FAA
Commercial Space Transportation

Quarterly Launch Report
2nd Quarter 2006

Featuring Launch results from the 1st Quarter 2006 and Forecasts for the 2nd and 3rd Quarters 2006.

Quarterly Report Topic: Commercial Space and Launch Insurance: Current Market and Future Outlook

HQ-020606.INDD

Introduction

The Second Quarter 2006 Quarterly Launch Report *features launch results from the first quarter of 2006 (January-March 2006) and forecasts for the second quarter of 2006 (April-June 2006) and the third quarter of 2006 (July-September 2006). This report contains information on worldwide commercial, civil, and military orbital and commercial suborbital space launch events. Projected launches have been identified from open sources, including industry references, company manifests, periodicals, and government sources. Projected launches are subject to change.*

This report highlights commercial launch activities, classifying commercial launches as one or both of the following:

- *Internationally-competed launch events (i.e., launch opportunities considered available in principle to competitors in the international launch services market)*
- *Any launches licensed by the Office of Commercial Space Transportation of the Federal Aviation Administration under 49 United States Code Subtitle IX, Chapter 701 (formerly the* Commercial Space Launch Act*)*

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Cover (photo courtesy of Sea Launch, copyright © 2006): Sea Launch's Zenit 3SL vehicle lifts off from the Odyssey Launch Platform in the Pacific Ocean carrying a commercial communications satellite in February 2006.

First Quarter 2006 Highlights

In January, the U.S. Department of Defense (DoD) conditionally approved a plan to allow Lockheed Martin and Boeing to merge their fleets of Evolved Expendable Launch Vehicles (EELVs) into a 50-50 partnership aimed at cutting costs for both firms.

In January, the Indian Space Research Organisation (ISRO) demonstrated an air-breathing scramjet engine at Mach 6 for seven seconds at the Vikram Sarabhai Space Center in Thiruvananthapuram, India. The scramjet test was the latest step in a program to develop an Indian rocket engine aimed at cutting satellite launch costs to between $500 and $1,000 per kilogram (roughly $1,000 to $2,000 per pound) to low Earth orbit (LEO). The next step is to demonstrate the engine suborbitally aboard a sounding rocket.

ISRO also in January kicked off an internal review process leading up to an expected 2007 decision on whether to mount an effort to conduct an indigenous manned spaceflight in 2015 aboard an upgraded version of India's Geostationary Satellite Launch Vehicle (GSLV).

In January, Rocketplane discussed plans to conduct an atmospheric flight test of its four-seater suborbital spaceplane in January 2007, which will be followed by 24 more test flights before entering commercial service.

In January, the Russian state news agency RIA Novosti reported the timetable for the development of the Kliper vehicle, manufactured by the Russian company Energia. The first unmanned test flight of the Kliper is scheduled for 2012; the first manned test flight is slated for 2013; and the first crewed flight of the six-person vehicle to the International Space Station (ISS) is expected in 2015.

In February, the State of New Mexico agreed to provide $100 million over three years to fund construction of a spaceport to support commercial suborbital space tourism. The site will be located 45 miles north of Las Cruces. Virgin Galactic CEO Richard Branson plans to base his US space tourism operation at the new spaceport. Virgin Galactic is considering basing its European space tourism operations in Kiruna, Sweden.

Also in February, Space Adventures announced plans to develop commercial suborbital spaceports in Ras al-Khaimay, United Arab Emirates, as well as Singapore, co-funded by local government and business leaders. The spaceports will feature astronaut training facilities, public education and interactive visitor centers, and other attractions including high altitude jet flights and a simulated zero-gravity enviroment via a neutral buoyancy tank. These spaceports may use a suborbital tourism vehicle being jointly planned by Space Adventures and Russia's Myasischev Design Bureau. The vehicle, called Explorer, would be able to carry five people.

On March 1, an International Launch Services (ILS) flight of a Proton vehicle from Baikonur carrying the EADS Astrium-built Arabsat 4A failed when the booster's Breeze M upper stage terminated prematurely. Arabsat 4A was effectively lost when it was left stranded in an irrecoverable orbit. An investigation by a Russian State Commission subsequently concluded that the cause of the premature shutdown was likely a foreign particle blocking the nozzle of the hydraulic pump that fed the booster's oxidizer supply. ILS Proton launches are expected to resume in the second quarter of 2006.

In early March, the majority owner of Rocketplane, George French, purchased Kistler Aerospace, forming a new company, Rocketplane Kistler. The new company's Rocketplane division is continuing work on its proposed suborbital tourism vehicle, Rocketplane XP. Meanwhile, French, who also serves as CEO, has said that the first priority for the company's Kistler division is pursuing commercial ISS resupply opportunities.

On March 7, the Russian Space Agency Roscosmos announced that Japanese entrepreneur Daisuke Enomoto had been cleared to fly aboard a Soyuz spacecraft to the ISS in October 2006 as the fourth Space Adventures space tourist. Enomoto will be following space tourists Dennis Tito in 2001, Mark Shuttleworth in 2002, and Gregory Olsen in 2005.

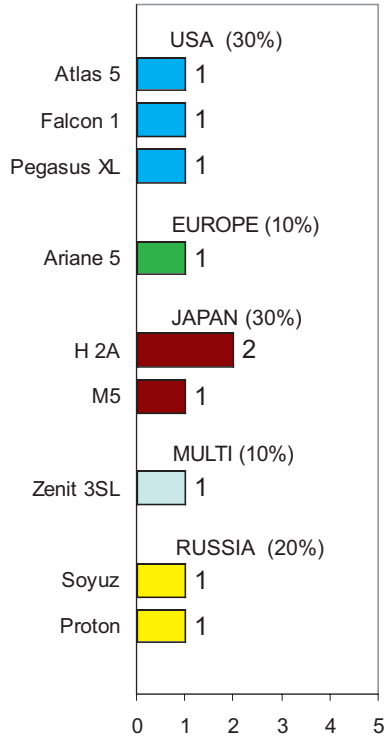
On March 25, the Falcon 1 vehicle, developed and operated by Space Exploration Technologies Corporation (SpaceX), failed approximately 30 seconds into its initial launch attempt from Kwajalein Atoll in the Pacific Ocean. The booster was carrying the U.S. Air Force Academy's cadet-built Falconsat 2 satellite, which was partially recovered. The failure is thought to have been caused by a fuel leak near the first stage engine that caused a fire around the top of the main engine that cut into the first stage helium pneumatic system. The resulting loss in pneumatic pressure caused the engine prevalves to close, shutting down the engine.

SpaceX is undertaking a full review of the vehicle following the failure, and hopes to stage another Falcon 1 launch attempt before the end of 2006.

Vehicle Use

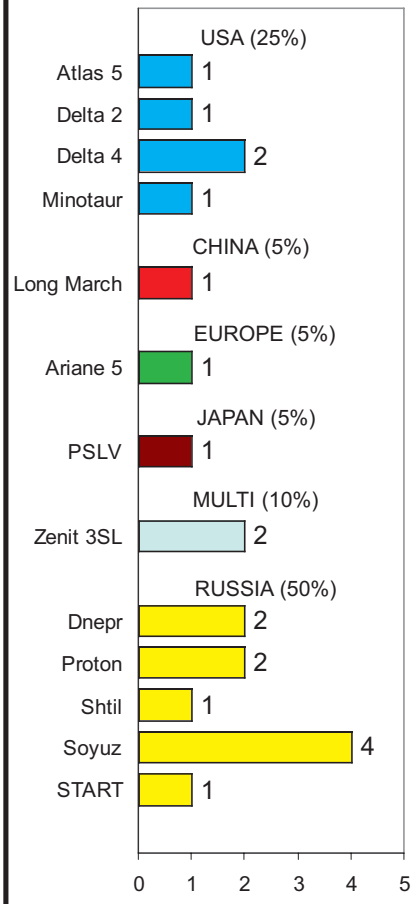
(January 2006 – September 2006)

Figure 1: First Quarter 2006 Total Launch Vehicle Use



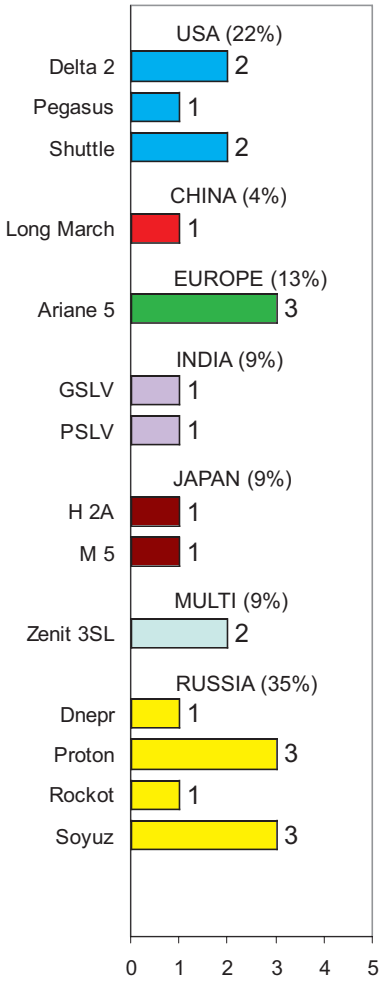
Total = 10

Figure 2: Second Quarter 2006 Total Projected Launch Vehicle Use



Total = 20

Figure 3: Third Quarter 2006 Total Projected Launch Vehicle Use



Total = 23

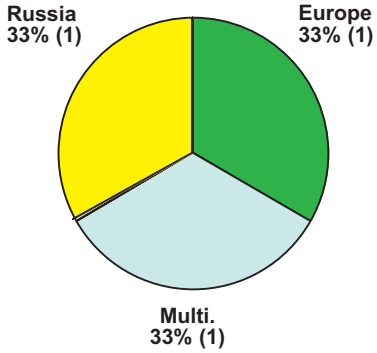
Figures 1-3 show the total number of orbital and suborbital launches (commercial and government) of each launch vehicle and the resulting market share that occurred in the first quarter of 2006, as well as projecting this information for the second quarter of 2006 and third quarter of 2006. The launches are grouped by the country in which the primary vehicle manufacturer is based. Exceptions to this grouping are launches performed by Sea Launch, which are designated as multinational.

Note: Percentages for these and subsequent figures may not add up to 100 percent due to rounding of individual values.

Commercial Launch Events by Country

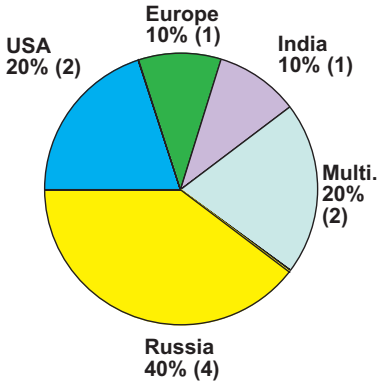
(January 2006 – September 2006)

Figure 4: First Quarter 2006 Commercial Launch Events by Country



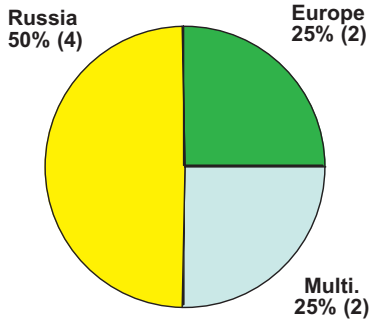
Total = 3

Figure 5: Second Quarter 2006 Projected Commercial Launch Events by Country



Total = 10

Figure 6: Third Quarter 2006 Projected Commercial Launch Events by Country



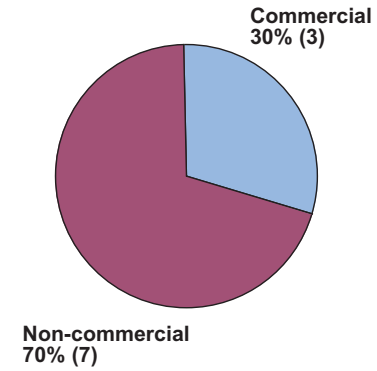
Total = 8

Figures 4-6 show all *commercial* orbital and suborbital launch events that occurred in the first quarter of 2006 and that are projected for the second quarter of 2006 and third quarter of 2006.

Commercial vs. Non-commercial Launch Events

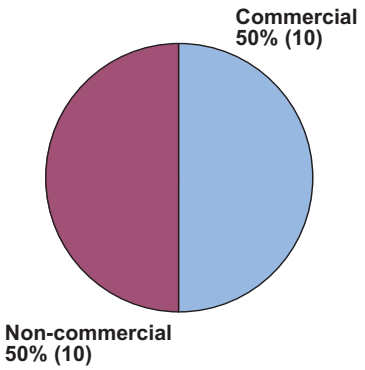
(January 2006 – September 2006)

Figure 7: First Quarter 2006 Commercial vs. Non-commercial Launch Events



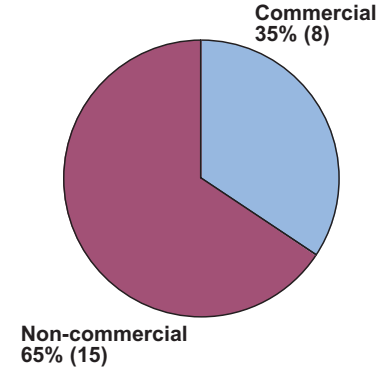
Total = 10

Figure 8: Second Quarter 2006 Projected Commercial vs. Non-commercial Launch Events



Total = 20

Figure 9: Third Quarter 2006 Projected Commercial vs. Non-commercial Launch Events

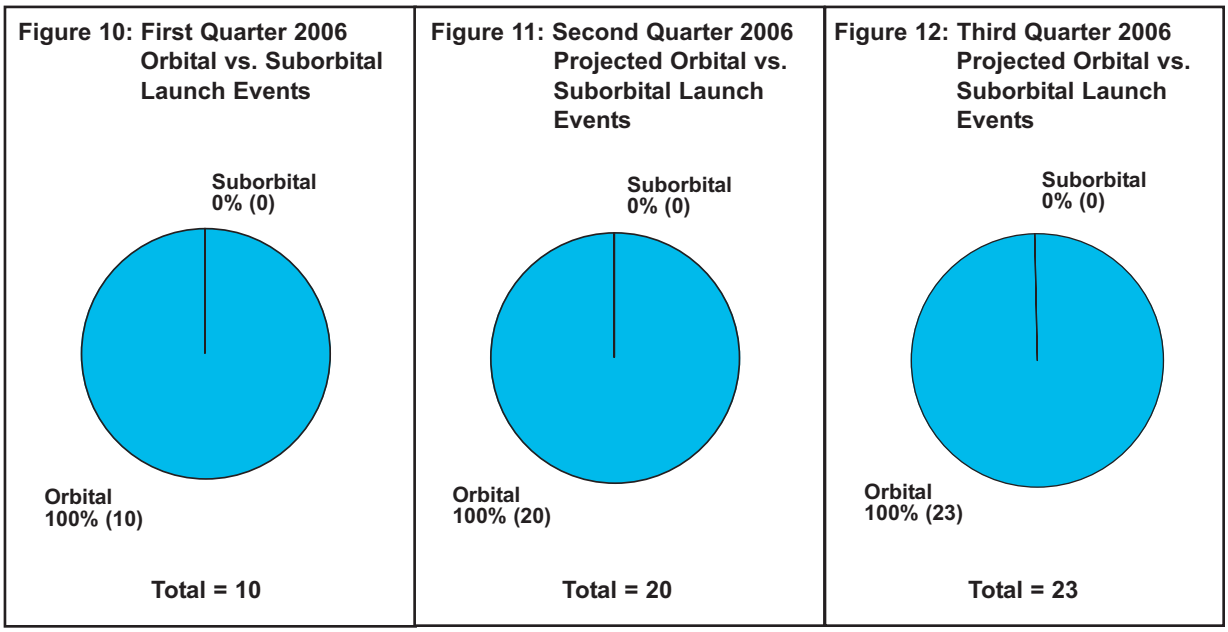


Total = 23

Figures 7-9 show commercial vs. non-commercial orbital and suborbital launch events that occurred in the first quarter of 2006 and that are projected for the second quarter of 2006 and third quarter of 2006.

Orbital vs. Suborbital Launch Events

(January 2006 – September 2006)



Figures 10-12 show orbital vs. suborbital launch events that occurred in the first quarter of 2006 and that are projected for the second quarter of 2006 and third quarter of 2006.

Launch Successes vs. Failures

(January 2006 – March 2006)

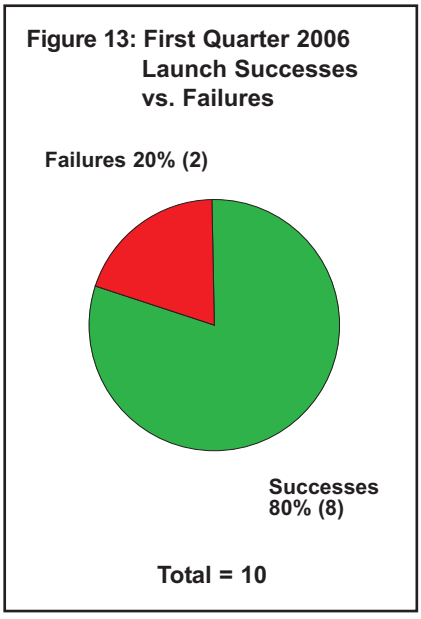
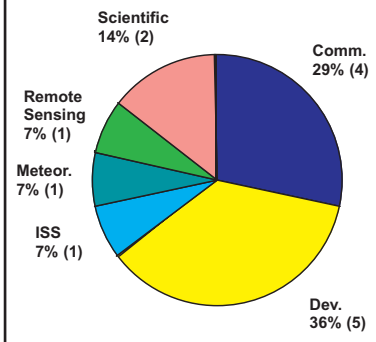


Figure 13 shows orbital and suborbital launch successes vs. failures for the period from January 2006 to March 2006. Partially-successful orbital launch events are those where the launch vehicle fails to deploy its payload to the appropriate orbit, but the payload is able to reach a useable orbit via its own propulsion systems. Cases in which the payload is unable to reach a useable orbit or would use all of its fuel to do so are considered failures.

Payload Use (Orbital Launches Only)

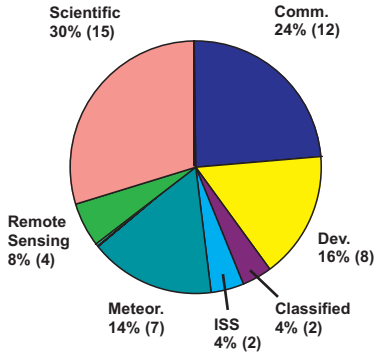
(January 2006 – September 2006)

Figure 14: First Quarter 2006 Payload Use



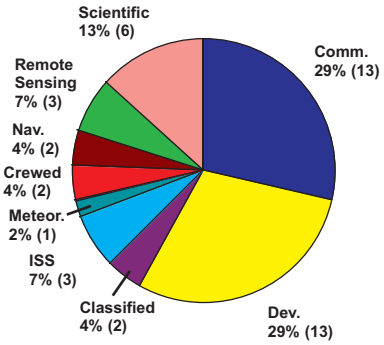
Total = 14

Figure 15: Second Quarter 2006 Projected Payload Use



Total = 50

Figure 16: Third Quarter 2006 Projected Payload Use



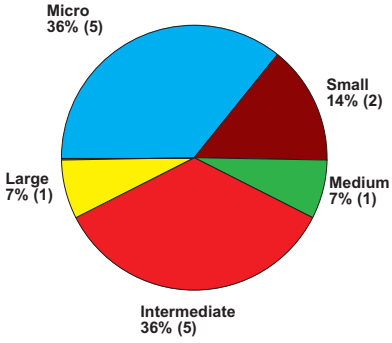
Total = 45

Figures 14-16 show total payload use (commercial and government), actual for the first quarter of 2006 and projected for the second quarter of 2006 and third quarter of 2006. The total number of payloads launched may not equal the total number of launches due to multi-manifesting, i.e., the launching of more than one payload by a single launch vehicle.

Payload Mass Class (Orbital Launches Only)

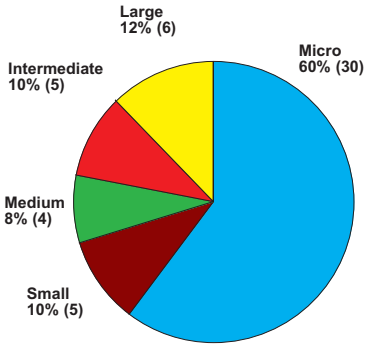
(January 2006 – September 2006)

Figure 17: First Quarter 2006 Payload Mass Class



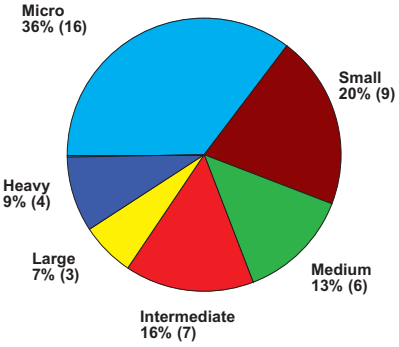
Total = 14

Figure 18: Second Quarter 2006 Projected Payload Mass Class



Total = 50

Figure 19: Third Quarter 2006 Projected Payload Mass Class



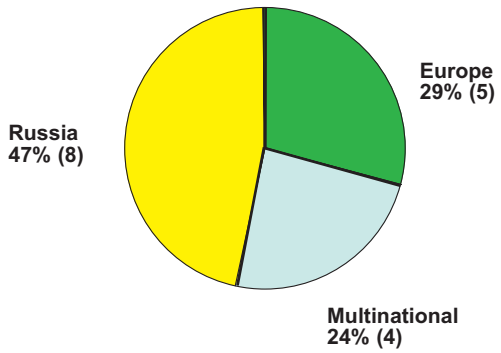
Total = 45

Figures 17-19 show total payloads by mass class (commercial and government), actual for the first quarter of 2006 and projected for the second quarter of 2006 and third quarter of 2006. The total number of payloads launched may not equal the total number of launches due to multi-manifesting, i.e., the launching of more than one payload by a single launch vehicle. Payload mass classes are defined as Micro: 0 to 91 kilograms (0 to 200 lbs.); Small: 92 to 907 kilograms (201 to 2,000 lbs.); Medium: 908 to 2,268 kilograms (2,001 to 5,000 lbs.); Intermediate: 2,269 to 4,536 kilograms (5,001 to 10,000 lbs.); Large: 4,537 to 9,072 kilograms (10,001 to 20,000 lbs.); and Heavy: over 9,072 kilograms (20,000 lbs.).

Commercial Launch Trends (Orbital Launches Only)

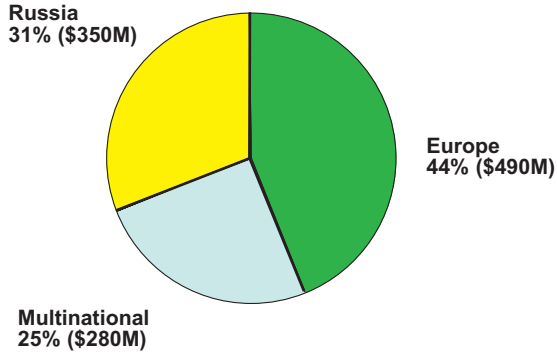
(April 2005 – March 2006)

Figure 20: Commercial Launch Events, Last 12 Months



Total = 17

Figure 21: Estimated Commercial Launch Revenue, Last 12 Months



Total = $1120M

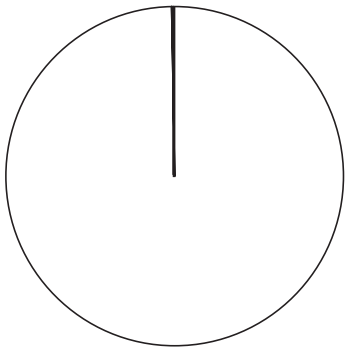
Figure 20 shows commercial orbital launch events for the period of April 2005 to March 2006 by country.

Figure 21 shows estimated commercial launch revenue for orbital launches for the period of April 2005 to March 2006 by country.

Commercial Launch Trends (Suborbital Launches Only)

(April 2005 – March 2006)

Figure 22: Commercial Suborbital Launch Events, Last 12 Months



Total = 0

Figure 22 shows commercial suborbital launch events for the period of April 2005 to March 2006 by country.

Commercial Launch History
(January 2001 – December 2005)

Figure 23: Commercial Launch Events by Country, Last Five Years

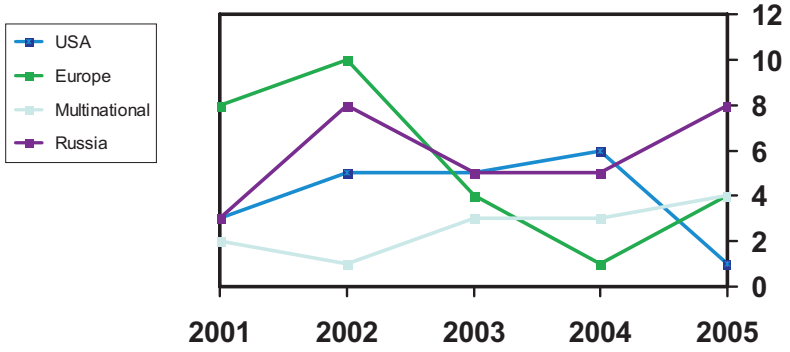


Figure 23 shows commercial launch events by country for the last five full years.

Figure 24: Estimated Commercial Launch Revenue (in $ millions) by Country, Last Five Years

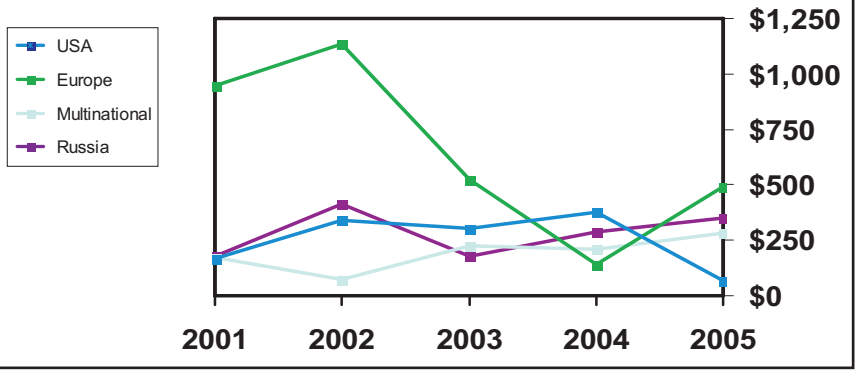


Figure 24 shows estimated commercial launch revenue by country for the last five full years.

Commercial Space and Launch Insurance: Current Market and Future Outlook

Introduction

This report represents a continuation of a series of reports published by the FAA/AST that examine the state of the space and launch insurance market. Since the last report published in the fourth quarter of 2002, notable events in the space insurance market include the following:

- Stagnant space and launch market
- Increase in market capacity in 2005 and 2006, breaking a 2002-2004 trend toward declining capacity
- Extension of the United States third-party liability indemnification regime

The layout of this report is broken down into three parts. Part one serves as a primer for understanding the space and launch insurance market. Part two will provide an analysis of the space and launch insurance market including a discussion of insurance capacity, the insurance market cycle, and current market conditions. Part three will discuss the outlook for the commercial space and launch insurance market.

Space and Launch Insurance Explained

Providing insurance for the commercial space industry is an international effort involving satellite owners, satellite manufacturers, launch services providers, insurance brokers, underwriters, financial institutions, reinsurers, and government agents worldwide. For a proper perspective of the space and launch insurance market, it is important to understand that 85-90 percent of the space and launch insurance business volume covers geostationary communications satellites.[1] However, space and launch insurance covers a wide range of space and launch activities (e.g. low Earth orbit communications constellations, commercial remote sensing satellites, commercial human space flight, etc.)

Why Do Companies Seek Space and Launch Insurance?

Satellites and their launch vehicles are designed to be reliable; however, failures do occur. Because of the large amount of risk associated with commercial space endeavors, it is important for companies to protect themselves against damage, loss, or injury. Figures 1, 2, and 3 provide a picture of the historical demonstrated risk associated with launching and operating a commercial payload.

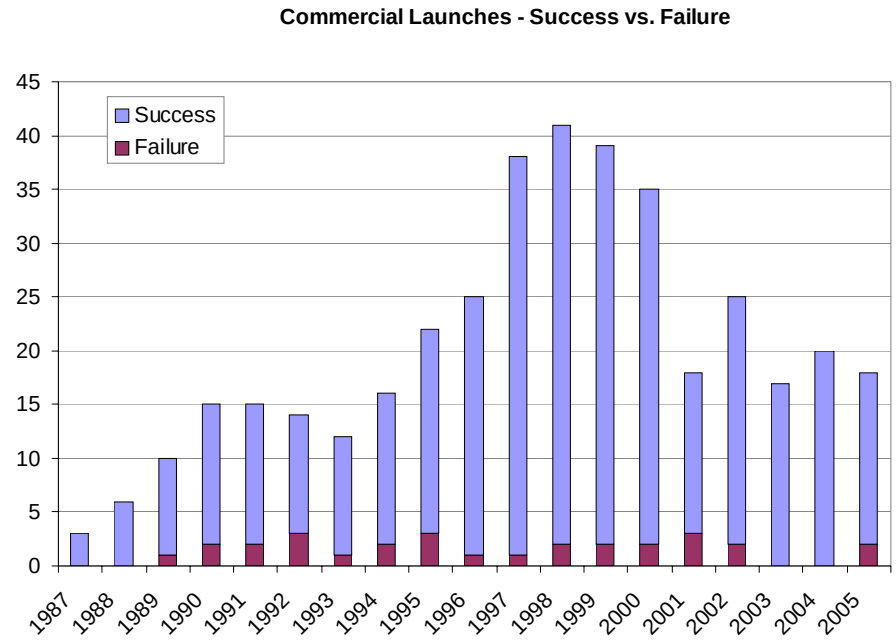


Figure 1 – Commercial Launches – Success vs. Failure by year since 1987

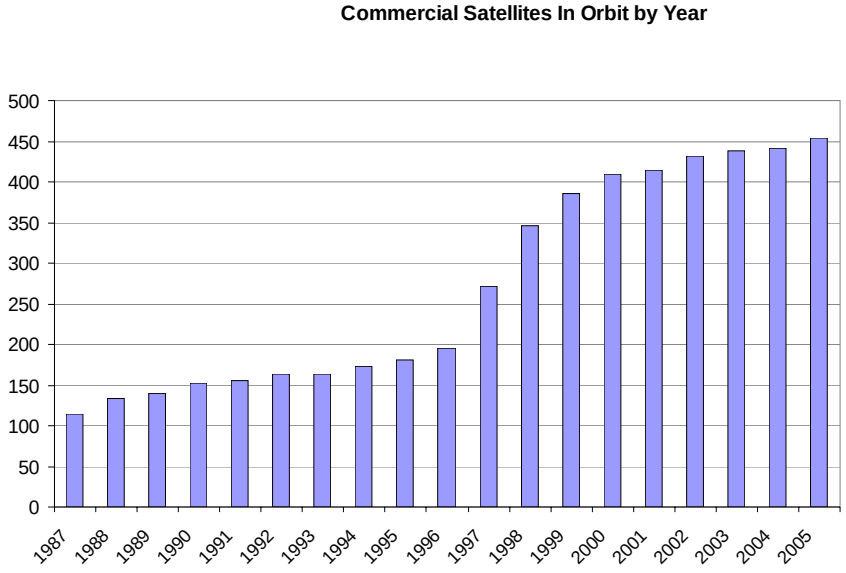


Figure 2 – Commercial Satellites In-Orbit

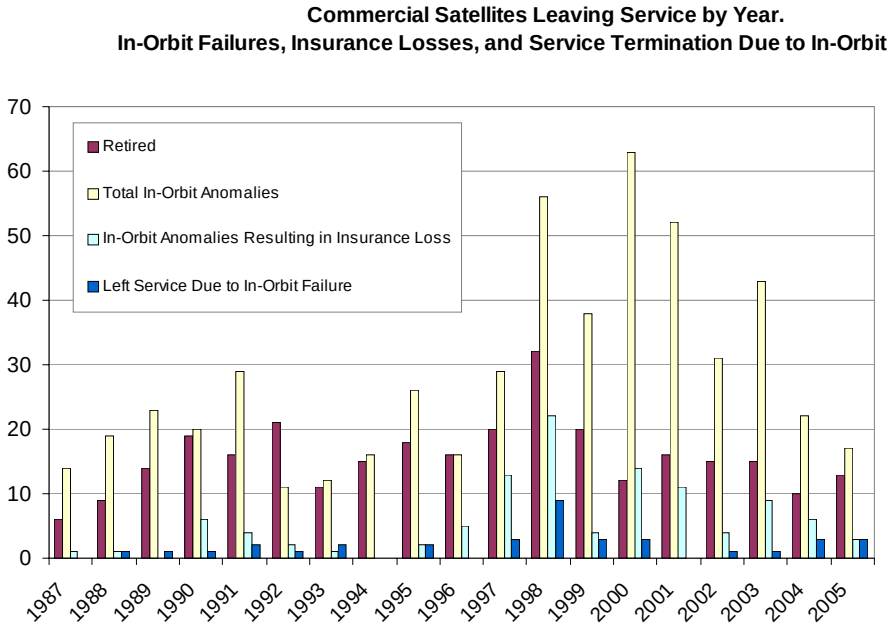


Figure 3 – Total failures, partial performance loss, and successes (for predicted lifespan) since 1987. Retired satellites are those which satellite operators have chosen to remove from service.

What Types of Space Insurance Are Available?

Space and launch insurance can be purchased to provide coverage during various phases of the lifetime of satellites and their launch vehicles including: manufacturing, pre-launch, launch, in-orbit commissioning, and in-orbit life. See Appendix A for more information on available types of insurance. The most commonly procured insurance policies cover launch, in-orbit commissioning, and in-orbit life. Over the past twenty years the majority of commercial satellite operators have procured such insurance. In certain circumstances, operators may choose to self-insure in order to mitigate risk (e.g. order production of an extra satellite as a ground spare or purchase backup protection). Most all United States government civil and military payloads and launch vehicles are self-insured by the government.

In addition to operators indemnifying themselves against loss, the FAA requires launch and re-entry licensees to purchase third-party (liability) insurance. This third-party liability insurance indemnifies a third party from loss related to hardware or mission failure (e.g. debris falling on private property). As a means of protecting the public, stimulating the commercial space and launch industry, and complying with international treaties, the United States government provides indemnification for excessive risk as detailed in United States CFR Title 49, Subtitle IX, Chapter 701, Section 70113.

It is important to note that there is some question whether the indemnification regime is necessary. The FAA has published a study on the subject titled: *Liability Risk-Sharing Regime for U.S. Commercial Space Transportation: Study and Analysis, April, 2002*. Space and launch insurance industry representatives support the indemnification regime. One representative is quoted as

saying, "I know this regime has doubters but failure to maintain this regime, I believe, in the long run could significantly harm the U.S. commercial launch business."[2] Furthermore, industry representatives believe that it may not be possible—or affordable—for commercial space and launch operators to purchase insurance on the world market capable of indemnifying the excess risk that is covered by the current U.S. indemnification regime. In 2004 the U.S. indemnification regime was extended another five years. However, debate on its necessity will be raised again when the extension runs out.

How Is Space and Launch Insurance Obtained?

The process of insuring a satellite involves a number of steps and different entities. Typically for a given launch project, either the satellite owner or manufacturer begins by choosing an insurance broker. This broker becomes the primary agent responsible for transmitting information between the insured party and the underwriters.

The underwriting process for a project begins when the satellite owner, through its broker, presents technical reports and contractual and financial information to a number of international underwriters. In order to decide what kind of coverage they can offer, the various underwriters conduct in-depth technical analyses of the satellite and the launch vehicle. The respective reliabilities of the launch vehicle variant, satellite model, and the satellite's intended orbit are evaluated. Details such as launch site location, contract specifics, and satellite value and financing are also taken into account.

When the various evaluations are complete, potential underwriters present the broker with offers containing information regarding capacity, premiums, and terms and conditions that they feel they can offer the insurance client.

How Is Space and Launch Insurance Provided?

Space and launch insurance is usually a small, specialty line of business within a larger multinational insurance conglomerate. Several of these umbrella companies offer various specialty insurance and financial services to a variety of international clients. Most of these insurance companies are publicly traded. Insurance conglomerates typically have large premium bases to protect themselves in the extremely volatile market. These conglomerates invest premium income and can return high profits on their investments, especially when located in favorable tax environments.

After negotiating a space insurance policy, many underwriters also seek protection. Reinsurers offer protection either on a similar or totally different basis. Risk is thus spread throughout the insurance/ reinsurance community (i.e. customers may choose to insure only against the third failure).

Space and Launch Insurance Market Analysis

The space and launch insurance market is a relatively volatile insurance market. The main factors that cause market volatility are the high-risk nature of launch vehicle activities and the concentration of risk in a short period of time. Generally, insurance spreads risk over either multiple events or long periods of time. In the space sector, the total number of orbital launches is small and the majority of risk occurs in an extremely short amount of time. In a typical space and launch insurance policy roughly 25 percent

of the premium is for the launch itself while 75 percent goes to cover the remaining operational lifetime of the satellite. This concentration of risk, coupled with the low frequency of launches, allows a few major launch failures to quickly change the nature of the market. Conversely, a series of successful launches can make a handsome profit for underwriters spurring further investment.

Market Capacity

An important tool for analyzing the space and launch insurance market is the concept of capacity. Capacity for a single satellite launch is the entire amount of coverage that insurance companies are willing to underwrite for the project. Total yearly space and launch market capacity is the theoretical amount of coverage available for all commercial space activities in a given year. See Figure 4 for a summary of available space and launch insurance market capacity since 1987.

The primary driver for the amount of capacity available is the underwriter return on investment. A series of launch failures and subsequent payouts will reduce insurance industry profitability causing underwriters to invest their capital in other more profitable markets. To increase insurance industry profitability, underwriters have to raise premiums in order to offset losses. A condition of low capacity and a subsequent increase in premiums is referred to as a "hard" market. Eventually high premiums restore overall insurance market profitability thereby stimulating renewed investment. More available underwriter capital allows brokers to offer lower premiums creating a "soft" market condition. This cycle between hard and soft markets is illustrated in Figure 5.

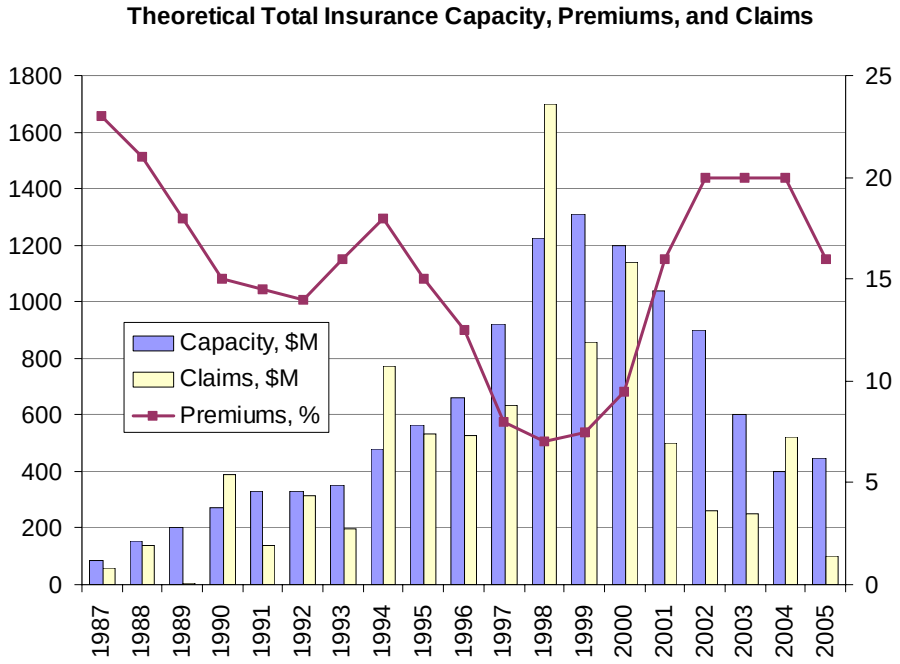


Figure 4 – Theoretical total insurance capacity available and used by year since 1980 (left y-axis). Insurance market net profitability by year (right y-axis).

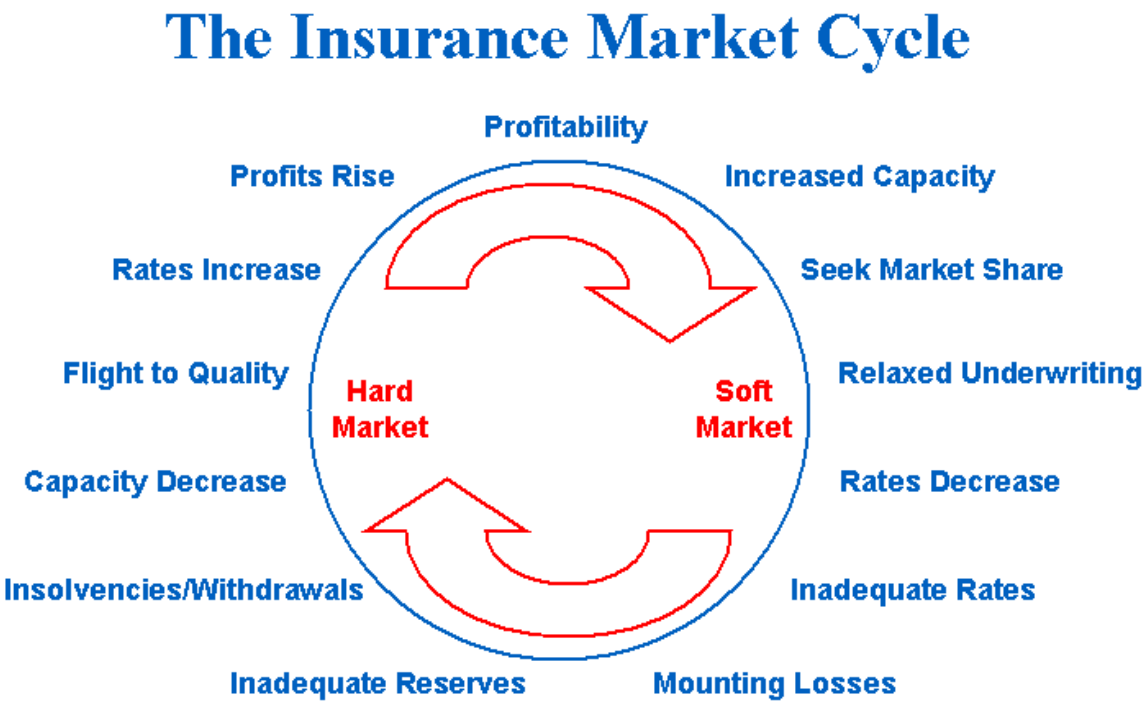


Figure 5 - Insurance Market Cycle[3]

Historical Overview

Given the volatile nature of the space and launch insurance market, the market history fluctuates in a cycle between soft and hard conditions. While the first space liability policy was written in 1965 for Comsat for the launch of EarlyBird (Intelsat I), the first commercial geostationary communications satellite, the specialized industry of space insurance really began in the 1980s with the growth of the private satellite industry. At that time underwriters started to specialize in space insurance by hiring space experts to help predict the risky nature of the space industry. After some initial volatility, in particular due to a series of dramatic losses, by the end of the 1980s the industry was becoming profitable. Insurance premiums for the most common policies for launch plus one year settled at around 15-20 percent. This profitability attracted underwriter capital, increasing space and launch insurance capacity. (See Figure 4)

The early 1990s showed increasing profitability in the space and launch insurance market, which caused ever-increasing investment in space insurance. In the last half of the 1990's the space insurance market experienced an increase in the number of underwriters writing space risks and a large increase in satellite underwriting capacity to support this expansion of business, fueled by multiple applications for GEO, LEO, and mobile systems. In response to these market forces, several changes resulted, including lower average premium rates, binding launch coverage to two or three years prior to the scheduled launch date, loosening policy terms and, most attractive of all, offering multi-year policies for in-orbit operation.

During the period from 2000 to 2004, the satellite launch risk defined as launch plus one year experienced significant changes.

The launch insurance market moved from a so-called "soft market" of ever increasing underwriting capacity and declining premium rates to a "hard market" of shrinking underwriting capacity, restrictive policy terms, and higher premium rates.

One key element of this change was the business failures of the NGSO communications networks, which caused an overall decrease in the launch rate. Sporadic large insurance payouts also contributed to the capacity downturn as underwriter profits sunk.

Since this time, underwriting practices and coverage changes have been implemented. Launch risk premiums generally are not quoted more than 12 months prior to a scheduled launch. Even after quoting and binding a launch program, if a so-called "material change" of the risk, in the opinion of underwriters, arises between binding coverage and risk inception (launch), some underwriters may seek to re-rate the risk prior to policy inception, exclude the material change, or seek to come off the risk.

Current Market Conditions

Since the last FAA report in 2002, the insurance market continued to harden through 2004. Beginning in 2005, however, the market has shown signs of softening through gradually increasing capacity coupled with slowly deceasing premiums.

A major contributor to the initial hardening of the market was a generic flaw on the Boeing 702 satellite series, which resulted in losses of six satellites launched in 2000 and 2001. The impacted satellite operators submitted claims totaling approximately US$1.5 billion for all six satellites. Premium levels did not match the submitted claim levels, thus creating an untenable imbalance. Generic satellite product failures became an underwriting challenge and most underwriters sought to exclude such failures in future policies. The BSS-702 claims severely impacted underwriters' liquidity, and for many smaller underwriters undermined their capital base.

The launch premium rates in 2000 were, in general, less than 15 percent for three-axis stabilized satellites, but since 2004 appear to be stabilizing in the range of 20 percent, plus or minus per the risk program. For many specialized launch risks the rates can be above 20 percent depending upon the satellite manufacturer, product class, maturity of the launch vehicle, and market conditions at the time of insurance placement. There may be exceptions to this figure—for example, where a multiple satellite program presented to the market by a highly respected satellite operator may yield less than 20 percent.

In-orbit satellite premium rates through 2004 also moved upward to somewhere between 2 and 4 percent per year, and unlike in the past, premiums were generally not available for more than one year at a time.

Nonetheless, the latest insurance data from 2005 indicates that the insurance market has recovered, and now is beginning to soften. Increased premiums and few payouts have allowed the space and launch insurance industry to produce a net profit in 2002, 2003, and 2004.[4] As can be seen in Figure 4, market capacity declined in 2004. In 2005, we began to see a softening in the market as industry profits attracted renewed underwriter investment in the industry. Calendar year 2006 has thus far seen a further decline in launch insurance rates.

Space and Launch Insurance Market Outlook

In 2005, we began to see an increase in available market capacity; however, further capacity increases over the next few years are predicted to be modest. The space and launch insurance market has seen net profitability every year since 2002 as a result of relatively high premiums and relatively few payouts. This trend may continue into the future. However, the stagnant space and launch market keeps the industry at a small scale. As a result, a couple of major failures could easily consume underwriter profits. In this market atmosphere, insurance underwriters may justify continued high premiums in order to attract further underwriter investment and therefore increase market capacity.

Insuring Commercial Human Spaceflight

In October of 2004, SpaceShipOne became the first commercially-built spacecraft to carry humans into space. This aerospace milestone may be the beginning of a new era of space tourism. In the new space tourism era, the space flight participants and companies that design and operate new spacecraft may be interested in purchasing insurance to mitigate the risk associated with spaceflight. Commercial human spacecraft operators are required by the FAA to purchase third party liability insurance, but they may also choose to purchase other insurance in order to mitigate financial risk. Indeed, the first space tourists, Dennis Tito and Mark Shuttleworth, both purchased insurance policies to cover their training for, transport to, and time spent in space. Insurance for commercial human space flight is an interesting new area to watch within the space and launch insurance market.

Appendix A: Main Types of Space and Launch Insurance Available

Launch Insurance
Launch insurance indemnifies the owner of a satellite for a failed launch, failed vehicle, and/or failed satellite. Premiums for launch insurance vary as market conditions change. Historically premiums are available at a cost of somewhere between 10-30 percent of total mission cost. Recent average insurance premiums are 16-20 percent.[5]

Government Property Insurance
Government property insurance indemnifies the government for loss of any government property due to launch operations. Such insurance typically requires a 1.5 to 2 percent premium.

Third Party or Liability Insurance
Liability insurance indemnifies a third party from loss related to hardware or mission failure. FAA/AST can demand up to $500 million in coverage but usually requires only $150 to $200 million, based on the results of a maximum probable loss analysis for a particular mission or class of launch vehicle. Typically this insurance sells for a 0.1 to 0.2 percent premium for large launch vehicles. Third party insurance is required for a launch license because governments are liable for injury or damage to third parties under the 1972 United Nations Convention on International Liability for Damage Caused by Space Objects. This convention obligates the launching country to assume liability for damage done by either a launcher or a satellite. Other launch providers, around the world, also require liability insurance for commercial launches.

Launch Risk Guarantees
Launch risk guarantees are a form of contractual guarantee begun by Arianespace, which is now regularly offered by many launch service providers. With this guarantee, the launch service provider provides a second launch if the first launch results in failure. In this case, the launch provider acts as the insurance company. Launch risk guarantees began as an enticement to payload owners who could not get a commitment from insurance underwriters sufficiently in advance to schedule a launch and begin manufacture of the spacecraft. A launch provider will typically offer one rate if the customer requires a cash payment in the event of failure and another rate if the customer will accept a re-launch.

In-Orbit Insurance
In-orbit insurance refers to insurance applicable during the on-orbit operations time period. It encompasses coverage for satellite owners and includes satellite life insurance, manufacturer incentive insurance, and insurance of satellites during in-orbit testing. Note that this type of insurance is for in-orbit operation only and is not related to the performance of the launch vehicle. In-orbit insurance is also available for individual satellites and for whole constellations.

Notes

[1] Kunstadter, Christopher (May 2005) “Space Insurance Experience and Outlook: A Statistical Review of Volatility” Presentation at the FAA COMSTAC May 2005
[2] Vinter, John W. (April 2005) “The Future Markets For Commercial Space” Testimony to the United States Congress
[3] United States Aviation Underwriters
[4] Interview with Christopher Kunstadter
[5] Satellite Finance Issue 78 (March 2005); Issue 86 (December 2005)

First Quarter 2006 Orbital and Suborbital Launch Events

Date		Vehicle	Site		Payload or Mission	Operator	Use	Vehicle Price	L	M
1/19/2006		Atlas 5 551	Cape Canaveral Air Force Station (CCAFS)		New Horizons	National Aeronautics and Space Administration (NASA)	Scientific	$75M	S	S
1/24/2006		H 2A 202	Tanegashima		ALOS 1	Japan Aerospace Exploration Agency (JAXA)	Remote Sensing	$85M	S	S
2/15/2006	√ +	Zenit 3SL	Odyssey Launch Platform	*	Echostar X	Echostar Communications Corporation	Communications	$70M	S	S
2/18/2006		H 2A 2024	Tanegashima		MTSat 2	Japan Ministry of Land, Infrastructure, and Transport	Meteorological	$85M	S	S
2/22/2006		M 5	Uchinoura		Akari	Institute of Space and Astronautical Science (ISAS)	Scientific	$50M	S	S
					Cute 1.7 + APD 1	Tokyo Institute of Technology	Development		S	S
3/1/2006	√	Proton M	Baikonur	*	Arabsat 4A	Arab Satellite Communications Organization (Arabsat)	Communications	$70M	F	F
3/11/2006	√	Ariane 5 ECA	Kourou		SpainSat	Hisdesat SA	Communications	$140M	S	S
				*	Hot Bird 7A	Eutelsat	Communications		S	S
3/22/2006		Pegasus XL	Vandenberg Air Force Base (VAFB)		Space Technology 5A	NASA	Development	$16M	S	S
					Space Technology 5B	NASA	Development		S	S
					Space Technology 5C	NASA	Development		S	S
3/25/2006		Falcon 1	Kwajalein Island		FalconSat 2	US Air Force (USAF) Academy	Development	$7M	F	F
3/30/2006		Soyuz	Baikonur		Soyuz ISS 12S	Russian Space Agency (Roscosmos)	ISS	$40M	S	S

√ Denotes commercial launch, defined as a launch that is internationally competed or FAA-licensed. For multiple manifested launches, certain secondary payloads whose launches were commercially procured may also constitute a commercial launch.

\+ Denotes FAA-licensed launch.

* Denotes a commercial payload, defined as a spacecraft that serves a commercial function or is operated by a commercial entity.

Notes: All prices are estimates, and vary for every commercial launch. Government mission prices may be higher than commercial prices. Ariane 5 payloads are usually multi-manifested, but the pairing of satellites scheduled for each launch is sometimes undisclosed for proprietary reasons until shortly before the launch date.

Second Quarter 2006 Projected Orbital and Suborbital Launch Events

Date			Vehicle	Site		Payload or Mission	Operator	Use	Vehicle Price
4/12/2006	√	+	Zenit 3SL	Odyssey Launch Platform	*	JCSAT 9	Japan Satellite Systems (JSAT)	Communications	$70M
4/14/2006			Minotaur	VAFB		Formosat 3 A	National Space Program Office (NSPO)	Meteorological	$14.5M
						Formosat 3 B	NSPO	Meteorological	
						Formosat 3 C	NSPO	Meteorological	
						Formosat 3 D	NSPO	Meteorological	
						Formosat 3 E	NSPO	Meteorological	
						Formosat 3 F	NSPO	Meteorological	
4/20/2006	√	+	Atlas 5 411	CCAFS	*	Astra 1KR	SES Astra	Communications	$70M
4/24/2006			Soyuz	Baikonur		Progress ISS 21P	Roscosmos	ISS	$40M
4/25/2006	√		START 1	Svobodny	*	EROS B	Imagesat International N.V.	Remote Sensing	$8.5M
4/27/2006			Long March 4B	Taiyuan		Yaogan 1	Chinese National Space Agency (CNSA)	Remote Sensing	$50M
4/28/2006			Delta 2 7420	VAFB		Calipso	NASA	Scientific	$50M
						CloudSat	NASA	Scientific	
5/3/2006			Soyuz	Plesetsk		Kosmos 2420	Russian MoD	Classified	$40M
5/20/2006	√	+	Delta 4 Medium-Plus (4,2)	CCAFS		GOES N	National Oceanic and Atmospheric Administration (NOAA)	Meteorological	$70M
5/25/2006			Shtil	Barents Sea		Kompass 2	Roscosmos	Scientific	$1.5M
5/26/2006	√		Ariane 5 ECA	Kourou	*	Thaicom 5	Shin Satellite Public Co.	Communications	$140M
					*	SatMex 6	Satelites Mexicanos S.A. de C.V.	Communications	
6/5/2006	√	+	Zenit 3SL	Odyssey Launch Platform	*	Galaxy 16	Pan American Satellite Corp. (PanAmSat)	Communications	$70M
6/8/2006			Proton K	Baikonur		KazSat 1	JSC Kazsat	Communications	$72.5M
6/13/2006	√		Dnepr 1	Dombarovskiy	*	Genesis Pathfinder 1	Bigelow Aerospace	Development	$9.5M
6/15/2006			Soyuz	Plesetsk		Resurs DK 1	Roscosmos	Remote Sensing	$40M
6/27/2006			Delta 4 Medium-Plus	VAFB		NRO L-22	DoD	Classified	$50M
6/28/2006			Soyuz	Baikonur		Progress ISS 22P	Roscosmos	ISS	$40M

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\+ Denotes FAA-licensed launch.

* Denotes a commercial payload, defined as a spacecraft that serves a commercial function or is operated by a commercial entity.

Notes: All prices are estimates, and vary for every commercial launch. Government mission prices may be higher than commercial prices. Ariane 5 payloads are usually multi-manifested, but the pairing of satellites scheduled for each launch is sometimes undisclosed for proprietary reasons until shortly before the launch date.

Second Quarter 2006 Projected Launch Events (Continued)

Date		Vehicle	Site		Payload or Mission	Operator	Use	Vehicle Price
6/28/2006	√	Dnepr 1	Baikonur		Egyptsat	Egyptian National Authority for Remote Sensing and Space Sciences	Remote Sensing	$9.5M
					AKS 1	AKC	Development	
					AKS 2	AKC	Development	
					Cubesat TBA	The Aerospace Corporation	Development	
					HAUSat 1	Hankuk Aviation University	Scientific	
					ICEcube 1	Cornell University	Scientific	
					ICEcube 2	Cornell University	Scientific	
					ION	University of Illinois	Development	
					KUTESat	Kansas University	Scientific	
					Mea Huaka'I	University of Hawaii	Scientific	
					Merope	Montana State University	Scientific	
					Ncube	Norwegian Student Satellite Project	Scientific	
					Polysat 1	Cal Poly Aerospace Engineering	Development	
					Polysat 2	Cal Poly Aerospace Engineering	Development	
					Rincon 1	University of Arizona at Tucson	Scientific	
					Sacred	University of Arizona at Tucson	Scientific	
					SaudiComsat 3	Space Research Institute	Communications	
					SaudiComsat 4	Space Research Institute	Communications	
					SaudiComsat 5	Space Research Institute	Communications	
					SaudiComsat 6	Space Research Institute	Communications	
					SaudiComsat 7	Space Research Institute	Communications	
					Saudisat 3	Space Research Institute	Scientific	
					SEEDS	Nihon University	Scientific	
2Q/2006	√	Proton M	Baikonur	*	AMC 14	SES Americom	Communications	$70M
2Q/2006	√	PSLV	Satish Dhawan Space Center		AGILE	Italian Space Agency (ASI)	Scientific	
					LAPAN-TUBSAT	Indonesia National Institute of Aeronautics and Space (LPAN)	Development	$20M

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Third Quarter 2006 Projected Orbital and Suborbital Launch Events

Date		Vehicle	Site		Payload or Mission	Operator	Use	Vehicle Price
7/1/2006		Shuttle Discovery	Kennedy Space Center (KSC)		STS 121	NASA	Crewed	N/A
					ISS ULF-1.1	NASA	ISS	
7/7/2006	√	Proton M	Baikonur	*	Hot Bird 8	Eutelsat	Communications	$70M
7/17/2006		Soyuz	Baikonur		Metop 1	Eumetsat	Meterological	$40M
7/22/2006		Delta 2 7925H-10L	CCAFS		STEREO A	NASA	Scientific	$50M
					STEREO B	NASA	Scientific	
7/28/2006	√	Rockot	Plesetsk		Kompsat 2	Korea Aerospace Research Institute (KARI)	Remote Sensing	$13.5M
7/2006	√ +	Zenit 3SL	Odyssey Launch Platform	*	KoreaSat 5	Korea Telecom	Communications	$70M
7/2006		GSLV	Satish Dhawan Space Center	*	Insat 4C	Indian Space Research Organization (ISRO)	Communications	$20M
7/2006		Long March 3B	Xichang		Sinosat 2	CNSA	Communications	$60M
7/2006		H 2A	Tanegashima		IGS 3A	Japan Defense Agency	Classified	$85M
					IGS 3B	Japan Defense Agency	Classified	
8/28/2006		Shuttle Atlantis	KSC		STS 115	NASA	Crewed	N/A
					ISS 12A	NASA	ISS	
8/2006	√	Proton M	Baikonur	*	Arabsat 4B	Arabsat	Communications	$70M
8/2006	√	Ariane 5 ECA	Kourou	*	JCSAT 10	Japan Satellite Systems (JSAT)	Communications	$140M
					Syracuse 3B	Delegation Generale pour l'Armement (DGA)	Communications	
9/13/2006		Soyuz	Baikonur		Soyuz ISS 13S	Roscosmos	ISS	$40M
9/14/2006		Delta 2 7925-10	CCAFS		Navstar GPS 2RM-2	USAF	Navigation	$50M
9/26/2006		M 5	Uchinoura		Solar-B	ISAS	Scientific	$50M
9/29/2006		Pegasus XL	VAFB		AIM Explorer	NASA	Scientific	$16M

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Third Quarter 2006 Projected Launch Events (Continued)

Date		Vehicle	Site		Payload or Mission	Operator	Use	Vehicle Price
9/2006		Soyuz	Baikonur		GIOVE B	European Space Agency (ESA)	Navigation	$40M
9/2006		PSLV	Satish Dhawan Space Center		SRE 1	Indian Space Research Organization (ISRO)	Development	$20M
					Cartosat 2	ISRO	Remote Sensing	
					Anusat	ISRO	Communications	
3Q/2006	√	Proton M	Baikonur	*	Measat 3	Binariang Satellite Systems Sdn Bhd	Communications	$70M
3Q/2006		Ariane 5 TBA	Kourou		Skynet 5A	British Defense Ministry	Communications	$100M
3Q/2006	√ +	Zenit 3SL	Odyssey Launch Platform	*	NSS 8	New Skies Satellites N.V.	Communications	$70M
3Q/2006	√	Ariane 5 TBA	Kourou	*	AMC 18	SES Americom	Communications	$70M
3Q/2006		Dnepr 1	Baikonur		BelKA	National Academy of Sciences of Belarus	Remote Sensing	$9.5M
					ALMASat 1	University of Bologna	Development	
					AtmoCube	University of Trieste	Scientific	
					Baumanets	Bauman Moscow State Technical University	Development	
					CanX-2	University of Toronto	Development	
					CubeSat RAFT	US Naval Academy	Development	
					Funsat	University of Florida	Development	
					JAESat Master Satellite	Australian Space Research Institute	Development	
					JAESat Slave Satellite	Australian Space Research Institute	Development	
					KatySat 1	Stanford University	Development	
					KiwiSat	Amsat ZL	Communications	
					Palamede	University of Milan	Development	
					PolySat 3	Cal Poly Aero. Engineering	Development	
					SaudiSat 4	Space Research Institute (S.A.)	Scientific	
					UCISat 1	University of California Irvine	Development	
					UniSat 4	University of Rome	Development	

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