



*Associate Administrator for Commercial Space Transportation  
Federal Aviation Administration*

*January 2004*

# **Commercial Space Transportation: 2003 Year In Review**





**Cover description:** The Sea Launch Odyssey Launch Platform, having been guided to the proper launch coordinates, is prepared for the launch of a Zenit 3SL carrying EchoStar 9 on August 7, 2003.

## INTRODUCTION

The *Commercial Space Transportation: 2003 Year in Review* summarizes U.S. and international launch activities for calendar year 2003 and provides a historical look at the past five years of commercial launch activities.

The Federal Aviation Administration's Associate Administrator for Commercial Space Transportation (FAA/AST) licensed eight commercial orbital launches in 2003, all of which were successful.

Of the eight FAA/AST-licensed launches in 2003, five were of U.S.-built vehicles. International Launch Services (ILS) launched two Atlas 3B vehicles, with one carrying AsiaSat 4 to geosynchronous Earth orbit (GEO) and the other lofting the final satellite for the U.S. Navy's UHF constellation to GEO. ILS also launched two Atlas 5 vehicles, sending Hellas Sat's second satellite and Cablevision's Rainbow 1 to GEO. In June, Orbital Sciences Corporation (OSC) successfully launched a Pegasus XL carrying the OrbView 3 remote sensing satellite to low Earth orbit (LEO).

Boeing Launch Services (BLS) fulfilled three contracts for the commercial launches of Thuraya 2, Echostar 9, and Galaxy 13 to GEO, each aboard a Ukrainian-built Zenit 3SL provided by Sea Launch, LLC.

Worldwide there were 63 orbital launches, including two launch failures. Of those 63, there were 17 commercial orbital launches, 27 percent of the total for the year. The 17 commercial launches represent a 29 percent decrease from 2002. FAA/AST-licensed launch activity accounted for 47 percent of the worldwide commercial launch market in 2003. Arianespace captured 24 percent of the commercial launch market with only four launches, a marked decrease from previous years for the company. Russia conducted five commercial launch campaigns, bringing its commercial launch market share to about 29 percent for the year.

FAA/AST issued no licenses for suborbital launch events in 2003; however, the FAA/AST does expect suborbital launches by new vehicles in 2004.

### ABOUT THE ASSOCIATE ADMINISTRATOR FOR COMMERCIAL SPACE TRANSPORTATION (AST)

The Federal Aviation Administration's Associate Administrator for Commercial Space Transportation (FAA/AST) licenses and regulates U.S. commercial space launch and reentry activity as authorized by Executive Order 12465 (*Commercial Expendable Launch Vehicle Activities*) and 49 United States Code Subtitle IX, Chapter 701 (formerly the *Commercial Space Launch Act*). AST's mission is to license and regulate commercial launch and reentry operations to protect public

health and safety, the safety of property, and the national security and foreign policy interests of the United States. Chapter 701 and the 1996 *National Space Policy* also direct the Federal Aviation Administration to encourage, facilitate, and promote commercial launches and reentries.

Additional information concerning commercial space transportation can be found on AST's web site at <http://ast.faa.gov>.

## DEFINITIONS

The following definitions apply to the *Commercial Space Transportation: 2003 Year in Review*.

### COMMERCIAL SUBORBITAL OR ORBITAL LAUNCH

A commercial suborbital or orbital launch has one or both of the following characteristics:

- The launch is licensed by FAA /AST.
- The primary payload's launch contract was internationally competed (see definition of internationally competed below). A primary payload is generally defined as the payload with the greatest mass on a launch vehicle for a given launch.

### COMMERCIAL PAYLOAD

A commercial payload is described as having one or both of the following characteristics:

- The payload is operated by a private company.
- The payload is funded by the government, but provides satellite service partially or totally through a private or semi-private company. This distinction is usually applied to certain telecommunication satellites whose transponders are partially or totally leased to a variety of organizations, some or all of which generate revenues. Examples are Russia's Express and Ekran series of spacecraft.

All other payloads are classified as non-commercial (government-civil, government-military, or non-profit).

### INTERNATIONALLY COMPETED

An internationally competed launch contract is one in which the launch opportunity was available in principle to any capable launch service provider. Such a launch is considered commercial.

### ORBITS

- A spacecraft in geostationary Earth orbit (GEO) is synchronized with the Earth's rotation, orbiting once every 24 hours, and appears to an observer on the ground to be stationary in the sky. GEO is a broader category used for any circular orbit at an altitude of 35,852 kilometers (22,277 miles) with a low inclination (i.e., over the equator).
- Non-geosynchronous orbit (NGSO) satellites are those in orbits other than GEO. They are located in LEO (lowest achievable orbit to about 2,400 kilometers, or 1,491 miles), medium Earth orbit (MEO, 2,400 kilometers to GEO), and all other high or elliptical orbits or trajectories. ELI is used to describe a highly elliptical orbit (such as those used for Russian Molniya satellites), and EXT is a designation used for orbits beyond GEO (such as interplanetary trajectories).

2003 FAA-LICENSED LAUNCH SUMMARY

Five of the eight FAA/AST-licensed commercial orbital launches for 2003 were conducted from U.S. ranges, while three launches were conducted from the Sea Launch Odyssey platform in the Pacific Ocean. All eight orbital flights were successfully executed for commercial customers, with none carrying multiple payloads. The eight FAA-licensed launches are listed in Table 1.

The eight FAA-licensed launches included the following characteristics:

- Seven launches were to GEO, and one to LEO.
- Revenue worth approximately US\$529 million.<sup>1</sup> This includes the launch of an Atlas 3B for the U.S. Navy.

FAA-licensed launches decreased in frequency each year from 1999 to 2001, with a steady annual increase evident from 2001 through 2003 (see Figure 1). A similar trend was observed for estimated FAA-licensed commercial orbital launch revenues (see Figure 2).

Figure 1. FAA-Licensed Orbital Launch Events

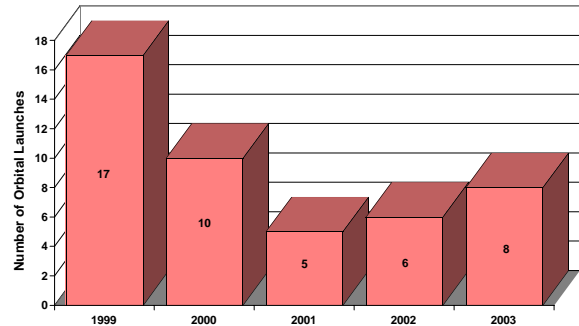


Figure 2. Estimated Revenues for FAA-Licensed Orbital Launch Events

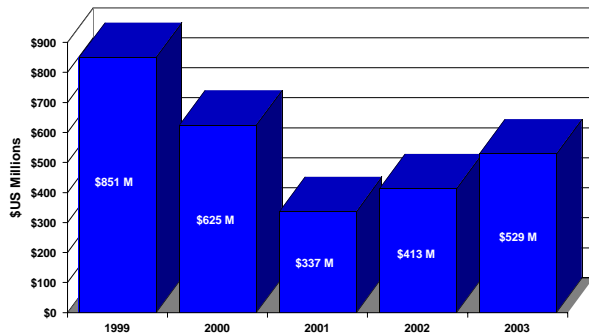


Table 1. 2003 FAA-Licensed Orbital Launch Events

Date	Vehicle	Payload	Launch Outcome	Orbit
Apr 11	Atlas 3B	AsiaSat 4	Success	GEO
May 13	Atlas 5 401	Hellas-Sat 2	Success	GEO
Jun 10	Zenit 3SL	Thuraya 2	Success	GEO
Jun 26	Pegasus XL	OrbView 3	Success	LEO
Jul 17	Atlas 5 521	Rainbow 1	Success	GEO
Aug 7	Zenit 3SL	EchoStar 9	Success	GEO
Sep 30	Zenit 3SL	Galaxy 13	Success	GEO
Dec 17	Atlas 3B	UHF F11	Success	GEO

<sup>1</sup> Revenues for both U.S. and foreign commercial launches are based on open source information and estimates by FAA/AST and are approximations only. Actual revenue received for a single launch may be spread over several years.

**U.S. AND FAA-LICENSED ORBITAL LAUNCH ACTIVITY IN DETAIL**

The United States carried out a total of 23 launches in 2003 (not including Sea Launch), five of which were licensed by FAA/AST. Sea Launch conducted three commercial launches, all of which were licensed by the FAA. See Table 2 for a detailed breakdown of U.S. launch activity (including Sea Launch) during 2003 by vehicle.

**BOEING LAUNCH SERVICES (BLS)**

Sea Launch successfully conducted three commercial launches in 2003. The Zenit 3SL is launched from the mobile Odyssey Launch Platform along the equator on the Pacific Ocean. The company sent Thuraya 2 to GEO in June, followed by EchoStar 9 in August, and Galaxy 13 in September. These three launches were done relatively rapidly in a four month period. Sea Launch plans five to six vehicles in 2004. The rapid turnaround of the three launches within a four-month period suggests that Sea Launch’s plan to launch five to six Zenit 3SL vehicles in 2004 is reasonable. Boeing, which markets the Zenit 3SL, is the majority shareholder (40 percent) of Sea Launch, LLC, whose partners include








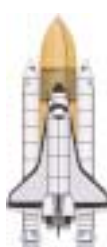


S. P. Korolev Rocket and Space Corporation Energia of Russia (25 percent), Kvaerner of Norway (20 percent), and SDO Yuzhnoye/PO Yuzhmash of Ukraine (15 percent).

Currently, BLS only offers the Zenit 3SL for commercial launches. Due to the downturn in prices and demand, Boeing has suspended submitting the Delta 4 in bids for commercial launch contracts and relies on the Zenit 3SL to address commercial customer needs. The Delta 4 remains active for government missions and made two successful launches in 2003.

**INTERNATIONAL LAUNCH SERVICES (ILS)**

ILS, a joint venture since 1995 between Lockheed Martin, Khrunichev State Research and Production Space Center, and S. P. Korolev Rocket and Space Corporation Energia, markets launch services using the Atlas and Proton vehicles. There were six successful launch campaigns in 2003, including one Russian Proton vehicle. Among the five Atlas launches, one was a non-commercial mission for the National Reconnaissance

**Table 2. U.S. and FAA-Licensed Launch Vehicle Performance in 2003**

	United States									Sea Launch
										
<b>Vehicle</b>	Pegasus XL	Titan 2	Delta 2	Atlas 2	Atlas 3	Atlas 5	Delta 4	Shuttle	Titan 4	Zenit 3SL
<b>2003 Total Launches</b>	4	2	7	1	2	2	2	1	2	3
<b>2003 Licensed Launches</b>	1	0	0	0	2	2	0	0	0	3
<b>Launch Reliability (2003)</b>	4/4 100%	2/2 100%	7/7 100%	1/1 100%	2/2 100%	2/2 100%	2/2 100%	1/1 100%	2/2 100%	3/3 100%
<b>Launch Reliability (Last 10 Years)</b>	28/31 90%	9/9 100%	70/71 99%	51/51 100%	4/4 100%	3/3 100%	3/3 100%	54/54 100%	26/29 90%	10/11 91%
<b>Year of First Launch</b>	1993	1964	1990	1991	2000	2002	2002	1981	1989	1999
<b>Launch Sites</b>	CCAFS, VAFB, Wallops	VAFB	CCAFS, VAFB	CCAFS, VAFB	CCAFS	CCAFS	CCAFS, VAFB	KSC	CCAFS, VAFB	Odyssey Pacific Ocean Platform
<b>LEO kg (lbs)</b>	443 (977)	1,900 (4,200)	4,887 (10,751)	8,298 (18,256)	10,764 (23,709)	12,500 (27,558)	11,475 (25,300)	23,435 (51,557)	20,822 (45,808)	15,246 (33,541)
<b>GTO kg (lbs)</b>	--	--	1,769 (3,892)	3,833 (8,433)	4,500 (9,920)	7,640 (16,843)	6,565 (14,475)	5,663 (12,459)	8,276 (18,207)	6,000 (13,228)

CCAFS - Cape Canaveral Air Force Station, KSC - Kennedy Space Center, VAFB - Vandenberg Air Force Base  
 Note: Launch reliability is determined by analyzing the number of successful and failed launches of a particular vehicle; mission outcome (success or failure) is not used in the calculation of launch vehicle reliability.

Office (NRO). Five commercial launches were conducted using each of three existing Atlas variants; however, one of those launches, that of a NRO payload aboard an Atlas 2AS, was not a commercial launch. An Atlas 5 401 successfully placed Hellas-Sat 2 into GEO in late spring, and an Atlas 5 521 successfully placed Cablevision's Rainbow 1 into GEO in July. Earlier in the year, an Atlas 3B was successfully launched carrying the GEO-bound AsiaSat 4, while another Atlas 3B was used in December to send the last UHF Follow-On satellite to GEO for the Department of Defense.

#### **ORBITAL SCIENCES CORPORATION (OSC)**

OSC, which focuses on providing small launch vehicles and payloads, launched one commercial Pegasus XL carrying ORBIMAGE's OrbView 3 in late June. The OrbView 3 launch, considered captive because the payload was designed to interface only with the Pegasus XL vehicle, is nevertheless considered commercial because it was licensed by FAA/AST. During the same year, OSC successfully launched three other Pegasus XL vehicles carrying U.S. Government payloads.

2003 WORLDWIDE LAUNCH ACTIVITY

Launch providers from the United States, Russia, Europe, China, Japan, India, and the multinational consortium Sea Launch conducted a total of 63 launch events in 2003 (see Table 3 and Figure 3), 17 of which were commercial. See Table 4 for a list of non-FAA-licensed commercial launches.

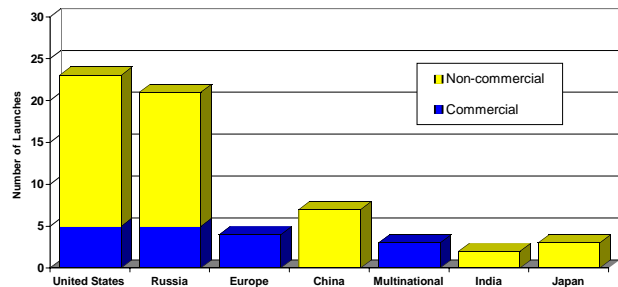
Table 3. 2003 Worldwide Orbital Launch Events

	Commercial Launches	Non-commercial Launches	Total Launches
United States	5	18	23
Russia	5	16	21
Europe	4	0	4
China	0	7	7
Multinational	3	0	3
India	0	2	2
Japan	0	3	3
TOTAL	17	46	63

Table 4. 2003 Non-FAA-Licensed Commercial Launch Events

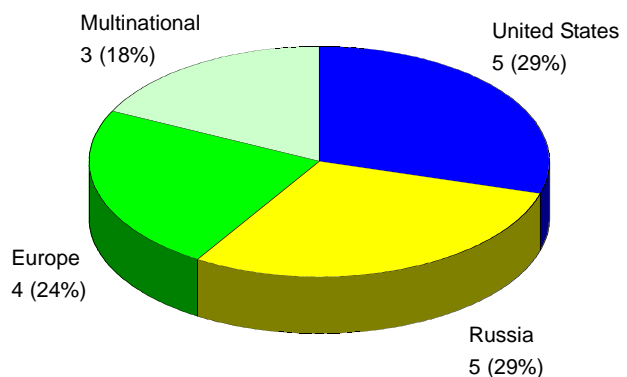
Date	Vehicle	Payload(s)	Launch Outcome	Orbit
Feb 15	Ariane 44L	Intelsat 907	Success	GEO
Apr 9	Ariane 5G	Insat 3A	Success	GEO
		Galaxy 12		GEO
Jun 2	Soyuz	Mars Express	Success	EXT
		Beagle 2		EXT
Jun 7	Proton K	AMC 9	Success	GEO
Jun 11	Ariane 5G	BSat 2C	Success	GEO
		Optus C1		GEO
Sep 27	Cosmos 3M	BiSat 1	Success	LEO
		BNSCSat		LEO
		Kaistsat 4		LEO
		Larets		LEO
		Mozhayets 4		LEO
		NigeriaSat 1		LEO
		Rubin 4-DSI		LEO
Sep 27	Ariane 5G	Insat 3E	Success	GEO
		eBird		GEO
		SMART 1		EXT
Oct 30	Rockot	SERVIS 1	Success	LEO
Dec 28	Soyuz	Amos 2	Success	GEO

Figure 3. 2003 Total Worldwide Launch Activity



The U.S. and Russia each conducted five commercial launches in 2003, with Europe launching four (see Figure 4), and Sea Launch close behind with three successful launch campaigns. Commercial launch providers in the United States and Russia each captured 29 percent of the launch industry’s global commercial market share. Europe’s four commercial launches represented a 24 percent market share. Sea Launch’s three commercial launches accounted for 18 percent of the market. China, Japan, and India did not conduct any commercial launches in 2003. The Appendix at the end of this report shows all 63 orbital launches worldwide in 2003 for commercial, civil, and military missions.

Figure 4. 2003 Worldwide Commercial Market Share



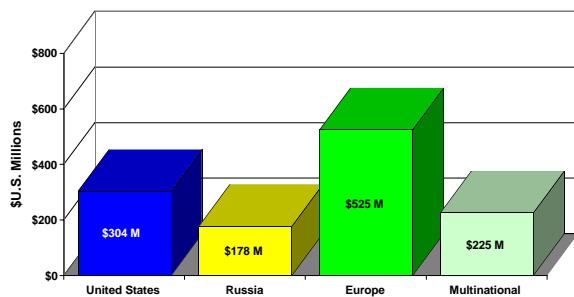
TOTAL: 17  
Commercial Orbital Launches



## WORLDWIDE LAUNCH REVENUES

Revenues from the 17 commercial launch events in 2003 were an estimated US\$1.2 billion, a 37 percent decrease from the 2002 total of approximately US\$1.9 billion. U.S. commercial launch revenues for 2003 were estimated to be US\$304 million; Russian revenues were about US\$178 million; European revenues were about US\$525 million; and Sea Launch earned approximately \$225 million (see Figure 5). Prices for individual launches to GEO dropped significantly during 2000-2003 compared to prior years. Although Europe has one less launch than the U.S. or Russia, Ariane vehicles can carry two satellites and gain more revenue per launch.

**Figure 5. 2003 Commercial Launch Revenues (approximate)**



Launch revenues are attributed to the country in which the primary vehicle manufacturer is based, with the exception of Sea Launch, which is designated simply as “multinational.” In the past, this method has worked well because most launch vehicles were manufactured, sold and launched by the same organization entirely in one country or, in the case of Europe, within a particular economic region.

With the rise of multinational launch service corporations, however, a clean division of revenue among countries for particular launches is becoming more difficult. For example, Russian launch activity is conducted in partnership with American and European launch service providers through a number of joint ventures. ILS markets launches of the Russian Proton vehicle in addition to the Atlas series. In 2003 the company made roughly US\$288 million conducting commercial launches of the Atlas vehicle family and about US\$73 million using the Proton K. Starsem, a French-Russian partnership, provides commercial launches of the Soyuz vehicle. The company successfully launched the European Space Agency’s (ESA) Mars Express (with Beagle 2) and Amos 2 payloads. The multinational Sea Launch represents a partnership among four organizations in four countries and launches from its own facility in international waters.

Because of the proprietary nature of business transactions and the internal financing of each organization, it is difficult to determine from estimated shared revenue totals the exact revenue amount earned for each launch service provider per year or characterize them in terms of allocated percentages between international partners. This is also true of some major component suppliers, such as NPO Energomash of Russia, which provides the RD-180 engines used to power the U.S. Atlas 3 and 5 vehicles.

WORLDWIDE ORBITAL PAYLOAD SUMMARY

Sixty-three launch vehicles carried a total of 91 payloads in 2003 (see Figure 6, Figure 7, and Table 5). Seventeen of these launches were commercial, and 46 were non-commercial (Figure 8).

Of the 91 payloads, 20 provide commercial services (including one captive satellite from the U.S. and three from Russia - these launches were not internationally competed) and 71 were for government, scientific, or non-profit purposes.

Figure 6. 2003 Total Worldwide Launch Activity by Payloads

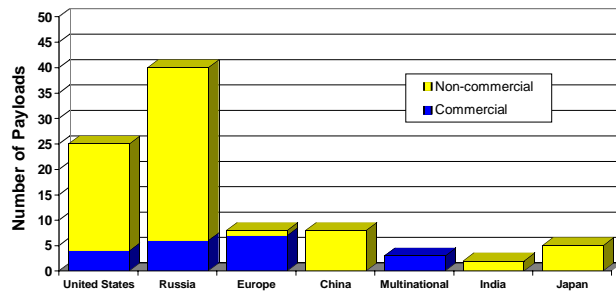


Table 5. Payloads Launched by Country in 2003

	Commercial Payloads (by service type)	Non-commercial Payloads (by service type)	Total Payloads
United States	4	21	25
Russia	6	34	40
Europe	7	1	8
China	0	8	8
Multinational	3	0	3
India	0	2	2
Japan	0	5	5
<b>TOTAL</b>	<b>20</b>	<b>71</b>	<b>91</b>

Figure 7. Total Payloads Launched by Country in 2003

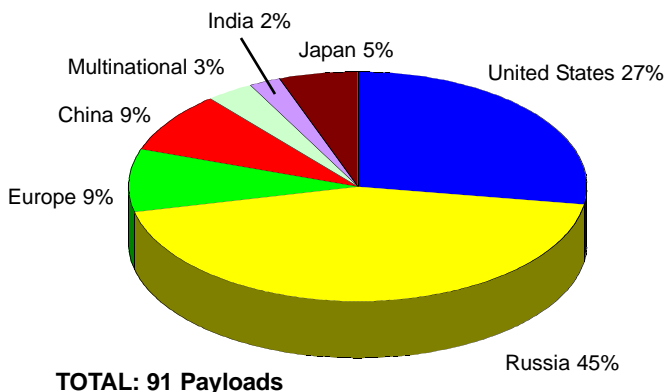
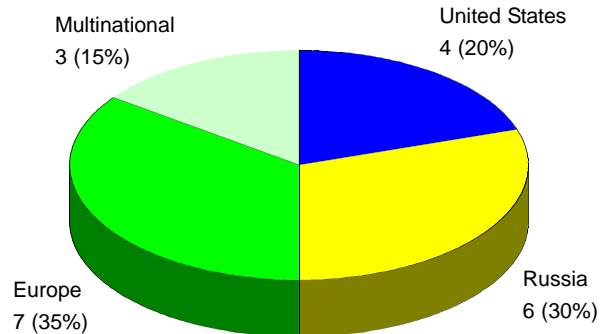


Figure 8. Commercial Payloads Launched by Country in 2003



TOTAL: 20 Payloads

COMMERCIAL LAUNCHES

Seventeen commercial launches carried a total of 28 commercial and non-commercial payloads into orbit, all of which reached their intended orbit.

Sixteen payloads were launched to provide commercial services:

- Fifteen of these were GEO satellites (AMC 9, Amos 2, AsiaSat 4, BSat 2C, eBird, EchoStar 9, Galaxy 12 and 13, Hellas-Sat 2, Insat 3A and 3E, Intelsat 907, Optus C1, Rainbow 1, and Thuraya 2); and
- One was a LEO satellite (OrbView 3).

Twelve payloads were launched to perform government or non-profit missions:

- Six civil satellites were launched to LEO (Bilsat 1, BNSCSat, Kaistsat 4, Nigeriasat 1, RUBIN 4-DSI, SERVIS 1), and three were launched on inter-planetary trajectories (Beagle 2, Mars Express, SMART 1);
- One military satellite was launched to GEO (UHF F11) and one to LEO (Larets); and
- One non-profit was launched to LEO (Mozhayets 4).

**NON-COMMERCIAL LAUNCHES**

Of the 63 orbital launches, 46 were non-commercial launches carrying a total of 63 commercial and non-commercial payloads, two of which did not achieve orbit.

Four payloads were launched to provide commercial services:

- Express AM22, QuakeSat, Yamal 201 and 202

Only one mission was launched by the U.S. Space Shuttle:

- STS-107, a scientific mission not associated with the International Space Station (ISS). This Shuttle Columbia mission, launched on January 16, 2003, ended in failure during reentry on February 1, killing all seven astronauts onboard. Flights of the Space Shuttle are not expected to resume until changes pursuant to the Columbia Accident Investigation Board (CAIB) recommendations are implemented. The next flight, mission STS-114 to the ISS, is tentatively planned for late 2004.

Twenty-six payloads were launched for military purposes:

- Eleven U.S. payloads (Coriolis, DMSP 5D-3-F16, DSCS 3-13 and 3-14, Milstar F6, Navstar GPS 2R-8 through 2R-10, USA 171, USA 173, and XSS-10);

- Eleven Russian payloads (Gruzomaket, Molniya 1T, Molniya 3-53, and Kosmos 2397 through 2404); and
- Four Japanese satellites (IGS 1A and 1B, and IGS 2A and 2B).

Excepting the Shuttle mission listed above, 32 payloads were launched for civil or non-profit purposes:

- Eight U.S. payloads (CHIPSat, GALEX, ICESat, Opportunity, Scisat 1, SORCE, Spitzer Space Telescope, and Spirit); and
- Twenty-four foreign payloads (AAU Cubesat, Beidou 3, CanX-1, CBERS/Ziyuan 2, Chuang Xing 1, CubeSat XI, CUTE, Double Star Equator, DTUsat, Gsat 2, Hayabusa, IRS P6, Jiangbing 4, Mimosa, Monitor E Mockup, MOST, Progress 10P through 12P, PS 2, Shenzhou 5, Soyuz 6S and 7S, and Zhongxing 20).

Two non-commercial launches ended in failure and the satellites did not achieve orbit:

- China's Kaitouzhe 1 carrying PS 2 on September 16; and
- Japan's H 2A 2024 carrying IGS 2A and 2B on November 29.

LAUNCH ACTIVITIES BY COUNTRY

RUSSIA







In 2003 Russia launched 21 vehicles, and of these, five were commercial launches. Russia launched only one commercial Proton K vehicle, marketed by ILS, carrying AMC 9. Eurockot, a joint venture between EADS Astrium and Khrunichev State Research and Production Space Center, launched two Rockot vehicles. One of these was a commercial launch carrying SERVIS 1 for the Japanese Aerospace Exploration Agency (JAXA). One commercial launch of a Cosmos 3M vehicle, procured through Puskovye Uslugi, carried seven payloads for customers around the world (Italy, Nigeria, South Korea, Russia, Turkey, UK) in September. Finally, Starsem, a joint venture between European and Russian companies founded in 1996, conducted two commercial launches using the Soyuz vehicle. One was of ESA's Mars Express and Beagle 2, launched together, and of Israel's Amos 2, launched in late December. See Table 6 for a detailed breakdown of Russian launch activity during 2003 by vehicle.

were Soyuz vehicles carrying Progress modules (ISS 10P, 11P and 12P), and two were Soyuz vehicles carrying replacement Soyuz modules for use as ISS lifeboats (ISS 6S and 7S). In addition, Russia conducted eight military launches, each carrying one or more satellites, and one civil launch (not including the ISS-related launches mentioned above). The military launches included two Molniya communications satellites (Molniya 3-35 and Molniya 1T) on separate Molniya launch vehicles, two intelligence satellites (Kosmos 2397 on a Soyuz and 2399 on a Proton K), four navigation satellites (Kosmos 2398 on a Cosmos 3M and Kosmos 2402 through Kosmos 2404 on a Proton K), and two communications satellites (Kosmos 2400 and 2401 on a Cosmos 3M). The inaugural launch of a Strela vehicle also took place, carrying a test package called Gruzomaket. The Strela is a modified SS-19 intercontinental ballistic missile (ICBM). The sole non-ISS civil launch was of a Rockot carrying AAU Cubesat, CanX-1, Cubesat XI, CUTE, DTU sat, Mimosa, Monitor E Mockup (the primary payload), MOST, and QuakeSat.

Russia also conducted 16 non-commercial launches, some of which were dedicated to resupplying the ISS. Of these 16, three

Two non-commercial launches were of Proton K vehicles, one carrying Express AM22, and another carrying Yamal 201 and

Table 6. Russian Vehicle Performance in 2003

						
<b>Vehicle</b>	Strela	Rockot	Cosmos 3M	Molniya	Soyuz	Proton K
<b>2003 Total Launches</b>	1	2	3	2	8	5
<b>Launch Reliability (2003)</b>	1/1 100%	2/2 100%	3/3 100%	2/2 100%	8/8 100%	5/5 100%
<b>Launch Reliability (Last 10 Years)</b>	1/1 100%	6/6 100%	30/31 97%	24/24 100%	99/102 97%	81/87 93%
<b>Year of First Launch</b>	2003	1994	1964	1960	1963	1967
<b>Launch Sites</b>	Baikonur	Plesetsk Baikonur	Plesetsk	Plesetsk	Baikonur Plesetsk	Baikonur
<b>LEO kg (lbs)</b>	1,700 (3,748)	1,800 (3,970)	1,350 (2,970)	1,800 (3,960)	6,708 (14,758)	19,760 (46,999)
<b>GTO kg (lbs)</b>	--	--	--	1,600 (3,520)	1,350 (2,975)	4,430 (10,868)



202, all three communications satellite providing commercial services to Russia and other points in Asia. Both launches are considered non-commercial because the launch contracts were not internationally competed.

**EUROPE**

Europe conducted only four launches in 2003, all of which were commercial. Of the four launches, one was conducted using the Ariane 4 family of vehicles, with the remaining three launches represented by the Ariane 5 series. The last Ariane 4 in the inventory, an Ariane 44L, was used to send Intelsat 907 to GEO. Soon after that successful launch, Arianespace lofted Galaxy 12 and Insat 3A together aboard an Ariane 5 in April, followed by BSat 2C and Optus C1 in June. Closing out the year was the successful launch of a trio of satellites, two of which are commercial communications satellites (eBird and Insat 3E) and one ESA scientific satellite destined for the Moon (SMART 1). Arianespace is planning four to five launches in 2004, two of which will be non-commercial.

**JAPAN**

Japan conducted three launches in 2003, the













same number as 2002. Two of these launches involved the H 2A vehicle and one the M 5, carrying a total of five government payloads. In March an H 2A 2024 vehicle successfully sent two intelligence satellites (IGS 1A and 1B) to LEO for Japan’s Ministry of Defense. Later in the year, an H 2A 2024 was launched carrying another group of intelligence satellites, IGS 2A and 2B, but the vehicle was intentionally destroyed after one of two solid boosters did not jettison after burnout as planned. An accident investigation board has been convened in an effort to determine the cause of the malfunction and it remains unclear if the H 2A will return to service in 2004.

Finally, in May 2003, an M 5 was successfully launched carrying Institute of Space and Astronautical Science’s (ISAS) Hayabusa (also called Muses C) on a trajectory that will take it to a rendezvous with asteroid Itokawa. The probe will gather samples from Itokawa in September 2005 and return them via a reentry capsule in June 2007.

**CHINA**

On October 15, 2003, China became only the third country capable of launching humans

**Table 7. European, Japanese, Chinese, and Indian Launch Vehicle Performance in 2003**

	Europe		Japan		China						India	
												
<b>Vehicle</b>	Ariane 4	Ariane 5	H 2A 202	M 5	Long March 2C	Long March 2D	Long March 2F	Long March 3A	Long March 4B	Kaituozehe 1	GSLV	PSLV
<b>Country/Region</b>	Europe	Europe	Japan	Japan	China	China	China	China	China	China	India	India
<b>2003 Total Launches</b>	1	3	2	1	1	1	1	2	1	1	1	1
<b>Launch Reliability (2003)</b>	1/1	3/3	1/2	1/1	1/1	1/1	1/1	2/2	1/1	0/1	1/1	1/1
<b>Launch Reliability (Last 10 Years)</b>	100%	100%	50%	100%	100%	100%	100%	100%	100%	0%	100%	100%
<b>Year of First Launch</b>	1988	1996	2001	1997	1975	1992	1999	1994	1999	2002	2001	2000
<b>Launch Sites</b>	Kourou	Kourou	Tanegashima	Kagoshima	Jiuquan	Jiuquan	Jiuquan	Xichang	Taiyuan	Taiyuan	Sihankota	Sihankota
<b>LEO kg (lbs)</b>	9,191 (20,220)	17,250 (37,950)	9,940 (21,868)	1,800 (3,968)	3,200 (7,048)	3,500 (7,709)	9,500 (20,900)	7,200 (15,859)	3,500 (7,700)	100-300 (221-662)	5,000 (11,013)	3,700 (8,140)
<b>GTO kg (lbs)</b>	4,748 (10,446)	6,534 (14,375)	4,100 (9,020)	--	1,000 (2,203)	1,250 (2,753)	3,500 (7,700)	2,500 (5,507)	--	--	2,500 (5,507)	800 (1,760)

into space, along with the United States and Soviet Union/Russia. A Long March 2F was successfully launched from Jiuquan carrying into orbit Lt. Col. Yang Lewei aboard Shenzhou 5.

China has not conducted any commercial launches since 1999. However, the country executed seven non-commercial launches, the highest since 1970 when it launched its first satellite. In May, a Long March 3A was successfully launched from Xichang carrying the third navigation satellite in the Beidou constellation in GEO. After a summer of no launch activity, China experienced a failure with the new Kaituozhe 1 small launch vehicle. This vehicle, carrying a payload called PS 2, has failed twice in as many attempts. Seven days after the Shenzhou 5, China launched two satellites (CBERS/Ziyuan 2 and Chuang Xing 1) aboard a Long March 4B, both to LEO.

China followed up with two more launches in November. A Long March 2D successfully placed Jiangbing 4, which included a scientific reentry capsule, into LEO to conduct biological experiments. In mid-month, a Long March 3A was launched

carrying Zhongxing 20, the first of a new generation of government communications satellites. From the Shenzhou 5 launch to Zhongxing 20, China conducted an unprecedented four launches within 30 days.

Rounding out the year, China successfully sent Double Star Equator on its way to an elliptical orbit using a Long March 2C launched from Xichang. Double Star Equator represents the first cooperative venture between the Chinese Space Agency and Europe's ESA.

#### INDIA

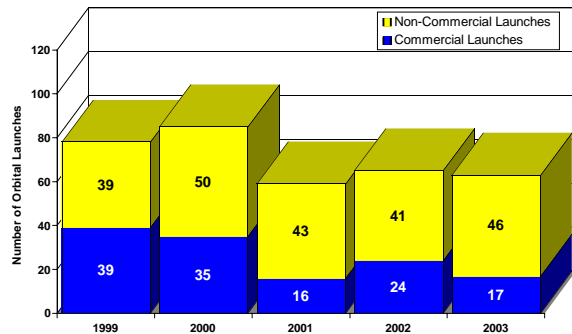
The Indian Space Research Organization (ISRO) performed two launches in 2003. A Geosynchronous Space Launch Vehicle (GSLV) was launched from the Professor Satish Dhawan Space Center (formerly Sriharikota Space Center), successfully placing a communications development satellite, Gsat 2, into GEO. This was the second successful launch of the new GSLV in as many attempts. Later in the year, a Polar Space Launch Vehicle (PSLV) successfully launched IRS P6 into LEO, enhancing India's existing suite of remote sensing satellites.

**FIVE-YEAR WORLDWIDE SPACE TRANSPORTATION TRENDS**

**OVERVIEW**

Between 1999 and 2000, there was an annual average of 82 total orbital launches worldwide, while the period 2001-2003 saw a decrease to an annual average of 62 launches (see Figure 9).

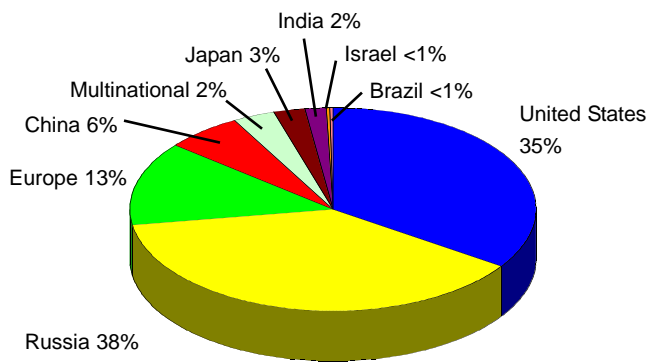
**Figure 9. Five-Year Summary (1999-2003) of Commercial and Non-commercial Launch Events**



While the number of commercial launches declined from 1999 to 2003, the number of non-commercial launches remained relatively steady. Over the past five years, the United States and Russia have produced the most orbital launches worldwide (Figure 10).

There were 131 commercial orbital launches during the same five-year period, with a high of 39 in 1999 and a low of 16 in 2001. Since 1999, the United States carried

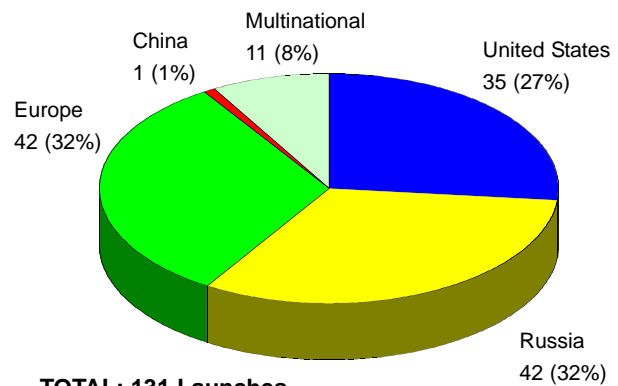
**Figure 10. Five-Year Worldwide Total Orbital Commercial and Non-commercial Launch Industry Share (1999-2003)**



**TOTAL: 350 Launches**

out 35 commercial launches. Europe exceeded this number with 42 commercial launches, the same number conducted by Russia (Figure 11). The lower number of U.S. launches reflects a decrease in the demand for commercial LEO launches, which peaked in 1998 at 19 worldwide (10 for the U.S.) Since GEO commercial launches remained the breadwinner for Arianespace during the same period, little impact was felt for the company as launches of LEO telecommunications satellites disappeared.

**Figure 11. Five-Year Worldwide Commercial Orbital Launch Market Share (1999-2003)**



**TOTAL: 131 Launches**

In 2003 the number of commercial launches decreased by 29 percent from the previous year to 17. Since 1999, the annual number of commercial launches to GEO has averaged about 17, with 2001 and 2003 being low years (Figure 12). Commercial LEO launches have declined over the past five years .

**Figure 12. Five-Year Worldwide Commercial GEO and NGSO Launch Events (1999-2003)**

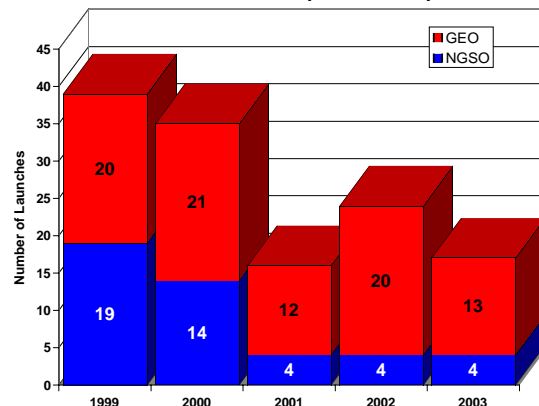
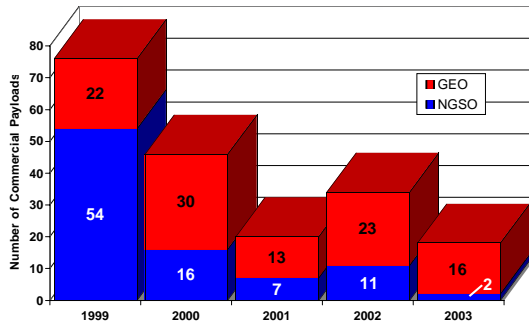


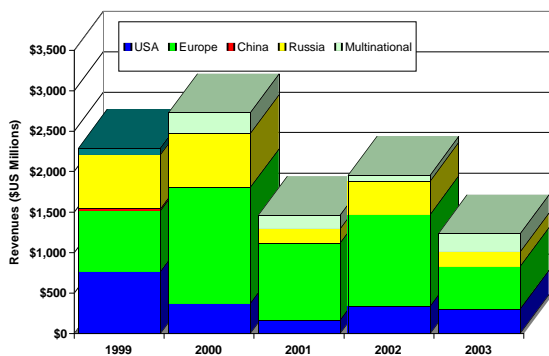
Figure 13 shows the number of commercial payloads launched on commercial and non-commercial launch vehicles over the past five years. The data shows that, while the number of commercial GEO satellites launched each year since 1999 has not changed significantly, the number of commercial NGSO satellites has decreased substantially. In 2003, only two commercial NGSO satellites were placed in orbit, OrbView 3 and QuakeSat.

**Figure 13. Five-Year Summary of Commercial Payloads Launched by Orbit (1999-2003)**



Estimated revenues during the period, highlighted in Figure 14 and Table 8, show 2003, with a global revenue total of US\$1.2 billion, to be the lowest during the five-year period, sinking below the US\$1.5 billion figure of 2001.

**Figure 14. Launch Revenues for Commercial Launch Events (approximate, in \$U.S. millions)**



**Table 8. Launch Revenues for Commercial Launch Events (approximate, in \$U.S. millions)**

	1999	2000	2001	2002	2003
United States	766	370	167	338	304
Russia	670	671	178	412	178
Europe	750	1,433	948	1,133	525
China	23	0	0	0	0
Multinational	85	255	170	75	225
<b>TOTAL</b>	<b>2,294</b>	<b>2,729</b>	<b>1,462</b>	<b>1,958</b>	<b>1,232</b>

**COMMERCIAL SATELLITE TRENDS**

The GEO telecommunications satellite industry is expected to remain essentially flat for a variety of reasons, and commercial launch providers can expect to remain in a very competitive stance. Today, the commercial space transportation market is driven largely by the demand for launches of GEO telecommunications satellites and, to a lesser extent, NGSO payloads. Therefore, developments in the industry over the next few years will parallel developments in satellite systems, including:

- Anticipated steady demand for launch of GEO communications satellite systems with a small but steady demand for LEO remote sensing systems;
- A near-term trend of heavier GEO telecommunications satellites (based on planned manifests) with a mid-term trend of more moderate and smaller satellites (based on recent orders); and
- Current trends show more demand will be generated by remote sensing and international science payloads in the near future, while NGSO telecommunications constellations represented a major driver of commercial launches a few years ago.

These satellite industry trends will be augmented by continued international competition to provide launch services by Europe, Russia, Ukraine, and China. Possible new entrants into the international launch services market include India, Japan, and Brazil.



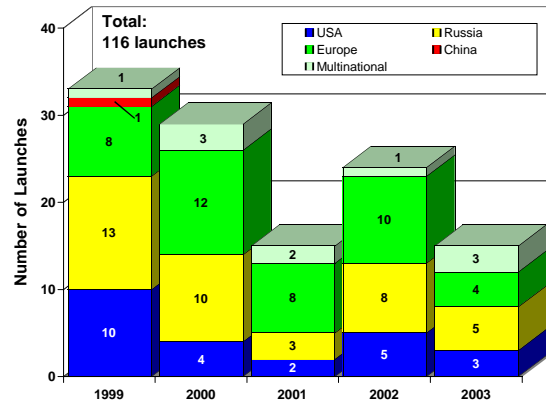
**INTERNATIONALLY COMPETED LAUNCHES**

As commercial space business increases and replaces various forms of traditionally government-operated activities, the definitions of “commercial payload” and “commercial launch” become more complex and open to interpretation. Figure 15 shows trends for each country with launch providers competing in the international market. The chart reflects only launch service providers competing in the international market for open bid launch service contracts.

From 1999 to 2003, 208 payloads had launch contracts that were internationally competed. Due to multimanifesting, this translates to 116 internationally competed launch events. In contrast, 33 payloads launched on commercial launches were not internationally competed and are considered captive payloads. Because of multimanifesting, this equates to 15 launches.

The chart also shows that Europe has gained a greater share of internationally competed launches over the course of the past five years. The share of internationally competed launches by the United States, Russia, and Europe dropped from 1999 to 2003 (except for a modest rise in 2002), with Sea Launch experiencing an increase in 2003.

**Figure 15. Five-Year Worldwide Internationally Competed Launch Events\***



\* An internationally competed launch contract is one in which the launch opportunity was available in principle to any capable launch service provider. For Figure 15 only, this definition precludes government-sponsored payloads launched commercially (some have been licensed by FAA/AST) when government policy prohibits open competition for the launch. The definition also does not cover payloads captive to their own launch providers (a distinction that is made by either country or launch service company), test payloads, dummy payloads, or small secondary payloads.

## APPENDIX: 2003 WORLDWIDE ORBITAL LAUNCH EVENTS

Date	Vehicle	Site	Payload(s)	Operator	Manufacturer	Use	Comm Price	L	M
1/6/2003	Titan 2	VAFB	Coriolis	United States Navy	Spectrum Astro, Inc.	Scientific		S	S
1/13/2003	Delta 2 7320	VAFB	CHIPSat ICESat	SpaceDev, Inc. NASA	SpaceDev, Inc. Ball Aerospace and Technologies Corp.	Scientific Remote Sensing		S	S
1/16/2003	Shuttle Columbia	KSC	STS 107	NASA	Rockwell International	Scientific		S	F
1/25/2003	Pegasus XL	CCAFS	SORCE	University of Colorado	Orbital Sciences Corp.	Scientific		S	S
1/29/2003	Delta 2 7925-10	CCAFS	Navstar GPS 2R-8 XSS-10	USAF USAF	Lockheed Martin Corp. USAF	Navigation Development		S	S
2/2/2003	Soyuz	Baikonur	Progress ISS 10P	Rosaviakosmos	RSC Energia	ISS		S	S
2/15/2003	√ Ariane 44L	Kourou	* Intelsat 907	Intelsat	Space Systems/Loral	Communications	\$85-125M	S	S
3/10/2003	Delta 4 Medium	CCAFS	DSCS 3-13	USAF	Lockheed Martin Corp.	Communications		S	S
3/28/2003	H 2A 2024	Tanegashima	IGS 1A	Japan Defense Agency (JDA)	Mitsubishi Electric Corp.	Intelligence		S	S
3/31/2003	Delta 2 7925-10	CCAFS	IGS 1B Navstar GPS 2R-9	JDA USAF	Mitsubishi Electric Corp. Lockheed Martin Corp.	Intelligence Navigation		S	S
4/2/2003	Molniya	Plesetsk	Molniya 1T	Russian MoD	NPO Prikladnoy Mekhaniki (NPO PM)	Communications		S	S
4/8/2003	Titan 4B/Centaur	CCAFS	Milstar F6	USAF	Lockheed Martin Corp.	Communications		S	S
4/9/2003	√ Ariane 5G	Kourou	* Insat 3A	Indian Space Research Organization (ISRO)	ISRO	Communications	\$125-155M	S	S
			* Galaxy 12	Pan American Satellite Corp.	Orbital Sciences Corp.	Communications		S	
4/11/2003	√ Atlas 3B	CCAFS	* AsiaSat 4	Asia Satellite Telecommunications Co. (Asiasat)	Boeing	Communications	\$65-75M	S	S
4/24/2003	Proton K	Plesetsk	Kosmos 2397	Russian MoD	NPO Lavotchkin	Intelligence		S	S
4/26/2003	Soyuz	Baikonur	Soyuz ISS 6S	Rosaviakosmos	RSC Energia	ISS		S	S
4/28/2003	Pegasus XL	CCAFS	GALEX	NASA	Orbital Sciences Corp.	Scientific		S	S
5/8/2003	GSLV	Satish Dhawan Space Center	Gsat 2	ISRO	ISRO	Communications		S	S
5/9/2003	M 5	Kagoshima	Hayabusa	Institute of Space and Astronautical Science	NEC Corp.	Scientific		S	S
5/13/2003	√ Atlas 5 401	CCAFS	* Hellas-Sat 2	Hellas Sat Consortium, Ltd.	Astrium	Communications	\$65-75M	S	S
5/25/2003	Long March 3A	Xichang	Beidou 3	China Academy of Space Technology (CAST)	CAST	Navigation		S	S
6/2/2003	√ Soyuz	Baikonur	Mars Express Orbiter	European Space Agency (ESA)	Astrium	Scientific	\$30-50M	S	S
6/4/2003	Cosmos 3M	Plesetsk	Beagle 2 Kosmos 2398	ESA Russian MoD	Astrium NPO PM	Scientific Navigation		F	S
6/7/2003	√ Proton K	Baikonur	* AMC 9	SES Americom	Alcatel Espace	Communications	\$60-85M	S	S
6/8/2003	Soyuz	Baikonur	Progress ISS 11P	Rosaviakosmos	RSC Energia	ISS		S	S
6/10/2003	√ Zenit 3SL	Odyssey Launch Platform	* Thuraya 2	Thuraya Satellite Communications Company	Boeing	Communications	\$65-85M	S	S
6/10/2003	Delta 2 7925-10	CCAFS	Spirit	NASA	NASA/JPL	Scientific		S	S
6/11/2003	√ Ariane 5G	Kourou	* BSat 2C * Optus C1	Broadcasting Satellite System Corp. (BSAT) Optus Communications Pty. Ltd.	Orbital Sciences Corp. Space Systems/Loral	Communications Communications	\$125-155M	S	S
6/19/2003	Molniya	Plesetsk	Molniya 3-53	Russian MoD	NPO PM	Communications		S	S
6/26/2003	√ Pegasus XL	VAFB	* OrbView 3	ORBIMAGE	Orbital Sciences Corp.	Remote Sensing	\$14-18M	S	S

√ Denotes commercial launch, defined as a launch that is internationally competed or FAA-licensed, or privately-financed launch activity.  
\* Denotes a commercial payload, defined as a spacecraft that serves a commercial function or is operated by a commercial entity.  
L and M refer to the outcome of the Launch and Mission: S = success, P = partial success, F = failure  
Note: All launch dates are based on local time at the launch site

## 2003 WORLDWIDE ORBITAL LAUNCH EVENTS (CONTINUED)

Date	Vehicle	Site	Payload(s)	Operator	Manufacturer	Use	Comm Price	L	M
6/30/2003	Rockot	Plesetsk	Monitor E Mockup	Khrunichev State Research and Production Space Center	Khrunichev State Research and Production Space Center	Test		S	S
			MOST	Canadian Space Agency	Dynacon Enterprises	Scientific			S
			Mimosa	Czech Republic	Russian Academy of Sciences	Scientific			S
			* QuakeSat		QuakeFinder LLC	Stanford University	Scientific		S
			CUTE		Tokyo Institute of Technology	Tokyo Institute of Technology	Development		S
			Cubesat XI		University of Tokyo ISSL	University of Tokyo ISSL	Development		S
			DTUsat		Danish Technical University	Danish Technical University	Development		S
			AAU Cubesat CanX-1		Aalborg University	Aalborg University University of Toronto	Development		S
7/7/2003	Delta 2 7925H	CCAFS	Opportunity	NASA	NASA/JPL	Scientific		S	S
7/17/2003	✓ Atlas 5 521	CCAFS	* Rainbow 1	Cablevision Systems Corporation	Lockheed Martin Corp.	Communications	\$70-85M	S	S
8/7/2003	✓ Zenit 3SL	Odyssey Launch Platform	* EchoStar 9	Echostar Communications Corporation	Space Systems/Loral	Communications	\$65-85M	S	S
8/12/2003	Pegasus XL	VAFB	Scisat 1	CSA	Bristol Aerospace Ltd.	Scientific		S	S
8/12/2003	Soyuz	Baikonur	Kosmos 2399	Russian MoD	TsSKB Progress	Intelligence		S	F
8/19/2003	Cosmos 3M	Plesetsk	Kosmos 2400	Russian MoD	NPO PM	Communications		S	S
			Kosmos 2401	Russian MoD	NPO PM	Communications		S	S
8/25/2003	Delta 2 7920H	CCAFS	Spitzer Space Telescope	NASA	Lockheed Martin Corp.	Scientific		S	S
8/29/2003	Soyuz	Baikonur	Progress ISS 12P	Rosaviakosmos	RSC Energia	ISS		S	S
8/29/2003	Delta 4 Medium	CCAFS	DSCS 3-14	USAF	Lockheed Martin Corp.	Communications		S	S
9/8/2003	Titan 4B/Centaur	CCAFS	USA 171	NRO	Classified	Intelligence		S	S
9/16/2003	Kaituozehe 1	Taiyuan	PS 2	China	China	Test		F	F
9/27/2003	✓ Cosmos 3M	Plesetsk	BilSat 1	Turkish Military	Surrey Satellite Technology Ltd.	Remote Sensing	\$12M	S	S
			BNSCSat	British National Space Centre	Surrey Satellite Technology Ltd.	Remote Sensing			S
			Kaistsat 4	Korean Advanced Institute of Science and Technology	Korean Advanced Institute of Science and Technology	Scientific			S
			Larets	Russian MoD	Russian MoD	Scientific			S
			Mozhayets 4	Mozhaiskiy Military Space Engineering Academy	Mozhaiskiy Military Space Engineering Academy	Development			S
			NigeriaSat 1	Nigeria	Surrey Satellite Technology Ltd.	Remote Sensing			S
			Rubin 4-DSI	Carlo Gavazzi Space	Carlo Gavazzi Space	Development			S
9/27/2003	✓ Ariane 5G	Kourou	* Insat 3E	ISRO	ISRO	Communications	\$125-155M	S	S
			* eBird	Eutelsat	Boeing	Communications			S
			SMART 1	ESA	Swedish Space Corp.	Development			S
9/30/2003	✓ Zenit 3SL	Odyssey Launch Platform	* Galaxy 13	Horizons	Boeing	Communications	\$65-85M	S	S
10/15/2003	Long March 2F	Jiuquan	Shenzhou 5	Chinese National Space Administration (CNSA)	Shanghai Academy of Spaceflight Technology	Crewed		S	S
10/17/2003	PSLV	Satish Dhawan Space Center	IRS P6	ISRO	ISRO	Remote Sensing		S	S

✓ Denotes commercial launch, defined as a launch that is internationally competed or FAA-licensed, or privately-financed launch activity.  
 \* Denotes a commercial payload, defined as a spacecraft that serves a commercial function or is operated by a commercial entity.  
 L and M refer to the outcome of the Launch and Mission: S = success, P = partial success, F = failure  
 Note: All launch dates are based on local time at the launch site

## 2003 WORLDWIDE ORBITAL LAUNCH EVENTS (CONTINUED)

Date	Vehicle	Site	Payload(s)	Operator	Manufacturer	Use	Comml Price	L	M
10/18/2003	Soyuz	Baikonur	Soyuz ISS 7S	Rosaviakosmos	RSC Energia	ISS		S	S
10/18/2003	Titan 2	VAFB	DMSP 5D-3-F16	USAF	Lockheed Martin Corp.	Meteorological		S	S
10/21/2003	Long March 4B	Taiyuan	CBERS/Ziyuan 2 Chuang Xing 1	CAST Chinese Academy of Sciences	CAST Shanghai Institute of Satellite Engineering	Remote Sensing Communications		S	S
10/30/2003	✓ Rockot	Plesetsk	SERVIS 1	National Space Development Agency	Mitsubishi	Development	\$12-15M	S	S
11/3/2003	Long March 2D	Jiuquan	Jiangbing 4	CNSA	CAST	Scientific		S	S
11/15/2003	Long March 3A	Xichang	Zhongxing 20	CNSA	CAST	Communications		S	S
11/24/2003	Proton K	Baikonur	* Yamal 201 * Yamal 202	Gazkom Joint Stock Gazkom Joint Stock	RSC Energia RSC Energia	Communications Communications		S	S
11/29/2003	H 2A 2024	Tanegashima	IGS 2A IGS 2B	JDA JDA	Mitsubishi Electric Corp. Mitsubishi Electric Corp.	Intelligence Intelligence		F	F
12/2/2003	Atlas 2AS	VAFB	USA 173	NRO	Classified	Classified		S	S
12/5/2003	Strela	Baikonur	Gruzomaket	NPO Machinostroyeniya	NPO Machinostroyeniya	Test		S	S
12/10/2003	Proton K	Baikonur	Kosmos 2402 Kosmos 2403 Kosmos 2404	Russian MoD Russian MoD Russian MoD	NPO PM NPO PM NPO PM	Navigation Navigation Navigation		S	S
12/17/2003	✓ Atlas 3B	CCAFS	UHF F11	United States Navy	Boeing	Communications	\$65-75M	S	S
12/21/2003	Delta 2 7925-10	CCAFS	Navstar GPS 2R-10	USAF	Lockheed Martin Corp.	Navigation		S	S
12/28/2003	✓ Soyuz	Baikonur	* Amos 2	SpaceCom Limited	Israel Aircraft Industries	Communications	\$30-50M	S	S
12/29/2003	Proton K	Baikonur	* Express AM22	Russian Satellite Communication Co.	NPO PM	Communications		S	S
12/30/2003	Long March 2C	Xichang	Double Star Equator	CNSA	CAST	Scientific		S	S

✓ Denotes commercial launch, defined as a launch that is internationally competed or FAA-licensed, or privately-financed launch activity.

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

L and M refer to the outcome of the Launch and Mission: S = success, P = partial success, F = failure

Note: All launch dates are based on local time at the launch site