations will only have suborbital launches and reentries and no on-orbit activities that require

---

<sup>30</sup>Those states are Colorado, Florida, New Mexico, Texas, and Virginia.

<sup>31</sup>FAA, *FAA's Response to NASA on the Insurance Task for Commercial Crew* (Washington, D.C.: Apr. 30, 2012).

---

regulation. Therefore, according to officials from two launch companies, they did not believe that on-orbit activities need to be regulated by FAA or that federal indemnification coverage should be provided. However, one insurer noted that other proposed manned launches—such as Bigelow’s planned on-orbit “hotel”—will not be NASA related and therefore will not be covered by any regulatory regime. An expert noted that such a proposal for an on-orbit hotel remains an open question regarding regulation and liability exposure. In addition, the expert noted that federal oversight of on-orbit activities may be needed to provide consistency and coordination among agencies that have on-orbit jurisdiction. He pointed out that the Federal Communications Commission and the National Oceanic and Atmospheric Administration have jurisdiction over their satellites and NASA has jurisdiction over the ISS. Thus, according to the expert, there should be one federal agency that coordinates regulatory authority over on-orbit activities.

FAA may seek statutory authority over on-orbit activities, according to senior agency officials. They further explained that they are not seeking on-orbit authority for satellite or spectrum usage. An insurer told us that having FAA in charge from launch to landing would help ensure that there were no gaps in coverage. According to this insurer, this would help bring stability to the insurance market in the event of an accident as involved parties would be clear on which party is liable for which activities. However, having FAA license on-orbit activities would increase the potential costs to the federal government for third party claims. If FAA obtains authority to license on-orbit activities then the potential costs to the government may increase as its exposure to risk increases.

---

### Ending Indemnification Could Potentially Decrease U.S. Competitiveness

Our work to date suggests that while the actual effects on competition of eliminating CSLA indemnification are unknown, several launch companies and customers with whom we spoke said that in the absence of CSLA indemnification, increased risk and higher costs would directly affect launch companies and indirectly affect their customers and suppliers. The same participants said that two key factors—launch price and launch vehicle reliability—generally determine the competitiveness of launch companies. According to two launch customers, launch prices for similar missions can vary dramatically across countries. For example, two customers said that a similar launch might cost about \$40 million to \$60 million with a Chinese launch company, about \$80 million to \$100 million with a French launch company, and approximately \$120 million with a U.S. launch company. However, another U.S. launch company told us that it is developing a vehicle for a similar launch for which it intends to

---

charge about \$50 million. Other considerations also would be involved in selecting a launch company, according to launch customers with whom we spoke. For example, some said that export restrictions for U.S. customers could add to their costs or prevent them from using certain launch companies. One launch customer also said that it considers the costs of transporting the satellite to the launch site as well as other specific aspects of a given launch.

Launch company officials said that the lack of government indemnification would decrease their global competitiveness by increasing launch costs. Launch company officials said their costs would increase as a result of their likely purchase of greater levels of insurance to protect against the increased potential for third party losses, as the launch companies themselves would be responsible for all potential third party claims, not just those up to the maximum probable loss amount. As previously discussed, whether the private insurance market has the capacity to provide coverage at levels currently provided by the government, or at what price they might sell such coverage, is uncertain. Some launch company officials said that their costs may also increase if their suppliers decided to charge more for their products or services as a result being at greater risk from a lack of CSLA indemnification. That is, to compensate for their greater exposure to potential third party claims, some suppliers might determine that they need to charge more for their products to cover the increased risks they are now assuming. Some launch companies told us that they would likely pass additional costs on to their customers by increasing launch prices. Two launch customers told us that in turn, they would pass on additional costs to their customers. Several also told us that they might increase the amount of their own third party liability insurance, another cost they might pass on to their customers. Two said they might be more likely to choose a foreign provider if the price of U.S. launches rose.

According to launch companies and customers we spoke with, ending CSLA indemnification would also decrease the competitiveness of U.S. launch companies because launch customers would be exposed to more risk than if they used launch companies in countries with government indemnification. For example, officials from several launch companies and customers said that if some aspect of the launch payload is determined to have contributed to a launch failure, they could be exposed to claims for damages from third parties. Launch customers are currently protected from such claims through the CSLA indemnification program. Several launch customers with whom we spoke said that without CSLA

---

indemnification they might be more likely to use a launch company in a country where the government provides third party indemnification.

According to launch companies with whom we spoke, ending CSLA indemnification could also have other negative effects. For example, some said that the increased potential for significant financial loss for third party claims could cause launch companies, customers, or suppliers to reassess whether the benefits of staying in the launch business outweigh the risks. If some companies decided it was no longer worthwhile to be involved in the launch business, it could result in lost jobs and industrial capacity. Lastly, one industry participant pointed out that some suppliers, such as those that build propulsion systems, have to maintain significant amounts of manufacturing capacity whether they build one product or many. If there are fewer launches, the cost of maintaining that capacity will be spread among these fewer launches, resulting in a higher price for each launch. To the extent that the federal government is a customer that relies on private launch companies for its space launch needs, it too could face potentially higher launch costs.

The actual effects of eliminating CSLA indemnification are unknown. For example, we do not know how insurance premiums or other costs might change as well as the availability of coverage. In addition, we do not know whether or to what extent launch customers might choose foreign launch companies over U.S. companies. Furthermore, it is difficult to separate out the effects of withdrawing indemnification on the overall competitiveness of the U.S. commercial space launch industry. Many factors affect the industry's competitiveness, including other U.S. government support, such as research and development funds, government launch contracts, and use of its launch facilities, in addition to the third party indemnification.

---

## Concluding Observation

Although the number of commercial launches by U.S. companies has generally decreased over the past few years, commercial space is a dynamic industry with newly developing space vehicles and missions. With the termination of the shuttle program, NASA plans to procure cargo delivery to the ISS from private launch companies later in 2012 and intends to use private companies to carry astronauts to the ISS starting in 2017. In addition, private launch companies have been developing launch vehicles that will eventually carry passengers as part of an emerging space tourism industry. Our work to date suggests that both of these developments may increase the number and type of flights eligible for third party liability indemnification under CSLA. As the industry changes

---

and grows, continually assessing federal liability indemnification policy to ensure that it protects both launch companies and the federal government will be important. As we complete our analysis, we will more fully address any additional federal actions needed in response to these developments.

---

**Agency Comments**

We provided a draft of this statement to FAA and NASA. FAA provided no comments and NASA provided technical comments which we incorporated as appropriate.

---

Chairman Palazzo, Ranking Member Costello, and Members of the Subcommittee, this concludes our prepared statement. We would be pleased to respond to any questions that you may have at this time.

---

**GAO Contacts and Staff Acknowledgments**

If you or your staff have any questions about this testimony, please contact Alicia Puente Cackley at (202) 512-8678 or [cackleya@gao.gov](mailto:cackleya@gao.gov) or Dr. Gerald L. Dillingham at (202) 512-2834 or [dillinghamg@gao.gov](mailto:dillinghamg@gao.gov). Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this statement. GAO staff who made key contributions to this testimony are listed in appendix II.

---

## Appendix I: Scope and Methodology

---

To determine how the current U.S. commercial space launch indemnification policy compares to policies in other countries we conducted a literature review and selected four countries for comparison—China, France, India, and Russia—because they are the only countries other than the United States that have conducted commercial space launches in the last 5 years. Our source for the amounts of government indemnification provided by these countries is a 2006 Aerospace Corporation report and a 2002 Federal Aviation Administration (FAA) report.<sup>1</sup> To the extent possible, we verified information from the literature review through discussions with officials from FAA, insurance companies, launch companies, and experts. We did not find sufficiently reliable information about India to report on its government indemnification.

To determine the federal government's potential costs under the Commercial Space Launch Act Amendments of 1988 (CSLA), we reviewed CSLA, our past work on the budget treatment of insurance programs, and FAA's maximum probable loss calculation. We also interviewed FAA officials and experts in risk modeling. To determine the extent to which the insurance market is able and willing to provide third party liability insurance at levels currently provided by CSLA, we reviewed CSLA to determine the amount of coverage the act provides commercial launch companies; reviewed relevant industry reports; and interviewed officials from FAA, insurance companies, and brokerage companies. We also interviewed launch company officials to determine the additional coverage they might seek absent CSLA indemnification. To determine a range of paid claims, we reviewed data from the National Aeronautics and Space Administration (NASA) on third party claims that have been paid as the result of the Space Shuttle Columbia accident and from an insurance official on third party claims paid as a result of a U.S. Air Force launch accident. We found the data sufficiently reliable for our purposes.

To determine issues and implications of commercial manned launches for the current federal indemnification policy, including the gaps, if any, that exist in that policy and the potential financial risks those gaps pose, we interviewed officials from FAA, NASA, insurance companies, brokerage

---

<sup>1</sup>The Aerospace Corporation, *Study of the Liability Risk-Sharing Regime in the United States for Commercial Space Transportation* (El Segundo, Calif.: August 2006), and FAA, *Liability Risk-Sharing Regime for U.S. Commercial Space Transportation: Study and Analysis* (Washington, D.C.: April 2002).

## Appendix I: Scope and Methodology

companies, and launch companies, and experts. To determine what is known about the effects of ending indemnification on the competitiveness of U.S. commercial launch companies, we obtained information from FAA on launches, payloads, and revenues from 1997 through 2011. As the information was used for background, we did not assess the reliability of the data. We also conducted interviews with officials from launch companies, launch customers, and industry associations, and experts.

We selected launch companies, insurance companies, brokerage companies, and launch customers for interviews that had conducted or participated in commercial launches in the past 5 years. In addition, we selected launch companies that are competing to conduct commercial launches as part of NASA's Commercial Crew Development program or plan to conduct launches for space tourism. We also selected launch customers to include U.S. companies and foreign companies and those that had used both U.S. and foreign launch companies. We selected experts to interview to provide a variety of expertise, including space liability, risk modeling, and space law issues. Table 1 lists the organizations and agencies whose officials we interviewed as well as the experts we interviewed.

**Table 1: Organizations and Agencies Interviewed**

Category	Organization or agency
Brokerage company	AON
	Marsh USA
	Willis Inspace
Insurance company <sup>a</sup>	Chartis Europe Limited
	Global Aerospace
	Starr Aviation
	XL Insurance
Launch company	The Boeing Company
	Orbital Sciences Corporation
	Sierra Nevada Corporation Space Systems
	Space Exploration Technologies Corp (SpaceX)
Launch customer <sup>a</sup>	Digital Globe
	GeoEye
Risk modeling company	AIR Worldwide
	Risk Management Solutions
Industry association	The American Academy of Actuaries
	Aerospace Industries Association <sup>b</sup>
	Satellite Industry Association

---

 Appendix I: Scope and Methodology
 

---

Category	Organization or agency
Federal agency	FAA NASA
Expert	Henry R. Hertzfeld, Research Professor, Elliott School of International Affairs, Space Policy Institute and Adjunct Professor of Law, The George Washington University Howard Kunreuther, James G. Dinan Professor of Decision Sciences & Public Policy, Co-Director Risk Management and Decision Processes Center, Wharton School, University of Pennsylvania Rosanna Sattler, Partner, Posternak, Blankstein, and Lund LLP

Source: GAO.

\*An additional insurance company and launch customer were interviewed but did not wish to be identified.

\*The Aerospace Industries Association convened a panel that included the launch companies Lockheed Martin and Virgin Galactic and the launch supplier ATK.

We conducted this performance audit from November 2011 to June 2012 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

---

## Appendix II: GAO Contacts and Staff Acknowledgments

---

### GAO Contacts

Alicia Puente Cackley, (202) 512-8678 or [cackleya@gao.gov](mailto:cackleya@gao.gov)

Dr. Gerald L. Dillingham, (202) 512-2834 or [dillinghamg@gao.gov](mailto:dillinghamg@gao.gov)

---

### Staff Acknowledgments

In addition to the contacts named above, individuals making key contributions to this testimony include Teresa Spisak and Patrick Ward (Assistant Directors), Maureen Luna-Long, James Geibel, Carol Henn, David Hooper, Shelby Oakley, Susan Offutt, Amy Rosewarne, Steve Ruszczyk, Melvin Thomas, and Frank Todisco.

This is a work of the U.S. government and is not subject to copyright protection in the United States. The published product may be reproduced and distributed in its entirety without further permission from GAO. However, because this work may contain copyrighted images or other material, permission from the copyright holder may be necessary if you wish to reproduce this material separately.

<b>GAO's Mission</b>	The Government Accountability Office, the audit, evaluation, and investigative arm of Congress, exists to support Congress in meeting its constitutional responsibilities and to help improve the performance and accountability of the federal government for the American people. GAO examines the use of public funds; evaluates federal programs and policies; and provides analyses, recommendations, and other assistance to help Congress make informed oversight, policy, and funding decisions. GAO's commitment to good government is reflected in its core values of accountability, integrity, and reliability.
<b>Obtaining Copies of GAO Reports and Testimony</b>	The fastest and easiest way to obtain copies of GAO documents at no cost is through GAO's website ( <a href="http://www.gao.gov">www.gao.gov</a> ). Each weekday afternoon, GAO posts on its website newly released reports, testimony, and correspondence. To have GAO e-mail you a list of newly posted products, go to <a href="http://www.gao.gov">www.gao.gov</a> and select "E-mail Updates."
<b>Order by Phone</b>	The price of each GAO publication reflects GAO's actual cost of production and distribution and depends on the number of pages in the publication and whether the publication is printed in color or black and white. Pricing and ordering information is posted on GAO's website, <a href="http://www.gao.gov/ordering.htm">http://www.gao.gov/ordering.htm</a> .  Place orders by calling (202) 512-6000, toll free (866) 801-7077, or TDD (202) 512-2537.  Orders may be paid for using American Express, Discover Card, MasterCard, Visa, check, or money order. Call for additional information.
<b>Connect with GAO</b>	Connect with GAO on Facebook, Flickr, Twitter, and YouTube. Subscribe to our RSS Feeds or E-mail Updates. Listen to our Podcasts. Visit GAO on the web at <a href="http://www.gao.gov">www.gao.gov</a> .
<b>To Report Fraud, Waste, and Abuse in Federal Programs</b>	Contact: Website: <a href="http://www.gao.gov/fraudnet/fraudnet.htm">www.gao.gov/fraudnet/fraudnet.htm</a> E-mail: <a href="mailto:fraudnet@gao.gov">fraudnet@gao.gov</a> Automated answering system: (800) 424-5454 or (202) 512-7470
<b>Congressional Relations</b>	Katherine Siggerud, Managing Director, <a href="mailto:siggerudk@gao.gov">siggerudk@gao.gov</a> , (202) 512-4400, U.S. Government Accountability Office, 441 G Street NW, Room 7125, Washington, DC 20548
<b>Public Affairs</b>	Chuck Young, Managing Director, <a href="mailto:youngc1@gao.gov">youngc1@gao.gov</a> , (202) 512-4800 U.S. Government Accountability Office, 441 G Street NW, Room 7149 Washington, DC 20548



Please Print on Recycled Paper.

Chairman PALAZZO. I now recognize Mr. Frank Slazer for five minutes to present his testimony.

**STATEMENT OF MR. FRANK SLAZER,  
VICE PRESIDENT, SPACE SYSTEMS,  
AEROSPACE INDUSTRIES ASSOCIATION**

Mr. SLAZER. Thank you, Mr. Chairman. I am here on behalf of the Aerospace Industries Association, an organization of approximately 350 companies. The 350 companies represent about 90 percent of the U.S. aerospace business in this country, creating about 3.5 million jobs nationwide. I appreciate this opportunity to testify in support of the FAA's Launch Indemnification Program.

AIA wishes to stress to the Committee the importance of reauthorizing the Commercial Space Launch Act first mitigation provisions, substantially extending or eliminating the Sunset Provisions of the act, and removing the upper indemnification cap for space launch activities.

U.S. space launch capabilities are essential to our Nation's security and its ability to lead in space exploration. To sustain this capability a healthy launch industrial base is needed and to mitigate cyclical impacts. This would ideally include military, civil, government, as well as commercial businesses as customers.

As Chart A shows, the U.S. once had a very robust commercial launch industry position. This is a chart that shows the GEO-synchronous launches that were previously made by the United States from 1990, to 2001. That bluish part of the bar towards the bottom represents the number of U.S. launches. There were comparable numbers of non-GEO-stationary launches for systems such as Iridium and Globalstar at that time.

Unfortunately, as shown in Chart B, our launch industrial base has lost commercial market share and is struggling to adapt to declining demand by government, especially since the end of the Space Shuttle Program. International launch services providers have been aggressively winning commercial opportunities, often with the help of their governments and through financial assistance or low-cost financing.

The sad reality is that U.S. launch services now have a negligible share of the world commercial market, and as you noted, Mr. Chairman, in 2011, there were no commercial orbital launches from a U.S. spaceport.

Despite the dismal record trend for American launchers, new investments by U.S. industry, including several AIA member companies, are enabling the emergence of new domestic space launch systems. The willingness of our private sector to commit resources to develop new U.S. launch capabilities is a uniquely American development that should be supported. No other nation in the world has a similar effort underway. These new systems have the potential to increase the U.S. share of the commercial launch market, open up new markets, and create jobs.

Chart number C shows a conservative estimate, again, by the FAA, through their Commercial Space Transportation Advisory Committee, of the potential future market, and this is not blue sky, wild-eyed opportunities. These are fairly baseline capabilities al-

ready in place, not really even counting the potential new markets enabled by these new systems.

Companies, our companies are making their investment decisions within the current launch policy business framework, and, again, strong international competition. Mr. Chairman, the U.S. space launch industry is not seeking subsidies, but it does require a stable and predictable business environment, one that will be enabled by maintaining the existing launch risk mitigation framework. It is worth noting that foreign launch competitors already benefit from more general indemnification rules and other advantages.

FAA's Launch Indemnification Program has been in place for over 20 years, providing critical risk management and supporting the emergence of this new domestic commercial launch market, benefiting our broader space industry, technology leadership, and ultimately our Nation's security without costing U.S. taxpayers a dime.

Our industry needs the more level playing field provided by the FAA's program. For the U.S. to take a purely laissez-faire approach to commercial launch business when competing against Russian, European, and other nations, who operate under more favorable risk-management frameworks, would amount to unilateral disarmament, and we are already at a pricing disadvantage. Even if U.S. firms could insure for the initial risk commercially, it would add costs that their competitors do not have to bear, making U.S. commercial launch sales even more difficult. Given that our current risk approach has been in place for so long, it is not clear if sufficient additional underwriting capability is available in the space insurance market.

In the end, adding new uncertainty will harm U.S. industry without saving the government any money. In fact, the CBO has previously estimated the FAA's indemnification authority has had no budgetary impact on the government. A rationale for continued indemnification support is not narrowly focused on its benefits just for industry.

It also provides benefits for the Federal Government and America. In recent years the U.S. government launch costs have increased substantially, partly due to the shift of commercial satellite launches to foreign systems, adversely impacting domestic space industrial base. The success of new-launch ventures will help the Federal Government since they have the potential to reverse this trend. Without a renewal of the regime, our Nation's space industrial base may forego business that could help spread the fixed cost of space launch capabilities between government and commercial customers. Again, savings that could be passed onto taxpayers.

CSLA enables U.S. launch providers like their foreign competitors to operate without betting the company with every single launch. This launch indemnification backstop has been renewed four times since 1988, creating a reasonable expectation it will be renewed again in the future, without entirely eliminating the business uncertainty. Given the long lead times for space launch, the development and the need for stable policies to promote investment and maximize our industry's competitiveness, Congress should eliminate the Sunset Provisions of the act or at least extend them for a much longer time than prior renewals.

To be consistent with our international competitors, AIA recommends Congress remove the indemnification caps beyond tier one for space launch activities.

In conclusion, AIA sees continuing FAA's Launch Indemnification as a very low-risk way to support our Nation's vital space launch industrial base with substantial upside potential to enable new markets, create jobs, and ensure U.S. space leadership. American industry is investing capital and innovative ideas to create this new future. It would be a shame if these efforts were to flounder due to a lack of even a partially leveled playing field with foreign competitors.

Thank you, and I look forward to your questions.  
[The prepared statement of Mr. Slazer follows:]



*Ensuring American Space Launch Competitiveness*

**Mr. Frank Slazer**

**Vice President, Space Systems Division**

**Aerospace Industries Association**

**Subcommittee on Space and Aeronautics  
House Committee on Science, Space and Technology**

**June 6, 2012**

***Aerospace Industries Association***  
1000 Wilson Boulevard, Suite 1700  
Arlington, VA 22209  
(703) 358-1000

## Ensuring American Space Launch Competitiveness

Chairman Palazzo, Ranking Member Costello and distinguished members of the subcommittee, my name is Frank Slazer and I am the Vice President for Space Systems at the Aerospace Industries Association. I appreciate the opportunity to testify before the subcommittee on the Federal Aviation Administration's (FAA) Launch Indemnification Program.

AIA wishes to address this Committee to stress the importance to renew the Commercial Space Launch Act risk management provision, to eliminate the sunset provision of the Act, and remove its indemnification cap for space launch activities

The Aerospace Industries Association (AIA) represents over 350 aerospace manufacturing companies and their highly-skilled employees. These companies make the spacecraft, launch vehicles, sensors, and ground support systems employed by NASA, NOAA, the Department of Defense, the National Reconnaissance Office (NRO), other civil, military and intelligence space organizations throughout the globe, and many of the commercial communication satellites. This industry sustains nearly 3.5 million jobs, including much of the high-technology work that keeps this nation on the cutting edge of science and innovation. The US aerospace manufacturing industry remains the single largest contributor to the nation's balance of trade, exporting \$89.6 billion and importing \$47.5 billion in relevant products, for a net surplus of \$42.1 billion.

US space launch capabilities are essential to our nation's security and its ability to lead in space exploration. To sustain this capability, a healthy US space launch industrial base is needed; as with aviation, to mitigate cyclical impacts, this industrial base would ideally serve military, civil government and commercial customers. Unfortunately, in recent years, our nation's space launch industrial base has been struggling to adapt to reduced demand by government - especially due to the end of the Space Shuttle program - and downward pressures on DOD, NASA and NOAA budgets that threaten to exacerbate the risk to the industrial base. Furthermore, international launch providers have been aggressively bidding and winning commercial opportunities, often with the help of their governments in the form of either financial assistance or low cost financing. The sad reality is that the US launch services industry has had a minimal share of the commercial worldwide market for launches; indeed, in 2011, there were NO commercial orbital launches from a US space port.

Nonetheless, recent private sector investments by US industry - including AIA member companies ATK, Aerojet, Boeing, Lockheed Martin, Northrop Grumman, Sierra Nevada, Space X and Virgin Galactic as well as others - and supportive policies by government agencies are enabling the emergence of new domestic space launch capabilities. These new systems have the potential to increase the US share of the commercial launch market while also opening up exciting new markets. These companies have made their investments

within the existing domestic launch business climate and domestic policy framework, but they face a challenging international competitive environment.

Many foreign launch providers competing against US companies already benefit from generous indemnification rules. For example, the European company Arianespace is required to purchase insurance up to just 60 million Euros (roughly \$75 million). Any damages above this cap are the guaranteed responsibility of the French government.<sup>1</sup>

Mr. Chairman, the US space launch industry is not seeking any subsidy. Instead, the US commercial space launch industry requires a stable and predictable business environment enabled by maintaining the existing launch risk mitigation framework for the foreseeable future. FAA's launch indemnification program has been in place for over twenty years – providing critical risk management enabling the emergence of a US commercial launch market, benefiting the broader US space industry, US technological leadership, and ultimately, the US consumer through the launch of US communications satellites - without ever costing US taxpayers a dime.

Under the existing program, the risk exposure of the federal government is managed; FAA controls the level of company insurance required by establishing the Maximum Probable Loss coverage required for each license and Congress ultimately controls the government's assessment of loss legitimacy since a specific Appropriation is required to pay any claims. Moreover, given that the current US risk approach has been in place for so long, it is not clear how much additional underwriting capability is available in the space insurance market; adding new uncertainty will harm US industry.

For the United States to adopt a purely laissez-faire approach to the US commercial launch business, which competes in an international launch market where its Chinese, Japanese, European, and Indian competitors all operate under comparable risk management frameworks would amount to unilateral disarmament: Even if commercial companies could insure for the additional risk exposure commercially, it would add costs their competitors do not include, thus making commercial US launch sales more difficult.

But our rationale for continuing indemnification support is not narrowly focused on its benefits for industry – it also provides benefits for the US Government. When US launch rates were relatively high, the costs for all users – including the US government – were more affordable as the fixed costs of launch infrastructure and investments were spread out over a wider base of customers.

To better understand the importance of providing space launch risk mitigation legislation, understanding the history of US commercial space launch is essential. Two decades ago, American space launch capabilities were a major player in the market - with a high percentage of worldwide commercial launches leaving from our spaceports.

---

<sup>1</sup> Study of the Liability Risk-Sharing Regime in the United States for Commercial Space Transportation by J. A. VEDDA, Center for Space Policy and Strategy, National Space Systems Engineering, The Aerospace Corporation. 1 August 2006, Page 58.

Figure 1 shows how large the US share of commercial space launch was from 1990 – to 2001. The benefits to the US economy were also significant; in 1999, according to a study by the FAA’s Office of Commercial Space Transportation, commercial space transportation and enabling industries were responsible for \$3.5B in economic activity and over 28,000 jobs – by 2009, those numbers had shrunk to \$827M and just under 4,000 jobs.

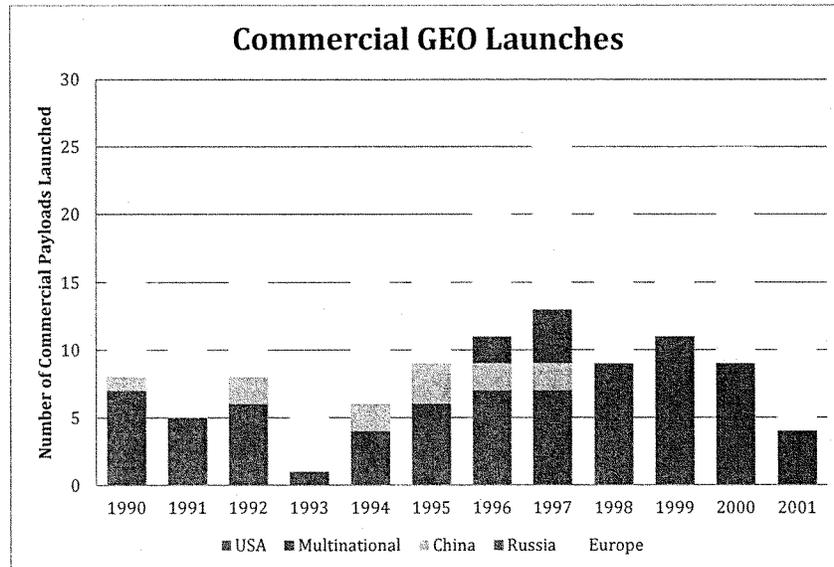


FIGURE 1 – Commercial GEO Payloads Launched by Country from 1990- 2001.  
Source of data: FAA Office of Commercial Space Transportation.

The US launch market share began a precipitous decline (see FIGURE 2) as a result of the collapse of the Soviet Union – which brought large numbers of Soviet developed Russian and Ukrainian launch capabilities into the market with a cost structure far below US prices. Additionally, in this same timeframe, there was the advent of the more capable Ariane 5 launch vehicle, developed by the European Space Agency.



investments by NASA and DOD, these new systems should soon enable our nation to regain its space launch leadership while creating new markets and thousands of new US jobs.

Figure 3 shows the projections by the FAA COMSTAC (Commercial Space Transportation Advisory Committee) of the potential for 300 commercial space payloads that will require 128 commercial launches through 2021. It should be stressed that this market forecast is a conservative estimate based only on existing markets; future markets for suborbital or orbital launch systems are not included but could potentially greatly increase the number of missions. These space launch investments have also been made in a business environment where, for over two decades, the US government has understood the need for a statutory risk management framework, enabling industry to pro-actively manage the potential liability in the event of a catastrophic accident. This space launch indemnification program is modeled after similar liability provisions for other industries that the government has sought to nurture, including nuclear power (e.g. the Price-Anderson Act) and homeland security related safety technology.

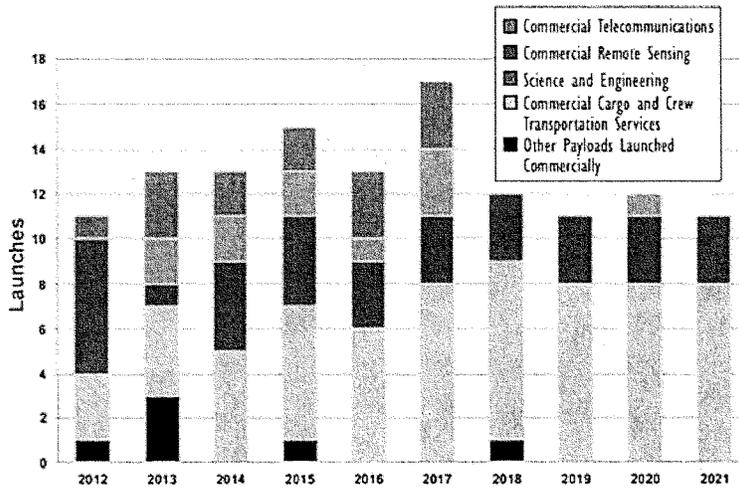


FIGURE 3 - Commercial Space Launch Market Forecast 2012-2021  
 Source of graph: 2012 Commercial Space Transportation Forecasts, FAA Commercial Space Transportation and the Commercial Space Transportation Advisory Committee

### Mitigating Space Launch Risks

The current FAA approach to risk management has three tiers with substantial industry responsibility:

- Tier 1:** The FAA calculates the maximum probable loss (MPL) that could result from the licensed launch – that is the damage that could result to uninvolved third parties from the most likely worst case scenario. The launch provider, as the licensee, is required to purchase private insurance for the MPL covering all parties involved with the launch, including the US government. The MPL is capped at \$500 million, though rarely is that full amount required by the FAA’s calculations.
- Tier 2:** Subject to Congressional appropriations following a Presidential request, the US government is authorized to pay up to a \$2.7 billion cap for third-party claims that exceed the insurance coverage and therefore the FAA calculated maximum probable loss. It should be noted that payments of claims are not automatic and no funds are committed to this regime. Congress can approve such payment and appropriate funding to implement it only if and when a claim is made. To date, no loss has ever occurred that would have triggered this regime, and Congress has never been asked to appropriate funding for the CSLA.
- Tier 3:** Any third-party claims above the Tier 2 cap are the responsibility of the licensee or the liable party.

The CSLA’s risk management regime assures adequate liability coverage in case of catastrophic launch-related events, minimizes government risk exposure, avoids any need for annual outlays while also supporting the US space and national security industrial base. It also strengthens US international competitiveness in a global space launch market characterized by foreign providers offering government indemnification as a standard and discriminating feature of their services.

By maintaining continuity in the business environment, CSLA supports existing launch service providers and encourages new US entrants into the launch business, ultimately enabling the development of new commercial innovative space markets - both for suborbital and orbital vehicles. In the end then, CSLA helps to keep vital space launch jobs in the United States.

Based on the 2004 Congressionally-mandated FAA Study of the Liability Risk-Sharing Regime in the United States for Commercial Space Transportation conducted by The Aerospace Corporation, the FAA Commercial Space Transportation Advisory Committee (better known as COMSTAC) has strongly endorsed and recommended to the Secretary of Transportation continuation of the commercial space launch risk management regime in the CSLA. The Congressional Budget Office (CBO) has also previously estimated that extending the agency’s indemnification authority would have no significant budgetary

effect for 5 years following its proposed extension in 1999. The current risk management regime is exactly the same regime assessed by the CBO in 1999.<sup>2</sup>

#### **Risks of Non-Renewal**

The CSLA regime enables US launch providers, like their foreign competitors, to operate without “betting the company” with every single launch. In a competitive market with narrow returns, the loss of the risk management regime would cause US companies to reconsider the risks and benefits of staying in the commercial launch business, suspend activity, and even exit the market.

Failure to renew CSLA would unnecessarily hamstring US companies' ability to compete in the international launch services market. Without the risk management regime, US launch providers appear riskier and more costly to prospective launch customers in a market with numerous foreign launch providers whose governments indemnify launches. As if harming US commercial market competitiveness would not be bad enough, the US civil and national security space communities could also experience increased launch costs for essential government payloads for communications, weather observation, remote sensing, GPS, and other satellite systems that are an integral part of our nation's infrastructure and economy. Without a renewal of the regime, our nation's space industrial base could be foregoing business that would share the fixed cost of space launch from government programs with the commercial market – savings that could be passed on to the taxpayer.

Non-renewal of the risk management regime could also mean an outright exit from the commercial launch market by US providers, making it much harder to sustain high technology space launch jobs in the United States. We cannot afford to drive away highly skilled technical jobs to foreign countries, where the regulatory frameworks provide better critical risk management tools. Lastly, a non-renewal could impede new US entrants to the commercial launch market, discourage future space launch innovation and entrepreneurial investment. Without a level playing field for competition, new US entrants could find it highly undesirable to begin their business ventures in the United States, reversing recent trends.

#### **Updating Space Launch Risk Management for the 21st Century**

FAA's space launch indemnification approach began in 1988 when the Congress enacted amendments to the Commercial Space Launch Act (CSLA) of 1984, establishing a regulatory regime for FAA-licensed commercial space launches that included a risk management regime for third-party losses resulting from launch-related activities. Today, this risk management regime factors into all US commercial space launch business decisions and

<sup>2</sup> The CBO's assessment of H.R. 2607, The Commercial Space Transportation Competitiveness Act of 1999 stated that “Based on information from DOT, we estimate that extending the agency's indemnification authority would have no significant budgetary effect over the next five years. DOT has never had to pay claims to third parties for incidents involving commercial space vehicles or services. Thus far, the costs associated with incidents have been small and have been covered by private insurance.” H.R. 2607 became Public Law No: 106-405 in 2000, extending the risk management regime to 2004, which was extended again in 2009.

provides a more level playing field for US competitors. The FAA's launch risk indemnification backstop has been renewed 5 times since 1988 – creating the reasonable expectation that it will be renewed in the future without completely eliminating the business uncertainty. But developing space launch systems is a long term effort – not uncommonly five years or more - and launch contracts are typically signed at least two years prior to launch. AIA believes the sunset provision of this law should be eliminated thereby increasing business confidence and promoting additional new investment.

FAA's three tier approach has never been utilized; losses to date have been relatively minor and have never exceeded the commercially-insured Maximum Probable Loss threshold let alone the cap on the federal tier 2 limit. Given that any Tier 2 payout would require a specific Appropriation anyway, AIA recommends that the Tier 2 cap should be dropped and that Tier 3 should be eliminated entirely.

In conclusion, the Aerospace Industries Association sees the continuation of US space launch indemnification as an exceedingly low risk means to support to our nation's vital space launch industrial base that provides substantial upside potential to enable new markets, create new jobs, and assure US space technology leadership for the 21st century. US industry is investing capital and innovative ideas to support this new future and US government agencies and the Congress have also taken important steps that have helped foster these new initiatives. It would be a shame if these nascent capabilities were to be limited in its potential or even founder due to the lack of a level playing field with foreign competitors.

In order to allow US companies to compete on a more level playing field for hundreds of new payload opportunities and creating thousands of new jobs:

- AIA recommends the Congress renew the Commercial Space Launch Act risk management provision (Section 70113(f) of title 49 of Public Law 111-125) well in advance of its expiration on December 31, 2012.
- Given the long lead times for space launch development and operations, the need for stable policies to promote investment and to maximize our industry's ability to be competitive, Congress should eliminate the sunset provision of the Act or at least extend them for a much longer time than in the prior renewals.
- To be consistent with our international competitors, AIA recommends the Congress remove the indemnification caps beyond tier 1 for space launch activities.

I thank you for this opportunity to testify on behalf of the US space industry and I welcome the opportunity to answer any questions that you may have.

Chairman PALAZZO. I now recognize our final witness, Ms. Alison Alfery, for five minutes to present her testimony.

**STATEMENT OF MS. ALISON ALFERS,  
VICE PRESIDENT, DEFENSE AND INTELLIGENCE,  
DIGITALGLOBE INC.**

Ms. ALFERS. Thank you, Chairman. Chairman Palazzo and Ranking Member Costello and Members of the Subcommittee, thank you for this opportunity to testify before the Committee on the issue of extension of the Federal Aviation Administration's Launch Indemnification Program. As noted in the introductory remarks, I currently serve as Vice President of the Defense and Intelligence Business Unit for DigitalGlobe Inc.

DigitalGlobe is a leading global provider of high-resolution satellite imagery and related products and services. We operate a constellation of high-resolution, electro-optical imaging satellites, and our business is highly dependent on the availability of reliable and cost-effective launch services. Our detailed written statement is on file with the Committee, and so I would like to use the time provided here to highlight certain points that as a consumer of launch services we view as significant.

First, the reduced demand for launch services by the U.S. government and the corresponding increase in launch prices and reduction in launch vehicle options has, in our view, resulted in the U.S. launch services industry losing the global leadership position it once had. We see this as detrimental to U.S. national security interests and as certainly detrimental to the health of the broader U.S. industrial base.

With regard to our specific business, the increase in launch costs has necessarily required us to seriously consider foreign launch providers. For our WorldView-3 launch scheduled for launch in mid-2014, we went so far as to get necessary export approvals in place to allow us to select the foreign provider that bid for the launch. The single driving factor for considering a foreign launch at all was cost. In our experience, foreign launches are now on average 40 percent less than the current prices for U.S. launches.

We ultimately selected a U.S. provider for WorldView-3 because we did not feel that foreign provider's success record was well-enough developed, but this is rapidly changing with each successful launch by a foreign provider.

With regard to the specific issue before the Committee, the extension of the Launch Indemnification Program, as a consumer of commercial launch services, we believe extension of the program is critical to encourage U.S. providers, current providers to stay in the market and to incentivize new providers to enter the market. In our view, the Indemnification Program provides a degree of certainty around risk management for launch providers. That is essential if U.S. launch capabilities are to remain or some may say return to a position of global leadership.

Without the indemnification program launch, providers are operating in an environment of totally uncapped risk, which we believe will absolutely be reflected in prices that are passed onto launch consumers like DigitalGlobe. The U.S. launch services industry is

already, in our view, not competitive with foreign providers on price, and it is rapidly losing its edge on technological superiority.

As noted in our written statement, we believe we are at a tipping point, in that any changes in the Indemnification Program that may lead to higher launch prices will result in foreign providers being the first choice for consumers for DigitalGlobe because the cost differential would be so significant and the technological differences will be so minimal. We see this as a very negative development, both from a national security standpoint and from our position as a U.S. company that consumes commercial launch services. We would much prefer to use a U.S. provider, but it is rapidly becoming an impractical option due to price and related considerations.

That said, we are very encouraged by increasing private sector investments in U.S. launch capabilities. We believe that the private investment has potential to reverse the current downward trend and to once again return the U.S. to unquestioned superiority in launch capabilities.

To succeed, however, will require that these companies have the ability to manage risks with some degree of certainty, and that is the very important role that is played by the Indemnification Program. It provides a vital degree of certainty that allows providers to manage risks, and that is reflected in prices.

In the time remaining, I would like to also encourage the Subcommittee and Congress to consider elimination of the current three-year Sunset Provision or, at a minimum, to consider significant extension. We typically contract for launches three to four years ahead of the scheduled launch, and we believe that continued uncertainty around the status of the Indemnification Program will eventually translate into higher costs as providers hedge against potential shifts in the Indemnification Program.

So, in summary, as a consumer of commercial launch services, we encourage Congress to, at a minimum, extend the current program to continue to incentivize investment, private investment in launch services industry and to consider significant extension or, ideally, elimination of the current Sunset Provision.

Thank you, and I would be glad to answer any questions.

[The prepared statement of Ms. Alfors follows:]



**SIGNIFICANCE OF STRONG U.S LAUNCH INDUSTRY TO COMPETITIVENESS OF  
U.S SPACE BASED INDUSTRIES**

**MS. J. ALISON ALFERS**

**VICE PRESIDENT, DEFENSE AND INTELLIGENCE**

**DIGITALGLOBE, INC**

**SUBCOMMITTEE ON SPACE AND AERONAUTICS**

**HOUSE COMMITTEE ON SCIENCE, SPACE AND TECHNOLOGY**

**JUNE 6, 2012**

DigitalGlobe, Inc.  
1601 Dry Creek Drive, Suite 260  
Longmont, Colorado 80503

Chairman Palazzo, Ranking Member Costello and distinguished members of the subcommittee, my name is Alison Alfors and I am the Vice President, Defense and Intelligence for DigitalGlobe, Inc. I also previously served for five years as the company's General Counsel. On behalf of DigitalGlobe, I would like to thank you for the opportunity to testify before the subcommittee on the issue of extension of the Federal Aviation Administration's (FAA) Launch Indemnification Program.

***About DigitalGlobe***

DigitalGlobe is a leading commercial provider of high resolution satellite imagery and related products and services. We are a publicly traded U.S. company, incorporated in Delaware and headquartered in Longmont, Colorado, with offices in Washington, D.C., London and Singapore. We employ over 700 people and in 2011 our total revenue was approximately \$340 million.

We own and operate the largest constellation of commercial high resolution satellites, with three satellites (QuickBird, WorldView-1 and WorldView-2) on orbit and our fourth satellite, WorldView-3, scheduled for launch in mid-2014. Our largest customer is the U.S. Government and specifically the National Geospatial-Intelligence Agency (NGA). Our customers also include numerous foreign government entities as well as commercial companies such as Google, Microsoft and Nokia.

Our business depends on our ability to cost effectively build, launch and operate our constellation of high resolution imaging satellites.

***Developments in Launch Services Industry and Implications for Space Based Businesses***

The clear trend over the last several years has been a continuing reduction in demand for launch services by the US Government. This reduced demand for launch services has resulted in significant increases in launch costs as the US launch providers have been forced to spread the high fixed costs associated with launch services across fewer consumers, and available launch vehicle options (e.g. Delta II) have been reduced.

As a commercial consumer of launch services it is our view that US providers are not competitive on price and that their long held advantage over foreign providers with regard to payload safety and delivery (e.g. number of successful on-time launches) is fading rapidly. We concur with the sentiment expressed in the written statement submitted by the members of the Aerospace Industries Association that this loss of global leadership in the launch services market is detrimental US national security interests and the US companies that form the aerospace industrial base.

As a US company whose largest customer is the US Government, our overwhelming preference is to launch with US providers. Foreign launches, especially for our type of payload, come with significant complexities including export control requirements, payload transport, and uncertain insurance costs. That said, as a commercial company we have an obligation to our shareholders to maximize the return we generate from the investments we make. Procuring launch services is an investment we make and the costs we incur must either be flowed down to our customers through our price structure or absorbed by us through reduced margin. To the extent we are forced to raise our prices in the market or take margins down to unprofitable levels, we lose our ability to compete in the global market. We note that our business, like the launch services business, is

facing significantly increased foreign competition from largely government subsidized entities (e.g. the recently launched Pleiades satellite).

Unfortunately, the current status of reduced competitiveness of the US launch providers combined with the increased availability and reliability of foreign providers mandates that in the best interest of our business and our shareholders we seriously consider foreign providers for future launch requirements. As a point of example, while we ultimately elected to contract with a US provider for an Atlas-5 launch for WorldView-3, the cost is more than twice what we paid for the launch of WorldView-1 (2007) and WorldView-2 (2009) and borders on being prohibitive. The cost to launch WorldView-3 is also approximately 35-40% more than the bid we received from a comparable foreign provider. For WorldView-3 we ultimately selected Atlas-5 due to its stellar performance record and the still developing performance record of the foreign provider, but we expect that if the performance records of the foreign providers are well established over the next couple of years that cost considerations will necessarily become the primary factor in future selections.

As a commercial company, we are encouraged by recent private sector investments in domestic launch capabilities, including the entry of Space-X into the market. Through private investment, we believe that the US space launch industry has the potential to reverse the current downward trend and to reestablish its global leadership in launch services, but this cannot be achieved without support from the US Government in the form of the risk mitigation backstop that comes from the FAA Launch Indemnification Program. Specifically, the risk of third party claims from damage associated with space launch activities is a risk that we, as a consumer of launch services, would require the launch provider to protect us against. If the indemnification program did not exist, the launch provider would be in a position of having to insure the additional risk, either through third party insurance or self insure. We expect the costs would be significant, especially for new companies trying to compete in the launch services market but who do not yet have the established track record or balance sheet of the larger companies. These increased costs would either need to be passed on to us, the consumer, or absorbed by the provider. If passed on to us, we expect the total launch cost would be so prohibitively high that we would be forced to use a foreign provider absent problematic safety records or related considerations. If absorbed by the provider, we believe the effect on margin would likely impair profitability of the provider to the point where existing providers would be incented to exit the market and potential new providers would be deterred from entry. The end result of both scenarios is a vanishing US launch services industry which, as noted above, we view as very detrimental to US national security interests and the broader US industrial base.

#### *Subcommittee Questions*

As part of our written statement, we were also asked to address four specific questions. Our responses are set forth below.

#### **1. Do you consider a government-sponsored launch indemnification program as essential to maintaining a domestic commercial launch capability, and if so, why?**

Yes. As a consumer of commercial launch services, we believe the government sponsored launch indemnification program is essential to maintaining a domestic launch capability. In our view, the risk mitigation benefit provided by the program allows the launch providers to at least partially fix their exposure for damages associated with providing launch services and this translates directly into price competitiveness as well as the overall cost-benefit assessment that all providers do when deciding whether to enter or stay in the market.

Chairman PALAZZO. I thank the panel for their testimony. Reminding Members that Committee rules limit questioning to five minutes.

The Chair will at this point open the round of questions. The Chair recognizes himself for five minutes.

Dr. Nield, in your written testimony, you state that foreign launch providers are made competitive through government subsidies and preferential foreign national laws. How will extending the U.S. liability risk-sharing regime make domestic launch providers more competitive or level the playing field in the face of overt foreign subsidies to their launch providers?

Mr. NIELD. Mr. Chairman, as was mentioned by several of the other witnesses, there are a number of factors that go into the selection of a launch provider for a particular mission. One important factor is cost. The indemnification regime provides a piece of the cost because the provider must purchase insurance or otherwise look at the risks that it is facing financially in terms of its investments and its willingness to be in the market.

We believe that the indemnification regime at least levels the playing field with foreign providers. As the GAO has mentioned, in general, the foreign providers have more favorable indemnification systems under most circumstances.

Chairman PALAZZO. You recommended a five-year extension of the U.S. liability risk-sharing regime. How did you calculate that timeline and, for example, do you think the U.S. launch industry will sufficiently mature in five years to eliminate or phase out the regime, and is there a rationale for extending it indefinitely?

Mr. NIELD. That is an excellent question. I think there are two factors in play here. One perspective that we have heard is industry very much likes certainty in terms of its planning for investment, future operations, and hiring. So, from the industry's perspective, it would be ideal to know in advance what the indemnification regime is. This seems to support an argument for making the regime permanent.

On the other hand, we certainly understand Congress's interest and desire to be able to periodically examine the program and see what works and whether any particular changes are necessary. As we mentioned, Congress has approved an extension for just a few years at a time a number of times in the past.

As a result, the Administration believes that extending indemnification for five years would be a reasonable compromise. This would allow at least some near-term certainty for industry in terms of its planning and allow Congress to take another look when things have matured. After five years, we should see a lot more activity in terms of the sub-orbital market that is starting to develop. That may offer the Congress an opportunity to see if any additional changes are required.

Chairman PALAZZO. Ms. Cackley, under the current risk-sharing regime, FAA sets a maximum probable loss value which also serves as a threshold for the second tier, which is the liability assumed by the Federal Government. The first tier of coverage is capped and fixed at \$500 million, but the second tier the government's assumed risk is adjusted for inflation, which began at \$1.5 billion in 1989, and today is almost double that number.

Is it prudent that the government should continue to assume greater and greater exposure under this shared-risk regime while the first tier private insurance remains fixed, and shouldn't the first tier cap be adjusted for inflation as well?

Ms. CACKLEY. We looked at what industry could provide in terms of first-tier coverage and what we have been told through talking to insurance brokers and insurance providers is that that first, where the first tier cap is right now is the maximum of what industry is capable of providing, is willing to provide. So using an inflation adjustment would take the first-tier cap beyond what we have been told industry is willing to go. Now, that is where things stand right now. The question is in the future, how quickly industry's capacity might increase enough to allow that to increase as well. We didn't look at that directly, and so I don't have an estimate of how soon that cap would be able to be increased.

Chairman PALAZZO. Thank you. I now recognize Mr. Costello.

Mr. COSTELLO. Thank you, Mr. Chairman.

Dr. NIELD and the other witnesses, I suspect I know the answer to this question, but I want to get it on the record. Given that there are other high-risk, hazardous industries such as the nuclear power industry, that do not have similar shared risks, why is it necessary for the Federal Government to continue this structure for the commercial space launch industry?

Dr. NIELD. As you know, Congress originally structured this system based upon the nuclear power system.

Mr. COSTELLO. Right.

Dr. NIELD. There were a number of examples that could be drawn on to form this system. It appears that the current system represents a reasonable sharing of risks between all key stakeholders with the important point being that the most probable losses are covered by the operators themselves, and the less probable ones could potentially be covered by Congressional appropriation. It seems to be a reasonable approach.

Even though there have been space launches for 50 years, the industry itself, of course, is relatively new. The commercial sector is really only now starting to come into its own in terms of its future potential. As we look at the insurance capacity that is available and the risks of potential catastrophic accidents going forward, we would like to see the industry grow and insurance capacity increase and the vehicles continue to be made increasingly safe. But right now, we think this is a reasonable approach to sharing risk.

Mr. COSTELLO. Ms. Cackley, would you or other witnesses, would you like to comment?

Ms. CACKLEY. I think I agree with the statement of Mr. Nield that at this point in time the industry is not at a place where they are capable of taking on what is a small probability but a very high-value possibility and which could basically wipe out a company or even several companies if more than one company is insuring a given launch where a catastrophic accident were to happen.

Mr. SLAZER. I guess I would like to point out two differences in this industry. First is that it is something the United States needs for national security. Our military is completely dependent upon space capabilities to do the superb job they do of operating in mod-

ern combat, and we cannot allow that capability to be dependent on foreign suppliers.

So as long as we are going to need a launch business, how can we spread some of that cost out, and then how big is the base we can spread that cost out amongst? In the nuclear power industry, nuclear power provides about one-fifth of American generating capability. That is about 60 million customers can help share the cost of insuring those plants. In this case you are talking, even in the wildest hope of U.S. recapturing market share the next five or seven years, maybe 40 launches a year, 50 launches a year. Tremendously increased from our seven or eight now, but nothing near to the point where each launch could only take a very small part of the risk if you were to eliminate the risk mitigation capability that is there right now.

Mr. COSTELLO. Thank you.

Ms. ALFERS. We would echo that. I would describe the launch industry from the standpoint of a consumer as reemerging. It has been on years of decline, and it is now trying to recover, and the success, the factor that will determine whether or not it does succeed in recovering will be companies like SpaceX and smaller companies that are willing to invest in this industry.

I don't think some of the smaller companies right now are prepared even just on the strength of balance sheet basis to self-insure, to take on these risks right now to self-insure, and any incremental costs for even the larger providers I can tell you as a consumer will drive us, not out of desire but out of necessity, to foreign providers because when we are forced in a position to pay, you know, 40 percent premium or more on launches, we either have to reflect that in our pricing to our customers, and our largest customer is the U.S. government, or we have to absorb that and take it out of our margins. And at some point that just has such a negative effect on our bottom line that we have no choice but to go to foreign providers.

So the Indemnification Program I really see as a backstop that will help turn this industry around and return it to a thriving industry, we hope, because we would very much prefer to be launching on U.S. providers.

Mr. COSTELLO. Thank you. Dr. Nield, under the existing regime, would the FAA calculate the risk of potential third-party losses for unmanned versus manned or orbital versus suborbital flights differently? And if not, should they?

Dr. NIELD. We would use the same methodology. We think it is appropriate because, again, the purpose of the indemnification regime is to provide for the payments of third-party claims. Indemnification does not apply to either the flight crew or the spaceflight participants. What is on the rocket basically does not matter. What matters is the potential damage is done to the members of the public or to property on the ground.

Theoretically, the numbers could come out differently, depending on how reliable the system is, where the launch takes place, and so forth. The general methodology, however, would be the same.

Mr. COSTELLO. Ms. Cackley, did the GAO look at how the FAA approached calculating the MPL as compared to other methods of assessing risk, and if so, what did you find?

Ms. CACKLEY. We did look at the maximum probable loss calculation that FAA does, and we found that it is quite different from the way the industry in general does that calculation. In some instances it is almost in a reverse order where FAA starts with calculating the loss of casualties and then calculates property damages as just 50 percent of what the total casualty loss is.

The industry, on the other hand, told us that they start from doing a much more sophisticated model-based simulation of property damage and then do their calculation of casualties based on the area that their estimates calculate would be covered by such an accident.

Mr. COSTELLO. And you have recommended that the FAA change their methodology?

Ms. CACKLEY. We are definitely looking at the methodology and have some questions and suggestions for them about ways to improve it.

Mr. COSTELLO. Very good. Thank you, Mr. Chairman.

Chairman PALAZZO. I now recognize the gentleman from California, Mr. Rohrabacher.

Mr. ROHRABACHER. Thank you very much, Mr. Chairman. I remember when we were trying to get this through the very first time, and it was, it almost did not pass, and if, in fact, I was told to pull the bill right before it went for a vote because we didn't have the votes. And let me just note it was a bipartisan effort that saved it, and I remember quite well the Democrats who came over and helped us on this very much.

What if this wouldn't have passed? Would there be a SpaceX and Orbital and some of these private companies today? What if we would not have passed the Commercial Space Act of 2004?

Mr. SLAZER. It is difficult to say. I think part of the answer would be there would still be a market out there. There would still be a market for the U.S. government. In my experience and, as you are aware, because of the experience with Huntington Beach with the Delta Launch Vehicle, there was a government customer out there, which ULA still supports. There are occasional commercial launches which they still support, but they could be so much hurt by that. The commercial launches could go away, and then the government would be left with picking up the full cost of these launch providers. At the end of the day you still need GPS, you still need Milsatcom or AEHF and similar systems, and so that is really the risk out there. Launch services can be provided. The question is how can we make that grow, how can we broaden this space economy and make that bigger.

Mr. ROHRABACHER. Well, that was the big question. We either had to go this route that we are talking about, or there was another route that was lawyers in space, the Lawyers in Space Program, where we would shoot them into space, and that might take care of the problem. But, of course, we chose the more focused approach and went with indemnification.

Today we are talking about a company having basically \$2.7 billion worth of protection. Is that it?

Dr. NIELD. Again, the amount of insurance that the company must procure is based on the maximum probable loss up to a level of \$500 million or the amount of insurance available at reasonable

market prices. Above that, then Congress would have the opportunity to appropriate up to \$1.5 billion, adjusted for inflation, which is \$2.7 billion.

If the claims exceed even that total, then the responsibility, again, reverts to the launch operator.

Mr. ROHRABACHER. But up until \$500 million the company would have to pay itself, so the company is not off the hook. We are actually not taking responsibility off their shoulders. We are just sort of making sure that it is not such a great treat that nobody wants to participate.

Dr. NIELD. That is correct.

Mr. ROHRABACHER. And we have competition with Russia and France and China. Now, of course, we know people who stick their head up and sue people, but at least in Russia and China, that doesn't happen unless the government really wants them to. What about in France, and what about our European competition? Do they have this indemnification, and what does that look like?

Dr. NIELD. Based on the studies that have been previously done, all of the other space faring states, such as the ones that you have mentioned, have similar indemnification regimes. Although, in general, these regimes are more favorable because instead of a three-tiered system, they only have two tiers, where, again, the company would typically purchase insurance up to some amount, but then the government would step in, without limit, to pick up any claims above that level.

Mr. ROHRABACHER. Okay. Well, do you believe is it—I will go down the line. Do you want this? Should we just take the provision out in terms of having to revote on this every, is it four years or five years. How many years do we have before we have to do it again?

Ms. CACKLEY. Three.

Mr. ROHRABACHER. What is the Sunset Provision on this?

Mr. SLAZER. It ends this year, and it has varied over the last four years, last four times it has been reauthorized. I would just note that if you look at the development time, five years for a launch vehicle, launch system is not an uncharacteristic time from the time you first get the idea and you want to build a product to the time you actually do your first launch.

Mr. ROHRABACHER. So if we keep the Sunset Provisions, we should not have to do it for another five years?

Mr. SLAZER. Well, I would hope at a minimum, but I would also point out that launch contracts typically happen two or more years in advance, and so if you really want to look at the cycle time of the industry, it is more, it is longer than three to five years from the time you first start thinking you are going to do something until you start providing regular services to customers. And the closer we can get to that cycle time in the industry, the better it will be for investment decisions and the more likely we are to attract capital to develop new capabilities.

Mr. ROHRABACHER. Okay. Thank you very much.

Chairman PALAZZO. I now recognize the gentlelady from Maryland, Ms. Edwards.

Ms. EDWARDS. Thank you, Mr. Chairman, and for Mr. Rohrabacher, just for the record, I am a lawyer, and I actually do want

to go to space, and I want to make sure there is an appropriate MPL calculation for that trip.

Mr. ROHRBACHER. But our program didn't have any provisions for the lawyers coming back down.

Ms. EDWARDS. Right. I do want to come back. So thank you. I have been looking at this question for indemnification, and really my concern has been if there is some predictability in terms of what the obligation of the taxpayer would be and how we can establish more predictability with a model that has some way to more reasonably calculate what that liability would be.

And so I wonder, Dr. NiELD, I want to talk to you about the modeling that is used for airline carriers and other examples and perhaps we can get a comment also from GAO about this, that would give us a little bit more predictability in terms of taxpayer obligation beyond the cap.

Dr. NIELD. We are eager to look at all kinds of improvements on how we do what we do, and we would solicit recommendations from GAO, from Congress, and from industry experts about the best way to do that.

In fact, we have already begun an internal effort to look at alternate methodologies. We discussed some of these with the GAO as they prepared their report and we shared some of our thoughts on that. We certainly benefited from that discussion, and we think it would be an excellent idea to review the methodologies that could be used.

I would point out that the GAO had noted that in its discussions it found that sometimes a sophisticated model could require, for example, the purchase of a database costing many hundreds of thousands of dollars and experts in order to operate it. So, we need to make sure that we balance the costs and the benefits and ask: does it really change the MPL? Then we can decide whether that would be an appropriate change to make.

Ms. EDWARDS. Ms. Cackley, before you comment, I wonder if you could give us some idea. I am trying to figure out how it is that we recognize that the industry, the commercial industry is not mature yet. That is understandable, and I guess that that is some justification for some amount of indemnification.

And so my question, though, goes to how we can move the industry along so that it becomes mature enough to indemnify itself rather than to have over a course of time taxpayers foot that. And do you have some ideas of that? If we were, for example, to extend for a temporary period, is there some way in which we can, markers that we can identify that could move the industry along to getting some more predictability for a better model so that there is some rationale to why we would have a cap or why we would eliminate a cap. What are the things that we could ask for in an interim period that could help move the industry along so that indemnification catches up with maturity?

Ms. CACKLEY. I think one of the key things that has to happen is just enough launches have to take place so that industry has a better track record for different vehicles, for different companies so that risk assessments can be done that take advantage of more sophisticated methodologies, that take advantage of things like simulation, modeling, and that allow for better understanding of prob-

abilities, a richer set of probabilities that can be modeled using computer-based technology.

And that will require certainly data, it requires some expenditure of funds for the modeling, but it also requires time for enough launches to happen that you have a better understanding of what the risks are based on a track record.

Ms. EDWARDS. So rather than a five-year extension, for example, we could do something shorter and then use this time to begin deliberately gathering the kind of data that we need. Right?

Ms. CACKLEY. It is definitely important to be gathering the data. I don't have a specific time period that I think is the ideal time period, but certainly we don't think that it would be a good idea to continue with the calculations that we are using and continue that indefinitely.

Ms. EDWARDS. Thank you. Thank you, Mr. Chairman.

Chairman PALAZZO. I now recognize the gentlelady, Mrs. Adams, from Florida.

Mrs. ADAMS. Thank you, Mr. Chairman.

Ms. Cackley, I have been listening, and I have listened to your discussion about the lack of data, you are going to need more data, and I want to kind of start off where my colleague over there left off.

She was asking and you said, well, we need time for enough launches to take place with the different vehicles and the different categories, and then you need to use the technology from computerizing to do some kind of simulation.

The question I have is aren't these vehicles changing rapidly as we are moving forward? Or are they staying the same?

Ms. CACKLEY. Different vehicles are definitely being developed so that it depends which vehicle, you use different vehicles for different purposes.

Mrs. ADAMS. Correct.

Ms. CACKLEY. Some will have better track records than others, and you are right. That is definitely something that will always be true that—

Mrs. ADAMS. Technology keeps—

Ms. CACKLEY [continuing]. Technology will change, and so that is another reason why insurance is provided.

Mrs. ADAMS. Well, then my question is how long do you need with these different vehicles to have the capability of determining the time enough to make that determination, I guess is the best way to ask that.

Ms. CACKLEY. And I don't have an answer specifically, but I think what we would suggest is that there are risk-assessment experts who could tell you and who should be consulted and be part of the discussion.

Mrs. ADAMS. Right and I know, Dr. Nield, we have talked a lot about the modeling for the calculating the maximum probable loss, and we all understand the model hasn't been updated since '88, and GAO has some concerns of that, and we have heard a lot about that today. Do you believe that you will be trying to do some kind of update to it?

Dr. NIELD. Yes, definitely. We benefited from our discussion with the GAO, and we would welcome additional ideas.

Mrs. ADAMS. Ms. Cackley, in the absence of a current indemnification system in the United States, would it be possible for the Commercial Launch System industry to survive?

Ms. CACKLEY. In the absence of indemnification completely, I think that it is not that the market would go away, but there would be probably a large contraction of capacity of insurance, and there would be a great increase in cost potentially at some point. I think other witnesses have talked about whether that is sustainable in the long term, but we didn't really look at what that length of time might be.

Mrs. ADAMS. Has there ever been an estimate of the increase in the insurance cost if the launch indemnification were to lapse?

Ms. CACKLEY. No, we have not done that estimate.

Mrs. ADAMS. Mr. Slazer, if launch indemnification was allowed to sunset, is it your opinion that the launch industrial base would begin to deteriorate rapidly?

Mr. SLAZER. Given our low number of launches historically the last several years, I don't know if it would deteriorate much more, but it certainly wouldn't improve. It is more the upside that we are risking.

And I just want to take one quick second to point out a distinction here. Launch vehicles have launched for many years, and some of them haven't changed very much. Delta II has been pretty much the same since about 1997, 1998. Soyuz has been around since about the 1960s. Those launch vehicles, the maturity helps refine your understanding of the probability of loss and the potential consequences of the loss.

At the same time, two vehicles that are both mature, if one provider has a subsidized indemnification capability as with Soyuz and the other as with Delta II does not, you may wind up having the U.S. provider being at a competitive disadvantage and going out of business anyway, even if they are equal and mature.

So maturity has to be looked at. It is not going to be the answer to this. It just helps you make a better determination of the risk. It is not going to solve the issue.

Mrs. ADAMS. So, again, I will go back to Ms. Cackley then. With what Mr. Slazer has just said, we do have enough launches under our belts on some of these, and so we could be using that to identify possibly. Is that not correct?

Ms. CACKLEY. Identify?

Mrs. ADAMS. We are talking about how do we decide how to indemnify. Earlier when I said something about they are changing, and they are changing, but we do have, as Mr. Slazer just said, we have vehicles that have been operating, although they have changed slightly throughout the years, they are mature enough.

Ms. CACKLEY. Absolutely, and there is a market of space insurance providers who told us that they would be willing to indemnify at a higher level than the current maximum probable loss of the average current maximum probable loss of flight launches now. Part of what we discovered was that there is a difference between what the insurance companies provide now and what they said that they would be willing to provide in the future that is currently covered by government indemnification. That is not to say that

there is no need for any government indemnification, but it might be able to start at a higher level than it currently does.

Mrs. ADAMS. Okay. Earlier, because I am getting confused, and I just want to make sure. Earlier you said they are not capable or willing to provide, and now you are saying that there have been some that have said they could.

Ms. CACKLEY. They are not willing to provide beyond \$500 million, but right now they are not asked to provide beyond the maximum probable loss, which is much lower. Ninety-nine million dollars is the average. So what we are suggesting is that there is some room for the market to provide some indemnification at a higher level than they currently do, but it is still not completely indemnified up to whatever maximum there is.

Chairman PALAZZO. I want to welcome Chairman Hall to our hearing and recognize him for five minutes.

Mr. HALL. Mr. Chairman, thank you, and I am hesitant to ask anything because of not being here, don't know what questions they have been asked, but I listened to the gentleman from California and his debate with Ms. Edwards. I can't figure out who won that, but I am always on her side, usually.

And the gentleman from California mentioned France. That doesn't do anything to me. There is not a nation in the world they won't surrender to. They will fight to the last American the way they have been. So I wouldn't even consider them, but I do consider this.

Some might be tempted to argue that such a small share of no practical consequence. I don't agree with that. I think, I am convinced without it what small share we now have would all but disappear if we don't take some action, and I think we are going to, and FAA's Launch Indemnification Program is critical to the launch industry and its aspirations to compete for future business.

I actually look forward to working with you, Mr. Chairman, on moving the extension through the House this year. It can be done. It probably ought to be done, and I yield back my time, and I thank you, Mr. Chairman, for the good work you are doing.

Chairman PALAZZO. Thank you, Mr. Chairman.

I now recognize the gentleman from Alabama, Mr. Brooks.

Mr. BROOKS. Thank you, Mr. Chairman.

I am a stronger believer in the free enterprise system which typically means less government, not more government intervention in the marketplace. Typically government intervention results in distortions in the marketplace, less efficiency, and more cost to taxpayers.

At the same time, as you are very well familiar, America faces probably its greatest financial challenge since the War of 1812, when we last went into bankruptcy, not long after that war. We have got deficits probably going to be our fourth trillion dollar deficit in a row. We have got a debt where we blew through \$15 trillion last year. We are going to blow through \$16 trillion just this year. Just the increase in one year from fiscal year 2010, to fiscal year 2011, and the cost of servicing that debt is larger than the cost, this is one-year increase now, is larger than the entire cost of the NASA Program, all of our space activities.

So with that as a backdrop, I want you all to help me out as best you can. Taxpayers are being asked to be on the potential hook for roughly \$2.7 billion should we have a private sector space catastrophe of some kind, and I understand your argument about competition and how this help is needed with respect to that foreign competition, but we have got other industries in America who also would love to have their insurance costs subsidized by the Federal Government and America's taxpayers. You can talk about steel manufacturing, ship construction, bridge construction for our highways, auto industry, just every industry would love to have the similar kind of subsidy of its operational costs that the commercial space is asking of this United States Congress.

And so what I would like for you to help me with is why should commercial space receive insurance subsidies but not these other industries that are also facing stiff foreign competition that threatens to put them out of business, and how do you distinguish commercial space from these other American industries that are similarly facing stiff foreign competition such that you all should receive an insurance subsidy but they should not.

And I would ask for each of you to respond.

Dr. NIELD. I will start by reminding you that there actually has been no costs to the Treasury or to the general public in the 24 years that this system has been in place. Should there be a low probability, but high-cost, catastrophe at some point in the future, Congress would have the ability to make a decision whether or not to appropriate the funds above the cost of the insurance.

The other key point is to recognize that although we are continuing to look at alternate methodologies and the best way to calculate things, we are very confident at the FAA that we have a conservative calculation system today. The probability that the losses would exceed the maximum probable loss value that would be covered by insurance is very, very small, on the order of one in 10 million. So, there would need to be 10 million launches before one would expect to see the indemnification kick in.

Mr. BROOKS. All right. Thank you, and I am looking at my Committee notes that are similar to what you just said, and I will read it into the record. "In what is commonly referred to as indemnification, should any successful third-party claim be in excess of the MPL-based insurance requirement, then the U.S. government is authorized to pay up to an additional \$1.5 billion, adjusted for post-1988, inflation, approximately \$2.7 billion today. The payment is not automatic and subject to Congressional appropriations."

But I am hearing you here today because you are expecting the Congress will, in fact, provide that indemnification should we have some catastrophic accident.

And so, Ms. Cackley, what do you suggest, or what are your thoughts on this? How do we distinguish?

Ms. CACKLEY. I think that it is true that the industry does expect that Congress will appropriate the funds if there were, if indemnification came into play, even though it is subject to appropriation. It is part of what the industry told us is what makes them willing to invest and be part of the market is that they believe that there is that backstop.

To your further question about why this industry and not others, that is not something that GAO is taking a position on. We learn as much as we could about how the program works, but we are not—we don't have a position on why space and not any other particular market.

Mr. BROOKS. Mr. Slazer.

Mr. SLAZER. Yeah. I think the answer is that you are going to need this whether or not there is a commercial market or not. Other industries aren't in that same position. We can import those products, we can do without them we can make other substitutions, but we need to have a space launch capability for our national security.

As a result, we can choose to spread those fixed costs of development and operations over a broader base by bringing in commercial businesses and potentially expand that base to the point where it actually becomes a job and revenue generator kicking back into the Treasury, or we can go down to a minimalistic set of launches and have very high costs.

I would contend that is kind of the inflection point we have been at these last couple of years. And that is why we have seen costs for DOD launches, costs for NASA launches, NASA has been having a great deal of difficulty getting their science program launched because costs have risen so much. We have got the prospect in the near future as new companies come online, as new capabilities by existing companies are expanded, start bringing those costs down and spreading that fixed cost out, but we have to keep this regime in place to make that business case work.

Mr. BROOKS. Mr. Chairman, my time has expired, but is there any chance you would allow sufficient time for Ms. Alferts to also respond?

Chairman PALAZZO. Yes.

Ms. ALFERS. Okay. Thank you. We would echo the national security concern. The U.S. Government needs to have domestic launch capabilities available, and in addition to spreading the fixed costs, there is also an issue of maintaining the skill set. The launch business is a highly technical business. I mean, it is very complicated, and there are a handful of people that do this and do this well, and when you take a factory and you shut it down to the point where you are running one car off about every four years, you lose that skill set. That is a very high-risk situation for the U.S. government for when they need to call on those resources.

Right now the payloads that we launch are heavily relied upon by the U.S. government. Our largest customer is NGA, the National Geospatial-Intelligence Agency, and I will tell you that the U.S. launch market right now is not appealing to launch on, and we are looking at foreign launches for our Next Generation satellite, and unless there are new vehicles that come into the market.

And I want to make this point. There was discussion about the Delta II. One of the things that has happened as a result of the reduction in demand is that some of the launch vehicles that have been highly reliable and are more appropriately sized for commercial payloads are not available. We are being forced to launch on an Atlas V. I shouldn't say forced, but we are launching on an Atlas V, which is a much more expensive and much larger vehicle

than we would prefer to launch on, and that is simply a product of, or byproduct of, the declining U.S. launch industry.

So, in the interest of national security, we think it is very important that the U.S. industry fosters innovation, and we see the Indemnification Program supporting that because it does fix risks to some degree for the launch providers, and without that to answer an earlier question, I actually do think the U.S. launch industry will gradually fade away to a point that will be very detrimental to national security.

Mr. BROOKS. Thank you for your insight, and Mr. Chairman, thank you for the additional time.

Chairman PALAZZO. At this time, we are going to enter into a second round of questions where each Member will be allowed the opportunity to ask one question, and we will begin with the gentlelady from Maryland, Ms. Edwards.

Ms. EDWARDS. Thank you, Mr. Chairman. I just have a couple of questions here.

Ms. CACKLEY, there has been a lot of discussion about the impact on international competitiveness. Did GAO find any documented evidence regarding the impact of shared risk, third-party liability on international competitiveness or analysis that if we didn't have that protection, it would result in the loss of business to foreign launch providers?

Ms. CACKLEY. We did not find documented evidence. We certainly talked to launch customers who told us that because their two main factors that they look at are price and reliability and the indemnification has an impact on price, you can make the connection that it has some impact, but we could not quantify that.

Ms. EDWARDS. Are there other factors that impact competitiveness of the domestic launch provider?

Ms. CACKLEY. Besides—

Ms. EDWARDS. Besides the shared-risk regime?

Ms. CACKLEY. No. There are certainly many factors that affect competitiveness besides this regime.

Ms. EDWARDS. And even though we have had the shared risk, we have still lost market share. Right?

Ms. CACKLEY. That is right.

Ms. EDWARDS. And then I just have a question regarding the analysis about behavior. Has GAO made any determination or Dr. Nield, perhaps you could answer this, as to whether risk management practices among the providers, among the companies would be affected by eliminating the cap?

Dr. NIELD. In our discussions, it certainly has been made very clear that industry considers the current indemnification regime to be vital. The big concern I would have is that in the worst case, a straightforward business decision would be made that says, we can't afford to bet the company, and so we are just going to withdraw from the industry. It is hard to predict the likelihood of that, but that is certainly a very real possibility.

Ms. EDWARDS. Well, I am wondering, Mr. Slazer, if you could comment because my question is whether—what the risk management practices of a company would be if they knew that they wouldn't be on the hook for anything? Because I would think that

that would actually result in a greater probability of liability for taxpayers.

Mr. SLAZER. Yeah. I guess it is important to remember we are talking here about third-party indemnification, and so any of these companies that are getting into this business are putting hundreds, more likely billions of dollars of their own shareholders' capital at stake in developing these systems, and it is not in their interest to do something that is not going to work well. They are going to do everything they can to succeed in that business, and with so many providers in the very competitive international market with very good reliability rates, if you show any indication that you aren't able to deliver reliably, whether or not you have third-party liability issues or not, you are going to lose business.

And so it is the company's own self-motivation to make their businesses succeed are going to make them highly motivated to succeed. Regardless if they are completely indemnified for third-party issues, which they are not in the current regime.

Ms. EDWARDS. Well, so then that would also be an argument for keeping the cap, too. Right? The cap, too. Right? Why not?

Mr. SLAZER. The only reason there would be the competitive relative impact on pricing. So the number I—

Ms. EDWARDS. And so what is the documented evidence that you have that there would be an impact on competitiveness?

Mr. SLAZER. The one number I have seen out there, which goes—that I recall, that goes back to an aerospace corporation study in about 2006, that I believe is still accurate, is that European launcher Ariane has a requirement for indemnification insurance for maximum probable loss of about \$75 million by our \$500 million.

Ms. EDWARDS. I have a note from that same Aerospace Corporation study in 2006, that says, "Measuring the contribution of indemnification itself, which is critical to considering amendments to eliminate it or at the other extreme altering it to reallocate more risk to the government, is impossible." Do you agree with that?

Mr. SLAZER. It is extremely difficult, and I would throw in another factor that is extremely difficult is where companies are operating. If you are operating on the plains of Kazakhstan where no one is in the range of possibly being hit by any debris, I suspect your indemnification costs are going to have another natural advantage of being lower, but it is very difficult to make that determination.

Mr. EDWARDS. And just lastly, Mr. Slazer, to what extent do commercial launcher providers purchase third-party liability insurance above the level required by the MPL before you would reach the cap?

Mr. SLAZER. I am afraid I am not able to answer that question.

Ms. EDWARDS. It would be helpful for the industry to be able to answer the question as to how much they, I mean, because otherwise in-between \$99, whatever it is, \$99 million and \$500 million. That is a really big number. Who is on the hook for that?

Mr. SLAZER. I will take the action to try to get you some answers.

Ms. EDWARDS. Thank you. Thank you, Mr. Chairman.

Chairman PALAZZO. The gentlelady's time has expired.

I will ask my one question but of two people.

Would the FAA need additional, this is for Dr. Nield, will the FAA need additional regulatory authorities to extend the liability risk-sharing regime to on-orbit activity?

Dr. NIELD. Yes, we would. As you know, we currently have regulatory authority only over launch and reentry. As the GAO reported, at this point, there is a gap in terms of indemnification and in terms of regulatory authority. We have been in discussion with some other government agencies about the potential benefits of FAA asking for on-orbit authority, and that certainly is an item for further discussion.

Chairman PALAZZO. Ms. Cackley, would you like to add to that?

Ms. CACKLEY. We certainly recognize that if the FAA is regulating on-orbit activities and licensing for on-orbit activities, it is going to increase the number of possible activities that could be eligible for coverage under CSLA, and to the extent that there are more of these activities, there will be increased risk to the government in the case of an accident of this type.

Chairman PALAZZO. I want to thank the witnesses for their valuable testimony and the Members for their questions. The Members of the Subcommittee may have additional questions for the witnesses, and we will ask you to respond to those in writing. The record will remain open for two weeks for additional comments and statements from Members. The witnesses are excused, and this hearing is adjourned.

[Whereupon, at 11:22 a.m., the Subcommittee was adjourned.]

ANSWERS TO POST-HEARING QUESTIONS



Responses of Dr. George C. Nield, Associate Administrator for Commercial Space  
Transportation of the Federal Aviation Administration, to

Questions for the Record  
Subcommittee Chairman Steven Palazzo

An Examination of FAA's Launch Indemnification Program

Space and Aeronautics Subcommittee Hearing

June 6, 2012

---

1. How will commercial manned missions that include launch abort systems, and a crew member who may intercede during a potential emergency, impact the methodology for calculating the Maximum Probable Loss value?

Response: We do not foresee much of an impact on the methodology. The FAA is confident it can protect public safety while at the same time allow crew to take abort actions. Manned missions should not introduce scenarios that would change our approach to MPL or increase the MPL value.

2. How much of a factor does the heritage of a launch vehicle – the number of successful launches – influence the calculation of the maximum probable loss? All things being equal, are new launch systems assumed to be a higher risk than heritage systems, and does this in turn generate a different MPL?

Response: Although new launch systems are assumed to have a higher probability of failure than launch systems that have a proven record of reliability, this fact does not significantly influence MPL at current launch vehicle reliability levels. That is because MPL is not a measure of risk per se; it is a dollar estimate of an extreme event.

3. If a U.S. sub-orbital launch services company were to establish operations at foreign-based spaceports, what effect, if any, would this have on calculating a maximum probable loss for operations at foreign sites?

Response: The only difference is that the FAA would not establish financial responsibility requirements covering pre-flight activities. Pre-flight activities are only covered under a license for activities that occur on a U.S. launch site. The flight MPL calculation would not differ.

4. FAA has indicated a desire to seek on-orbit authority. What activities would FAA seek to regulate, and by introducing on-orbit activities as a part of the licensing regime, would the maximum probable loss calculation be expected to increase as a result of expanding coverage to include on-orbit activities?

Response: As the industry evolves, and the government's reliance on commercial vehicles changes, it may be necessary to revisit some of the statutes and regulations that

govern commercial space transportation. Specifically, the FAA's statutory authority may require expansion and adjustments to definitions to ensure public safety. For example, there may be a need for greater regulatory authority in the areas of transportation on orbit as well as launch and reentry. Earlier this year, prior to the FAA reauthorization, the Administration endorsed the concept of giving the FAA safety oversight of commercial on-orbit transportation. We look forward to working with the interagency community and Congress as the industry matures and evolves.

Overseeing the operation in orbit of transport spacecraft could help minimize orbital debris generation and on-orbit collisions. In the future, it would also allow for the regulation of the safety of people on board spacecraft while in space.

If Congress chooses to apply a similar shared-risk liability regime to the operation of transport spacecraft, and the FAA had the authority to license on-orbit activities, then a calculation by the FAA of MPL values could, in theory, be affected. Note, however, that third party damage on-orbit is addressed differently under international law than third-party damage on the ground. Liability for damages to space objects on-orbit is fault-based as opposed to absolute liability that attaches to certain third-party damages on the ground. It is unclear at this time whether, at the one in ten million threshold applied to calculate MPL, the potential for a negligent action by an operator on-orbit causing third party damage would have any impact on the MPL calculation.

5. You stated that FAA estimated the probability of a third party loss exceeding MPL value as no less than one in ten million. How did FAA reach this calculation?

Response: Our goal in setting an MPL value is to choose a value such that there is only a one in 10 million ( $10^{-7}$ ) chance that the third party claims arising out of a particular launch would exceed the insured amount. The scenarios used in the current methodology are extremely unlikely using current estimates of launch vehicle failure modes, and the probability of a flight safety system failure. That said, quantifying the chance of a rare event is difficult with any certainty.

In the early days of its program, when first employing its methodology, the FAA found that calculating the MPL using a threshold inclusive of risk with a higher probability of occurrence (e.g., a threshold of a one in one million chance as opposed to a one in ten million chance) resulted in determinations that insurance would not be necessary. Accordingly, the FAA relies on a threshold chance of occurrence of one in ten million for third party loss in order to prevent the U.S. Government from being exposed to the most likely risk, which includes potential liability for the first dollars of loss. The FAA believes that this threshold value appropriately balances the industry's need for reasonable insurance requirements with the government's need to minimize its liability exposure.

Responses of Dr. George C. Nield, Associate Administrator for Commercial Space  
Transportation of the Federal Aviation Administration, to

Questions for the Record  
Ranking Member Jerry Costello

An Examination of FAA's Launch Indemnification Program

Space and Aeronautics Subcommittee Hearing

June 6, 2012

---

1. Please outline the key reasons for establishing the shared-risk liability regime first passed in 1988. What were the goals this regime was expected to achieve and have they been met?

Response: The legislative history of the Commercial Space Launch Act Amendment of 1988 indicates that Congress established the shared-risk liability regime to address issues of insurance industry capacity and the availability of insurance at reasonable rates. Congress also became aware of increasingly competitive foreign launch providers receiving preferential treatment by foreign governments that included the assumption of risk that could otherwise be commercially insured.

Members of Congress recognized that the federal government must become a reliable partner with industry until insurance capacity could accommodate increased insurance requirements at reasonable rates. House of Representatives Report No. 100-693 (1988) from the Committee on Science, Space, and Technology stated "[t]he Committee views this risk burden [the lack of certainty that significant amounts of insurance could be obtained] on the emerging commercial launch industry as an intolerable risk that poses a major threat to the emergence of an internationally competitive launch industry. The absence of any government role in sharing this risk is also inconsistent with recent government policies to foster the U.S. industry, which includes plans to utilize commercial launch services to meet government requirements, U.S. government requirements and international treaty obligations which confer on the U.S. absolute liability for activities conducted by its citizens in space."

Were there currently no shared-risk liability regime, the issues that burdened the industry in 1988 would likely reemerge today. The legislative history of the 1988 act indicates that Congress set the initial \$500 million limit on the amount of insurance that could be required of a licensee because at the time that amount represented the upper limits of insurance capacity available given a practical assessment of the world market. Congress was also concerned with recent launch failures affecting the pool of available insurance. Similar conditions continue in effect today.

A recent assessment by the FAA determined that the market capacity for aerospace liability is \$1 billion. However, capacity may not always mean availability. A GAO report released July 30, 2012 addressing, among other things, the current willingness and

capability of the insurance market stated “[t]wo insurers said that there might be slightly more coverage available beyond \$500 million, and one said that up to \$1 billion per launch in liability coverage might be possible in the private insurance market.” The GAO report also stated insurance industry representatives believed that “[t]he insurance market is generally willing and able to provide up to \$500 million per launch coverage for third party liability. . .” Both the FAA and the GAO have found that the industry’s willingness to provide insurance was susceptible to change due to future market conditions or should a large loss occur. Furthermore, the GAO report explained that some insurers did not want to offer policies above \$500 million because a payout could exceed several years of small premiums in comparison to the potential liability, and they would risk insolvency. Also, some insurers, brokers, and insurance experts also told the GAO that in order to offer policies of above \$500 million they might have to charge premiums that would likely be unaffordable.

With regard to foreign launch providers, the GAO also stated that “the United States provides less commercial space launch indemnification for third party losses than China, France, and Russia. These countries put no limit on the amount of government indemnification coverage, which in the United States is limited by the Commercial Space Launch Act Amendments of 1988.” The absence of U.S. Government indemnification would disadvantage the domestic industry in competing with foreign providers.

Given the complexity of making predictions, the actual impact on the competitiveness of the industry will likely not be fully understood unless indemnification expires, something the Administration does not support. As the GAO report noted, “launch companies and customers GAO contacted believe that ending federal indemnification could lead to higher launch prices for U.S.-based launch companies, making them less competitive than foreign launch companies.” Relative to insurance premiums, the GAO report stated “[a]lthough the cost of third party liability insurance for launch companies has been about 1 percent of the dollar amount of coverage they purchased, how much this cost might increase in the absence of federal coverage is not clear. Launch customers said that the price and vehicle reliability were key factors in their choice of a launch company. Launch companies reported that additional costs would be passed along to customers, but whether this increase alone would be sufficient reason for a launch customer to choose a foreign company over a U.S. company is unclear.” The Report did mention that some customers stated that “they might be more likely to choose a foreign provider if the price of U.S. launches rose.”

2. The current cap on third party losses to government facilities, such as launch pads, is set in legislation at \$100 million. Have FAA Maximum Probable Loss (MPL) estimates ever exceeded the \$100 million cap, and if so, how many have exceeded the cap and by how much? With the value of government facilities having increased since the cap was set and the significant cost impacts from delays to other missions using the same launch pad and government facilities, if they are damaged, is it time to revisit that \$100 million cap? What would an assessment of the value of relevant government facilities entail?

**Response:** Yes, FAA MPL estimates for government property exceed the \$100 million cap for two launch vehicles from Cape Canaveral Air Force Station – the Atlas V and the

Falcon 9. These determinations were based on possible damage to Launch Complex 39A or B. Both launch complexes have current replacement values of approximately \$300 million so it is possible to exceed \$100 million of damage to U.S. Government property.

It may be time to consider revisiting the maximum amount of financial coverage for U.S. Government property, although the FAA has not conducted a comprehensive assessment of relevant government facilities. We do not at this time have an estimate of what an assessment would entail.

3. Flight termination systems are critical to protecting individuals surrounding the launch site. Areas overflowed are at risk from debris caused by an induced launch termination.
  - a. How is debris propagation affected by the type of flight termination system used by a launch vehicle?

Response: The potential to have a debris impact over a populated area is not affected by the type of flight termination system. All flight termination systems must meet the same safety standards in the FAA regulations. Thrust termination systems are becoming popular because of their simplicity and because in some cases they reduce risk compared with destruct systems.

- b. How are your assumptions on the amount of wind factored into the computation of debris propagation?

Response: Wind is not a factor in the current methodology. Risk analysts often use statistical wind data in risk calculations. However, because MPL is an estimate of an extreme event, the effect of wind is marginal.

- c. Would more sophisticated debris models be of value to FAA in performing the agency's analysis? If so, are they being developed and if not, why not?

Response: Yes. Better debris models would improve the FAA's calculation of MPL. The FAA, Air Force, and NASA continually research methods to better estimate debris generation.

4. FAA uses different methods for estimating third-party losses for the launch phase (the overlay method) and for a re-entry vehicle returning from space (risk profile method). Please describe these two methods and why the FAA applies different maximum probable loss approaches for launch and reentry.

Response: In the overlay method, the FAA uses the inert debris produced by a flight termination system activation as an upper bound for the debris produced by an aerodynamic or explosive breakup. The FAA then overlays the debris over a credible population center to estimate casualties. The FAA then multiplies total casualties by \$3M, which is the estimated cost of a casualty for liability purposes, and then adds 50% to this cost to account for property damage.

The outcome of the risk profile method is a plot that shows the probability of an accident causing a given number of casualties or more versus the number of casualties. A similar plot of property damage can be produced. These plots are computed using thousands of simulated accidents with a debris footprint computed for each, with resulting casualties and property damage. This method accounts for behaviors of a failing vehicle, probabilities of each scenario, a description of the debris created, numbers and locations of people at risk, and vulnerability models for exposed people and structures.

The overlay method is the FAA's primary method at this time for calculating MPL. The FAA has just begun to license reentries. The risk profile method has been used for reentry because of the difficulty in determining a credible population center at risk without the additional rigor of the risk profile method.

5. Prospective suborbital flights that are anticipated to carry paying passengers are planned to originate and land at spaceports located well within the confines of the continental U.S. The designs of several of the suborbital aircraft projected to be used rely on aerodynamic designs not unlike those found on aircraft. This would probably lengthen the flight time over populated areas. What factors will FAA consider in deriving the probability of launch and re-entry failure by suborbital vehicles over populated areas?

Response: The FAA will consider the following factors in the evaluation of the probability of launch and re-entry failure by suborbital vehicles over populated areas:

- The historical reliability of vehicles developed and operated under similar circumstances,
- The degree of component and integrated system level testing,
- The comparisons of test results to predictions,
- The fidelity of the test environments,
- The operator's level of understanding of the environments,
- The dynamics of the environment encountered in a particular phase of flight,
- The technology readiness level of subsystems,
- The rigor in monitoring and resolution of anomaly or discrepancy reports,
- Process control and verification,
- Analytical rigor of safety assessments,
- Independent safety assessments, and
- Key design features, including, but not limited to, full envelope abort capabilities, integrated health management, incremental flight test, system complexity, design margin, and level of redundancy of safety critical systems.

Responses of Dr. George C. Nield, Associate Administrator for Commercial Space  
Transportation of the Federal Aviation Administration to

Questions for the Record  
Congresswoman Donna Edwards

An Examination of FAA's Launch Indemnification Program

Space and Aeronautics Subcommittee Hearing

June 6, 2012

---

1. Has FAA recently assessed the capacity of the insurance industry to accommodate third-party claims? If so, what were the results of that assessment? If FAA hasn't done so yet, when do you plan to conduct such an assessment? If you don't plan to do so, why not?

Response: Earlier this year, the FAA completed a commercial market assessment to determine the availability and affordability of commercial insurance sufficient to meet the needs of NASA Commercial Crew Program missions. This report addressed numerous insurance issues including the market capacity for first and third-party liability coverage. In the preparation of this report interested entities, including the FAA's Commercial Space Transportation Advisory Committee (COMSTAC), commercial launch providers, the space insurance industry (including insurance underwriters and brokers), and academia were consulted. This market assessment has concluded that, under current market conditions, and with a notional flight profile of two NASA Commercial Crew Program missions per year (launch and reentry), the insurance industry has sufficient resources to cover claims up to the maximum CSLA third-party financial responsibility limit. Insurance brokers informed us that the insurance market capacity for aerospace liability coverage is \$1 billion. The only caution provided to this information is that to date there has never been a successful third-party liability claim resulting from space activities. Some insurers pointed out that the market has not been tested, and a large loss early in a program, before there is a chance to build up reserves, could have an effect on the insurance industry's willingness to commit additional capital.

Capacity may not always mean availability. We would like to note that a GAO report released on July 30, 2013 stated "[t]wo insurers said that there might be slightly more coverage available beyond \$500 million, and one said that up to \$1 billion per launch in liability coverage might be possible in the private insurance market." However, the report also stated that "[t]he insurance market is generally willing and able to provide up to \$500 million per launch coverage for third party liability. . ."

2. In your testimony, you noted that "*Extension of the indemnification provision would continue to enable industry to attract and maintain a customer base in the face of international competitors who offer more certain indemnification.*" However, over the past several years, during which time this provision was in place, the U.S. share of the international commercial space launch market declined precipitously. Does FAA have any recent quantitative analysis that supports the assertion that the continuation of the

indemnification provisions for third-party liability would help “*enable industry to attract and maintain a customer base*” or that changes to the provisions would have a significant impact on that customer base?

Response: The FAA does not have any quantitative analysis relevant to the assertion noted in this question. We also do not have quantitative analysis that changes to the provisions would have a significant impact on that customer base. As the GAO concluded in its report released on July 30, 2012, “it is difficult to separate out the effects of withdrawing indemnification on the overall competitiveness of the U.S. commercial space launch industry. Many factors affect the industry’s competitiveness . . . in addition to third party indemnification.” The GAO also concluded, “[t]he actual effects that eliminating CSLAA indemnification would have on the competitiveness of U.S. commercial launch companies are unknown.” Based on the best indicators known to me, the U.S. industry needs indemnification to continue to compete with foreign launch services providers who offer even more certain indemnification.

Given the complexity of making predictions, the actual impact on the competitiveness of the industry will likely not be fully understood unless indemnification expires, something the Administration does not support. Industry sources have consistently indicated that indemnification should be extended, in part because it is important for competition in the international commercial launch marketplace. The GAO report noted that “launch companies and customers GAO contacted believe that ending federal indemnification could lead to higher launch prices for U.S.-based launch companies, making them less competitive than foreign launch companies.” The report also mentioned that customers stated that “they might be more likely to choose a foreign provider if the price of U.S. launches rose.” Furthermore, in his June 20 testimony before the Senate Commerce Committee, Subcommittee on Science and Space, Gerald L. Dillingham, Director, Physical Infrastructure, GAO stated “[i]ndemnification is present in all of our competitors around the world. You have heard the captain say this morning -- and we heard it several times in our work -- that in terms of competition, without that, it could have a potentially negative impact on our ability in a competitive way, raise the cost of launches, and send business across the water, also impact on our national defense as well and our industrial base.” What is known is that foreign competitors offer indemnification. Should indemnification not be extended, the industry will have one less advantage than highly competitive foreign providers.

3. FAA’s Center of Excellence for Commercial Space Transportation is sponsoring research that is trying to develop and establish quantitative safety metrics appropriate for commercial space transportation launch and reentry. The tool being developed could inform a potential alternative to the current Maximum Probable Loss (MPL) model used by FAA and could be applicable to the diversity of future suborbital and orbital space launch systems currently being developed. What does FAA plan to do with the results of this study, once completed?

Response: The Center of Excellence for Commercial Space Transportation (COE CST) task referred to in this question is entitled “Analysis Environment for Safety Assessment of Launch and Re-Entry Vehicles.” This tool is designed to calculate risk, not the

maximum probable loss (MPL). MPL is not a measure of risk, but an estimate of the dollar amount of an extreme event. The FAA plans to use the COE tool to provide industry an enhanced and credible public risk analysis capability to facilitate planning and improve transparency for licensed launches and re-entries. It is unclear at this time whether the tool could inform an alternative calculation methodology of MPL.

4. In your testimony, you noted FAA's interest in looking at improvements to the methodology for estimating third-party losses from commercial space launches, the Maximum Probable Loss. What would an independent, external review and analysis of the maximum probable loss methodology and an assessment of alternative methodologies entail? What do you estimate such a review would cost and what time period would be required for the review?

Response: An independent, external review and analysis of the maximum probable loss methodology and an assessment of alternative methodologies would entail an assessment of methods to model extremely rare launch and reentry events, to estimate fatalities, serious injuries, and property damage from those events, and to estimate liability from court cases and settlements. Depending on what organization conducts the review and how extensive of a review it is asked to conduct, the review could cost over \$500,000 and take about a year.

5. What criteria does FAA use to assess the requirement for continued third-party indemnification as part of the shared-risk liability regime currently in place for U.S. commercial space launches and reentries? What indicators would signal to the FAA that the U.S. government's indemnification is no longer needed or no longer needed at the level currently being provided?

Response: The FAA views the financial responsibility and risk-sharing regime that it administers as an interlocking framework of complementary parts. The reciprocal waivers of claims between launch participants and the financial responsibility requirements that the FAA imposes cover the maximum probable losses that a launch or reentry could cause. The conditional payment of excess claims, subject to Congressional appropriations, would apply to losses that have only a one in ten million or lower probability of occurring. Were indemnification to expire, all components of this regime should be assessed.

Indicators that the FAA assesses now include foreign competition and insurance capacity. The current financial responsibility and risk-sharing framework was created with Congress recognizing the emergence of foreign launch services made competitive through government subsidies and preferential foreign national laws. Foreign launch service providers continue today to receive preferential treatment including government indemnification. The FAA has recently assessed that market capacity for aerospace liability coverage is \$1 billion. While insurance industry representatives have recently advised GAO that under current conditions "the insurance market is generally willing and able to provide up to \$500 million per launch as coverage for third party liability." Both of these indicators reflect a continuing need for indemnification.

**Questions for the Record for Alicia Puente Cackley, GAO, from  
“An Examination of Future Commercial Launch Markets and FAA’s Launch  
Indemnification Program”  
House Committee on Science, Space, and Technology  
Hearing on June 6, 2012**

Questions from Chairman Steven Palazzo

**1. In GAO’s estimation, should commercial manned missions that include launch abort systems and a crew member who may intercede during a potential emergency impact the methodology for calculating the Maximum Probable Loss methodology?**

**GAO Response:** The extent to which the introduction of a pilot should affect the Maximum Probable Loss (MPL) methodology would depend on an assessment whether the introduction of a pilot provides redundancy for safety controls as opposed to introducing potential for pilot error. This is an analysis that FAA would need to incorporate into its MPL methodology.

**2. Can GAO provide an estimate of the number of companies worldwide that provide third party insurance coverage for commercial launches that originate in the U.S. and overseas?**

**GAO Response:** According to a leading international broker of commercial space launch insurance, 16 insurance companies worldwide provide third party insurance coverage for commercial space launches that originate in the U.S. and overseas. They are: Chartis, Allianz, Amlin, Antares, GAUM, Generali, Hannover, Hiscox, Starr, Kiln, LRA, Tokio Marine, XL Insurance, Torus, Global Aerospace, and Argo.

Questions from Ranking Member Jerry Costello

**1. Is the same shared-risk liability and indemnification regime appropriate for both unmanned and crewed launches and also for orbital and suborbital commercial space launches or should Congress consider different risk sharing regimes? What factors should Congress consider in making that decision?**

**GAO Response:** Our work did not address whether the same shared-risk liability and indemnification regime is appropriate for manned and unmanned launches or whether the regime should be different for orbital or suborbital commercial launches. Such issues could be addressed in an independent detailed analysis.

**a. Did GAO’s work identify issues or findings on whether or not the introduction of suborbital and orbital commercial human space launch services increases the risk exposure of the U.S. government for potential third-party damages? If so, please describe those issues or findings.**

**GAO Response:** Yes, we identified 3 issues regarding the U.S. government’s potential risk exposure with commercial human space launches. First, the number of launches and landings covered by federal indemnification will increase as NASA procures manned launches and space tourism companies begin flights. Second, newly developed launch vehicles for commercial manned launches have less launch history and are thus viewed by the insurance industry as more risky than “legacy” launch vehicles, which increases the government’s risk exposure and potential for indemnification payments. Third, having people onboard a spacecraft raises the issues of informed consent and cross waivers, which could affect third party liability and the potential cost to the federal government. The Commercial Space Launch Act requires that passengers and crew on launches be informed by the launch company of the risks involved and to sign a cross waiver with the government agreeing not to seek claims against the government if an accident occurs.

**2. In discussions with insurance representatives, did GAO find any consensus on whether inclusion of humans in suborbital and orbital flights would lead to higher or lower risks with regards to third party claims? If not, what is the reason for the lack of consensus?**

**GAO Response:** Yes, our work found consensus among insurance representatives that the primary determinants of risk in a launch are the reliability of the launch vehicle and the flight’s trajectory, not whether humans are onboard.

**3. Did GAO examine how the demand for other types of space insurance, such as for spaceflight participants, payloads, and launch vehicles, affects the overall insurance pool for third-party liability claims? What did GAO find?**

**GAO Response:** No, we did not examine how the demand for other types of space insurance affects the overall insurance pool for third-party liability claims. However, insurance companies told us that generally the same pool of insurers provide coverage for third-party damages as well as coverage related to payloads and launch vehicles.

Questions from Representative Donna Edwards

**1. Your statement notes that FAA uses a dollar figure of \$3 million for the cost of a single potential casualty in estimating maximum probable loss.**

**a. What did GAO find as to whether or not that is a reasonable dollar figure?**

**GAO Response:** FAA has not updated this figure of \$3 million since it began using it in 1988. In addition, two insurers, as well as representatives of two companies that specialize in estimating damages from catastrophic events (modeling companies), said that this figure is likely understated. Because this amount has not been adjusted for inflation or updated in other ways, it may not adequately represent the current cost of injury or death caused by commercial space launch failures.

**b. Similarly, what did GAO find with respect to how FAA calculates the dollar figure for potential third-party property damage or losses?**

**GAO Response:** FAA's methodology for determining potential property damage from a commercial space launch starts with the total cost of casualties and adds a flat 50 percent to that cost as the estimate of property damage, rather than specifically analyzing the number and value of properties that could be affected in the event of a launch failure. One insurer and two risk modelers said that FAA's approach is unusual and generally not used to estimate potential losses from catastrophic events. For example, officials from both modeling companies noted that the more common approach is to model the property losses first and derive the casualty estimates from the estimated property losses. Specifically, if a property loss scenario involves the collapse of a building, that scenario would have a different casualty expectation than a scenario that did not involve such a collapse. One modeler stated that FAA's method might significantly underestimate the number of potential casualties, noting that an event that has a less than 1 in 10 million chance of occurring is likely to involve significantly more casualties than predicted under FAA's approach. Moreover, a 2007 FAA review conducted with outside consultants said that this approach is not recommended because of observed instances where casualties were low yet forecasted property losses were very large.

**2. You indicate in your prepared statement that the insurance industry has the capacity of insuring third-party losses of \$500 million. Since the average maximum probable loss determined by FAA is about \$99 million, elimination of federal indemnification would require launch providers to make up the difference. What additional cost in premiums would this add? Would the increase in cost be linear or be higher or lower percentage-wise than the premium paid for third-party liability insurance at the maximum probable loss level?**

**GAO Response:** Ending federal indemnification would not require launch companies to purchase additional insurance coverage. As noted in our testimony, to obtain an FAA license, launch companies must demonstrate that they have the financial ability to pay for third party damages in an amount equal to the maximum probable loss as determined by FAA. Launch companies generally demonstrate this ability through the purchase of insurance coverage up to that amount. This requirement will not change if federal indemnification ends. That is, the \$99 million figure represents the average amount of coverage FAA requires launch companies to purchase, which is dependent on FAA's licensing process and is not affected by the presence or absence of federal indemnification.

Launch company officials did say, though, that if federal indemnification ended they would likely purchase greater levels of insurance to protect against the increased potential for third party losses, as the launch companies themselves would be responsible for all potential third party claims, not just those up to the maximum probable loss amount. Two insurance brokers and one insurer told us that the cost to launch companies for purchasing third party liability insurance is approximately 1 percent or less of the total

coverage amount, so any additional cost to launch companies would depend on the amount of coverage purchased.

**3. How does the insurance industry assess and model risk in providing insurance for third-party liability and how does its approach compare to FAA's?**

**GAO Response:** One modeler told us that catastrophe modeling has become standard practice in the insurance and reinsurance industries. Catastrophe models consist of two components: a computer program that mathematically simulates the type of event being insured against and a highly detailed database of properties that could potentially be exposed to loss. Tens of thousands or more computer simulations are generated to create a distribution of potential losses and the simulated probability of different levels of loss. In contrast, FAA's method does not incorporate such catastrophe modeling and involves estimating only a single loss scenario.

**4. How would removal of the government's involvement in commercial space third-party liability affect the third-party liability insurance industry?**

**GAO Response:** Ending the government's involvement in commercial space third-party liability could increase sales of third-party liability insurance, depending on the amount of additional insurance coverage, if any, that launch providers might decide to purchase. As noted in the testimony, the insurance industry is currently willing to provide around \$500 million in third-party liability coverage per launch, which is above the average amount of coverage currently required by FAA for a commercial launch license. Some of the launch companies we spoke to said that if the government's involvement in commercial space third-party liability ended, they might seek to purchase coverage in amounts above that required by FAA to replace some of the coverage currently available through the government. Others said that they already purchased the maximum amount of coverage that insurers were willing to sell.

**5. What criteria should Congress use to assess the requirement for continued third-party indemnification as part of the shared-risk liability regime currently in place for U.S. commercial space launches and reentries? What, specifically, would demonstrate that the U.S. government's extension of indemnification is no longer needed or no longer needed at the level currently being provided?**

**GAO Response:** Identifying specific criteria to use for assessing when government involvement in third-party liability coverage for commercial space launches was no longer needed was not something we examined. However, the amount of such coverage the insurance industry is willing to provide for a single launch would be a key factor because it would determine the extent to which the industry might be able to replace coverage potentially available from the federal government. While the maximum coverage available is currently around \$500 million, which is above the average FAA insurance requirement of around \$99 million per launch and the highest requirement for any individual launch (around \$240 million), this might not always be the case.

According to some insurers we spoke to, a space launch accident with large third-party losses could significantly reduce the amount of coverage insurers are willing to provide. Other factors that affect the amount of coverage insurers are willing to provide include the number of insurers in the space launch market, the size of the premiums insurers are able to charge compared to the size of the potential losses, and the affordability to launch companies of the higher premiums insurers would need to charge for higher coverage amounts.

RESPONSES FROM MR. FRANK SLAZER

**Questions for the Record**  
**Ranking Member Jerry Costello**

An Examination of FAA's Launch Indemnification Program

Space and Aeronautics Subcommittee Hearing  
June 6, 2012

- 
1. In your prepared statement you state that *“given that the current US risk approach has been in place for so long, it is not clear how much additional underwriting capability is available in the space insurance market; adding new uncertainty will harm US industry.”* Has the commercial launch industry sought to assess how much third-party insurance underwriting capability is available for commercial space transportation? If not, why not?
  2. Have any U.S. commercial space launch contracts ever been lost to foreign launch providers because of the customer's concern about whether the shared liability regime for third-party losses and the provisions for government indemnification would be continued? If so, please identify them.

**AIA Response:**

1. Any commercial launch licensed under the FAA Office of Commercial Space Transportation (AST) must obtain insurance up to the maximum probable loss as calculated by AST, or no more than \$500 million as stated in tier one of the indemnification regime. Thus there has been at least enough underwriting capability to support these activities in previous years; however it is not clear how much additional underwriting capability is available in the launch insurance market above the tier one requirement. The FAA's launch risk indemnification backstop has been repeatedly extended by Congress, creating the reasonable expectation that it will be renewed in the future without completely eliminating the business uncertainty. As a result, the commercial industry to our knowledge has not assessed third-party insurance underwriting capability above the tier one cap. U.S. launch providers - whether providing commercial or government launches, already operate within narrow margins of return on their investments. Additionally, over the last 20 years, competition from foreign launch providers – all benefiting from some form of government indemnification and other modes of support (including Australia, Brazil, China, France, India, Japan, and Russia) has grown significantly. In many cases, foreign government indemnification for launch is already more robust than the current U.S.

indemnification regime. A non-renewal of U.S. government indemnification would absolutely drive U.S. launch business overseas.

2. Although no AIA members have reported losing commercial launch contracts outright due to concerns about the continuation of the indemnification regime, the regime itself has been identified by launch customers in the past as a distinguishing condition of U.S. commercial space launch services. Moreover, as Digital Globe's Alison Alfors remarked during the June 6<sup>th</sup> hearing, her company believes "if the elimination of the launch indemnification regime resulted in any incremental price increase...it would likely be the tipping point where the cost differential would be so significant that launch consumers would be forced to use foreign providers absent any significant payload safety considerations."

**Questions for the Record  
Congresswoman Donna Edwards**

An Examination of FAA's Launch Indemnification Program

Space and Aeronautics Subcommittee Hearing  
June 6, 2012

---

1. To what extent would the cost of additional third-party insurance premiums, in excess of the maximum probable loss level, translate into price increases for your customers, and what would the magnitude of that increase be percentage-wise? What is the basis of your estimates?

**AIA Response:**

1. It is difficult to say how the launch insurance market might adjust premiums in excess of the maximum, probable loss level, if there is no renewal of the regime. Given that the current U.S. risk approach has been in place for so long, it is not clear how much additional underwriting capability is available above the tier one regime in the space insurance market. Nevertheless, although it is undetermined how much underwriting capacity exists in the insurance market, AIA agrees with Digital Globe's June 6 hearing statement that "if the indemnification program did not exist, the launch provider would be in a position of having to insure the additional risk, either through third party insurance or self insure." This added insurance cost would undoubtedly be passed on to either the launch customer or be absorbed by the launch provider. U.S. launch providers - whether providing commercial or government launches, already operate within narrow margins of return on their investments. Additionally, over the last 20 years, competition from foreign launch providers - all benefiting from some form of government indemnification and other modes of support (including Australia, Brazil, China, France, India, Japan, and Russia) has grown significantly. In many cases, foreign government indemnification for launch is already more robust than the current U.S. indemnification regime. A non-renewal of U.S. government indemnification would absolutely drive U.S. launch business overseas.



July 31, 2012

Mr. Steven M. Palazzo  
Chairman, Subcommittee on Space and Aeronautics  
Committee on Science, Space and Technology  
2321 Rayburn House Office Building  
Washington, DC 20515-6301

RE: Question Response

Dear Chairman Palazzo:

Thank you again for the opportunity to testify at the June 6, 2012 hearing on the commercial launch indemnification program. Please find below answers to the questions provided in your correspondence of July 16, 2012.

1. What priority would your company assign to the availability of government indemnification in selecting a launch provider?

We believe that availability of government indemnification translates directly to the price offered by a launch provider. Specifically, the risk sharing that is reflected in the indemnification program allows providers to be more competitive on price and price is a key factor in the selection of a launch provider.

2. What factors, if any have a higher priority in selecting a launch provider?

The top two factors in selecting a launch provider for the type of payloads that we fly are, (i) mission success rate, and (ii) price. Other factors including export control issues and administration costs are also relevant, but the safety of the payload and the price are the two main considerations.

3. All else being equal, would your company pay a higher price to a provider whose government indemnified some portion of third party losses?

No. From a contract standpoint we would insist that the provider insure against all risks associated with the launch activity. In the absence of an indemnification program, our belief is that providers would further raise costs as they take on more risk. In the case of US providers any increases in cost would make them less competitive with foreign providers.

---

1601 Dry Creek Drive  
Suite 260  
Longmont, CO 80503

Phone: 303-684-4312  
Fax: 303-684-4570  
[www.digitalglobe.com](http://www.digitalglobe.com)



4. Has government indemnification been a significant determinant in your company's choice of launch providers to date?

To the extent the existence of the program has contributed to containing costs, yes. We do believe the program has helped US providers contain costs to some degree, particularly as other fixed costs associated with the launch business have rapidly increased and been passed on to customers like DigitalGlobe. Without the indemnification program we believe the cost to launch on US providers could become prohibitive, particularly as the mission success records of lower cost foreign providers become more well established.

Should you have additional questions, please let me know.

Sincerely,

A handwritten signature in cursive script that reads "J. Alison Alfors".

J. Alison Alfors  
Vice President, Defense & Intelligence

1601 Dry Creek Drive  
Suite 260  
Longmont, CO 80503

Phone: 303-684-4312  
Fax: 303-684-4570  
[www.digitalglobe.com](http://www.digitalglobe.com)