Federal Aviation Administration

COMMERCIAL SPACE TRANSPORTATION:

2012 YEAR IN REVIEW

JANUARY 2013

About the Office of Commercial Space Transportation

The Federal Aviation Administration's Office of Commercial Space Transportation (FAA/AST) licenses and regulates U.S. commercial space launch and reentry activity, as well as the operation of non-federal launch and reentry sites, as authorized by Executive Order 12465 and Title 51 United States Code, Subtitle V, Chapter 509 (formerly the Commercial Space Launch Act). FAA/AST's mission is to ensure public health and safety and the safety of property while protecting the national security and foreign policy interests of the United States during commercial launch and reentry operations. In addition, FAA/AST is directed to encourage, facilitate, and promote commercial space launches and reentries. Additional information concerning commercial space transportation can be found on FAA/AST's web site at

http://www.faa.gov/about/office_org/headquarters_offices/ast/.

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INTRODUCTION

The *Commercial Space Transportation: 2012 Year in Review* summarizes U.S. and international orbital launch activities for calendar year 2012, including launches licensed by the Federal Aviation Administration's Office of Commercial Space Transportation (FAA/AST). The report also provides a review and analysis of the past five years of commercial launch activity.

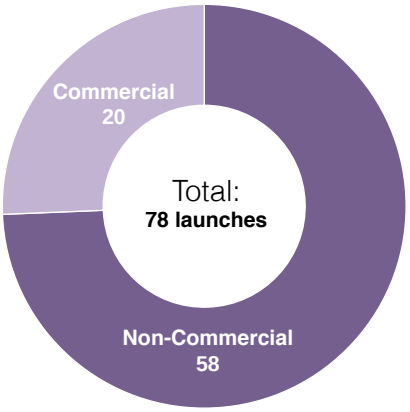
There were 78 orbital launch events worldwide in 2012, including commercial, civil, and military missions. These are listed in Appendix I. Definitions of terms used in this report are in Appendix II.

EXECUTIVE SUMMARY

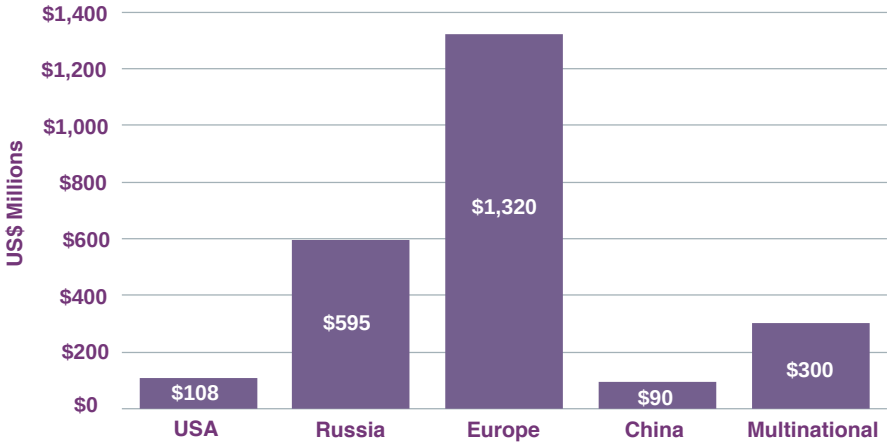
In 2012, the United States, Russia, Europe, China, Japan, India, Iran, North Korea, and one multinational provider conducted a total of 78 orbital launches, 20 of which were commercial. This is consistent with the 5-year average of 77 total orbital launches and 21 commercial launches per year. Five of the 78 launches failed: 2 of Iran's launch attempts failed, 1 of North Korea's attempts failed, and Russia's Proton M vehicle had a failure in October and a partial failure in December. None of the failures were for commercial launches.

Revenues from the 20 commercial orbital launches in 2012 were estimated to be slightly more than $2.4 billion. These revenues are consistent with commercial launch revenue in 2009 and 2010, but show a nearly half-billion dollar increase over 2011.

FAA/AST licensed five commercial orbital launches in 2012, compared to one licensed launch in 2011. SpaceX's Falcon 9 vehicle had two licensed launches: one in May, under NASA's Commercial Orbital Transportation Services (COTS) program, and another in October, under NASA's Commercial Resupply Services (CRS) program. Sea Launch's Zenit 3SL vehicle performed three licensed launches, which deployed Intelsat 19, Intelsat 21, and Eutelsat 70B communications satellites.



2012 Total Worldwide Launch Activity



Estimated 2012 Commercial Launch Revenues

2012 LAUNCH ACTIVITY

WORLDWIDE ORBITAL LAUNCH ACTIVITY

Launch providers from the United States, Russia, Europe, China, Japan, India, Iran, North Korea, and one multinational provider conducted a total of 78 launches in 2012, 20 of which were commercial. (See Figures 1 and 2, and Tables 1 and 2.) This is consistent with the 5-year average of 77 total launches and 21 commercial launches per year. The following is a summary of worldwide orbital commercial launches in 2012, by country.

- The United States had 13 launches in 2012, which is five fewer launches than in 2011. Two of the 13 launches were commercial; there were no commercial U.S. launches in 2011.
- Russia continues to have the most launches annually (24) as well as most commercial launches (7). Russia experienced two launch failures, including a partial failure in which the payload eventually reached its intended orbit. In 2011, Russia had 31 launches.
- Europe conducted 10 launches in 2012, 6 of which were commercial. The first launch of the new Vega vehicle took place in 2012. Europe had six launches in 2011.
- China had the same number of launches, 19, including commercial launches (2), in 2011 and 2012.
- The multinational Sea Launch Zenit 3SL launch vehicle performed three commercial launches.
- India and Japan each had two non-commercial launches.
- Iran attempted to launch its Safir 2 vehicle three times and had two failures.
- North Korea conducted two launch attempts of its Unha 3 rocket. The first attempt failed, but the second placed the first North Korean payload into orbit.

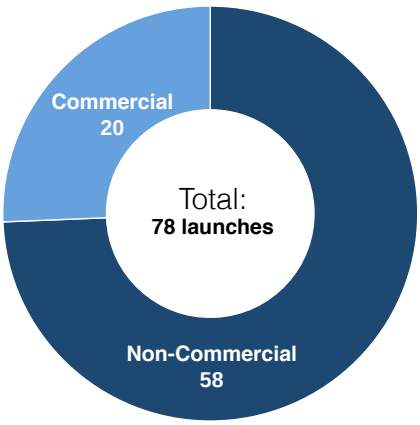


Figure 1. 2012 Total Worldwide Launch Activity

Figure 2. 2012 Worldwide Commercial Launch Activity

Country/Region	Commercial Launches	Non-Commercial Launches	Launches
United States	2	11	13
Russia	7	17	24
Europe	6	4	10
China	2	17	19
Japan	0	2	2
India	0	2	2
Iran	0	3	3
North Korea	0	2	2
Multinational	3	0	3
TOTAL	***20***	***58***	***78***

Table 1. 2012 Worldwide Orbital Launch Events

Date	Vehicle	Launching Country/ Region	Payload(s)	Orbit	Launch Outcome
14-Feb-12	Proton M	Russia	SES-4	GEO	Success
25-Mar-12	Proton M	Russia	Intelsat 22	GEO	Success
31-Mar-12	Long March 3B	China	APSTAR 7	GEO	Success
23-Apr-12	Proton M	Russia	Yahsat 1B	GEO	Success
15-May-12	Ariane 5	Europe	JCSAT 13 Vinasat 2	GEO GEO	Success
17-May-12	Proton M	Russia	Nimiq 6	GEO	Success
22-May-12	Falcon 9	USA	Dragon COTS Demo 2/3	LEO	Success
1-Jun-12	Zenit 3SL	Multinational	Intelsat 19	GEO	Success
5-Jul-12	Ariane 5	Europe	Echostar XVII MSG 3	GEO GEO	Success
9-Jul-12	Proton M	Russia	SES-5	GEO	Success
2-Aug-12	Ariane 5	Europe	HYLAS 2 Intelsat 20	GEO GEO	Success
18-Aug-12	Zenit 3SL	Multinational	Intelsat 21	GEO	Success
28-Sep-12	Ariane 5	Europe	Astra 2F GSAT 10	GEO GEO	Success
7-Oct-12	Falcon 9	USA	Dragon ISS 1D ORBCOMM OG2-01	LEO LEO	Success
14-Oct-12	Proton M	Russia	Intelsat 23	GEO	Success
16-Nov-12	Ariane 5	Europe	Star One C3 Eutelsat 21B	GEO GEO	Success
20-Nov-12	Proton M	Russia	Echostar XVI	GEO	Success
3-Dec-12	Zenit 3SL	Multinational	Eutelsat 70B	GEO	Success
19-Dec-12	Long March 2D	China	Gökturk 2	SSO	Success
19-Dec-12	Ariane 5	Europe	SkyNet 5D MexSat 3	GEO GEO	Success

Table 2. 2012 Worldwide Commercial Launch Events

The 2012 orbital launch activity by launch vehicle is presented in Figure 3.

Appendix I shows all 78 orbital launches worldwide in 2012, including commercial, civil, and military missions.

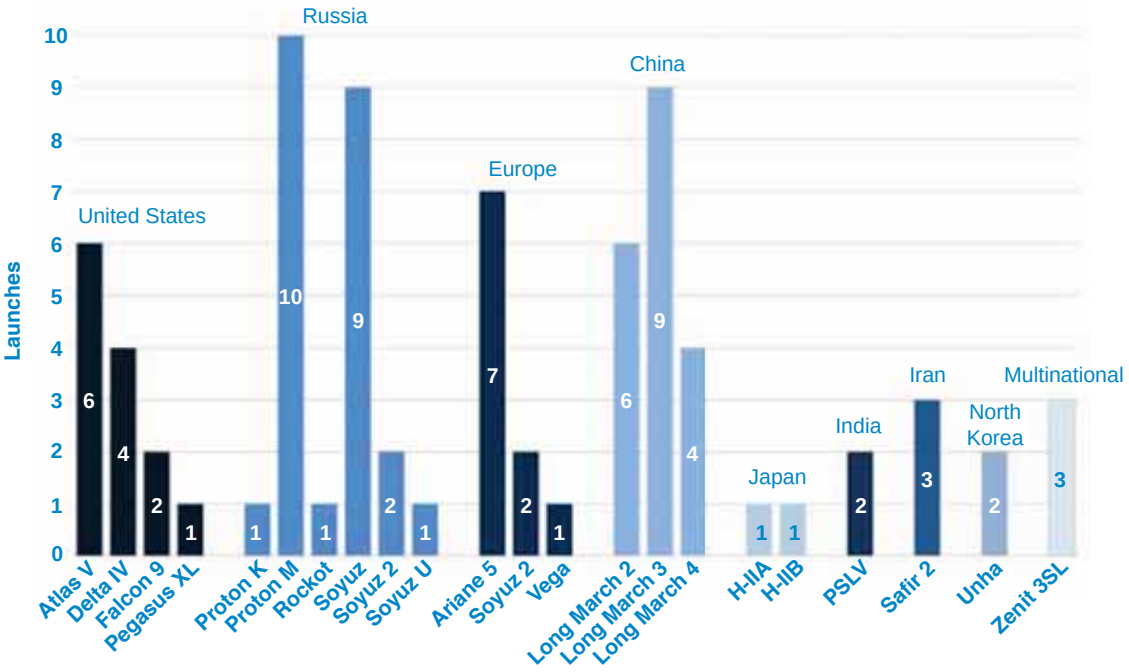


Figure 3. 2012 Launch Vehicle Use

Worldwide Launch Revenues

Estimated revenues from the 20 commercial launch events in 2012 amounted to approximately $2.4 billion. These revenues are consistent with commercial launch revenue in 2009 and 2010 but show a nearly half-billion dollar increase over 2011. (See Figure 4.) More detail on five-year revenue trends can be found in the Space Transportation Trends section. The following are 2012 revenues by country:

- Commercial launch revenues in the United States amounted to $108 million.
- Russian commercial launch revenues were approximately $595 million, down about 15 percent from last year, primarily due to Proton failures causing commercial launches to slip to 2013.
- European revenues were approximately $1.3 billion, a 50 percent increase over 2011 revenues.
- Chinese revenues dropped from 2011 by $50 million, for an estimated total of $90 million.
- Multinational (Sea Launch) revenues were approximately $300 million, up from $200 million in 2011.

Payments for launch services are typically spread over one to two years before the launch, but for the purposes of this report, revenue is counted in the year a customer's payload launches. Launch revenues are attributed to the country or region where the primary vehicle manufacturer is based. These revenues are assessed based on commercial launch price estimates for each launch vehicle using publically available information. (See commercial launch prices in Appendix A.)

Most launch vehicles today are manufactured, sold, and launched by the same organization in one country or within a particular economic region.[1] Sea Launch AG, however, is a multinational launch service corporation.

[1] International Launch Services (ILS) and Arianespace constitute an exception. ILS is a Russian-owned company incorporated in the United States and selling launches of the Russian Proton vehicles. Arianespace markets launches of a Russian-manufactured Soyuz 2 vehicle from the Kourou launch site in French Guiana.

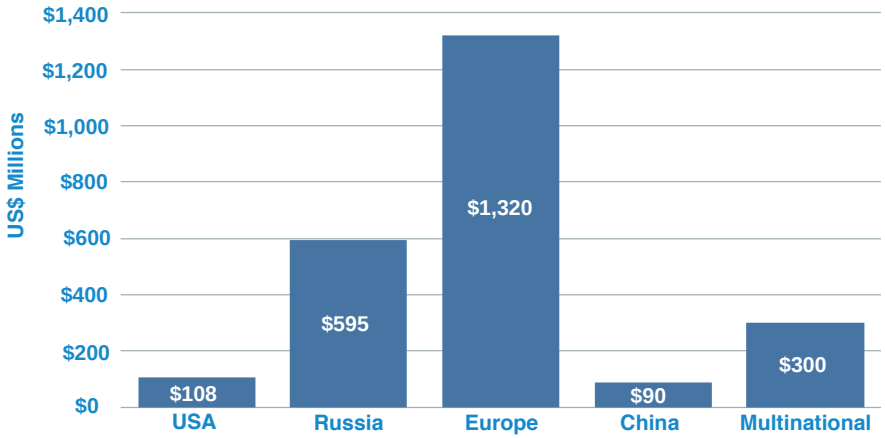


Figure 4. Estimated 2012 Commercial Launch Revenues

Worldwide Orbital Payload Summary

In 2012, 78 launches carried a total of 139 payloads to orbit (see Table 3 and Figures 6 and 7). Approximately 20 percent (27 payloads) provide commercial services. (See Figure 8 for these payloads by launch country.) The remaining 80 percent (112 payloads) were used for non-commercial civil government, military, or non-profit purposes.

The 2012 worldwide orbital launch activity by payload use type is presented in Figure 5.

Country/ Region	Commercial Payloads	Non-Commercial Payloads	Total Payloads
United States	3	25	28
Russia	10	24	34
Europe	7	18	25
China	3	27	30
Japan	0	10	10
India	1	3	4
Iran	0	3	3
North Korea	0	2	2
Multinational	3	0	3
TOTAL	***27***	***112***	***139***

Table 3. Payloads Launched by Country in 2012

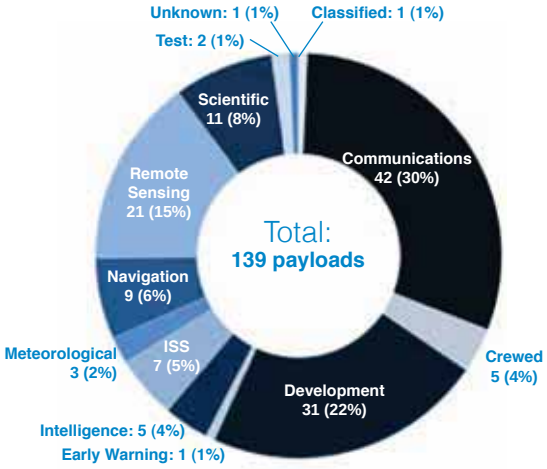


Figure 5. Payload Use Type

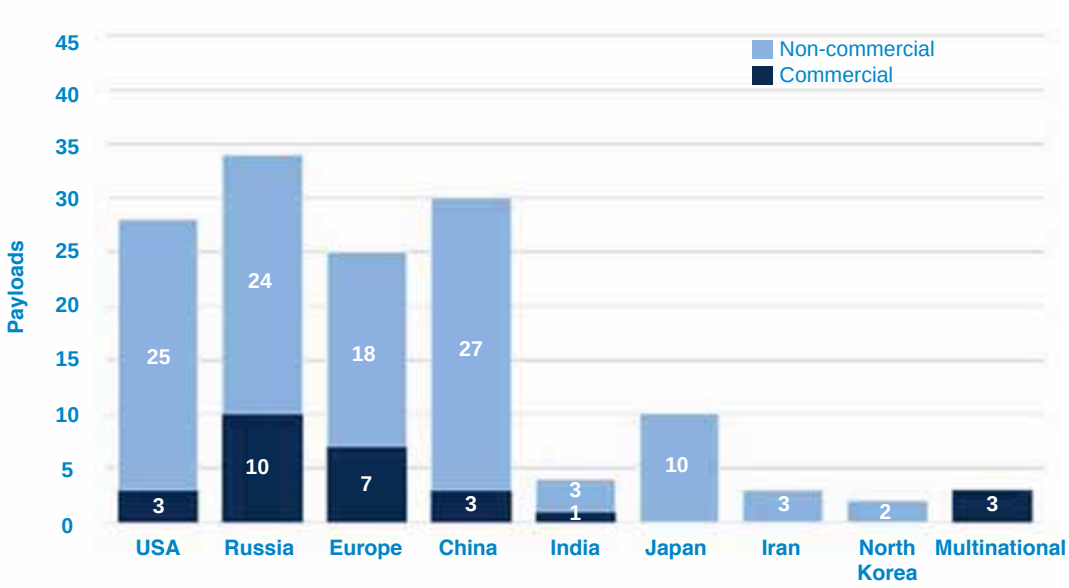


Figure 6. 2012 Total Worldwide Launch Activity by Payload

Commercial Launch Payload Summary

Twenty commercial launches carried a total of 27 commercial and non-commercial payloads into orbit. Four of these commercially launched payloads were deployed in non-geosynchronous orbits (NGSO) and 23 were launched to a geostationary orbit (GEO) (see Table 2). Two of the NGSO payloads were launches of the Dragon capsule, as part of NASA's COTS and CRS program. The other two NGSO payloads were Turkey's Gökturk-2 satellite and the ORBCOMM OG2-1 satellite. All but one GEO payload (MSG 3, a European meteorological satellite) were communications satellites.

ORBCOMM OG2-01, a communications satellite, was launched as a secondary payload on SpaceX's mission to the International Space Station (ISS). The launch was considered a success because it met its primary objective of transporting the Dragon capsule to the ISS, but it failed to place the ORBCOMM satellite into its intended orbit due to an anomaly on one of the Falcon 9's first stage engines. Because of the engine shutdown, and to remain in compliance with the plan approved for Dragon delivery to the ISS, the rocket was not allowed to execute the second burn. For this reason, the satellite was deployed in an orbit lower than intended.

Of the 27 commercially launched payloads, 21 provide commercial services and 6 are non-commercial (civil or defense). The governments of India, Mexico, United Kingdom, and Vietnam launched communications satellites commercially, all on Ariane 5 vehicles. Europe's meteorological agency, Eumetsat, launched a weather satellite on an Ariane 5, and Turkey launched a military satellite on a Long March 2C vehicle. (See Table 4.)

Launch Vehicle	Payload	Service Type	Use
Ariane 5	Vinasat 2	Civil	Communications
Ariane 5	MSG 3	Civil	Meteorological
Ariane 5	GSAT 10	Civil	Communications
Ariane 5	SkyNet 5D	Military	Communications
	MexSat 3	Civil	Communications
Long March 2D	Gökturk 2	Military	Intelligence

Table 4. Commercially Launched Government Civil and Military Payloads

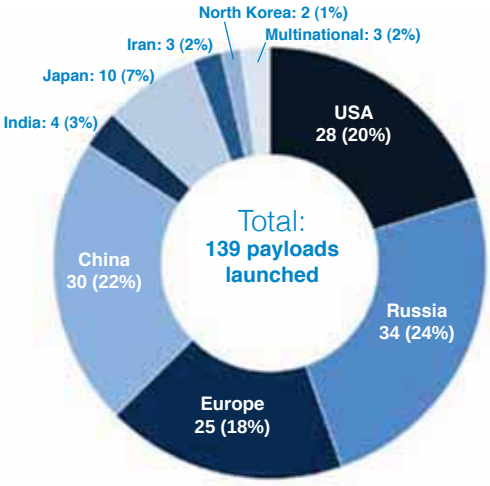


Figure 7. Total Payloads Launched by Country in 2012

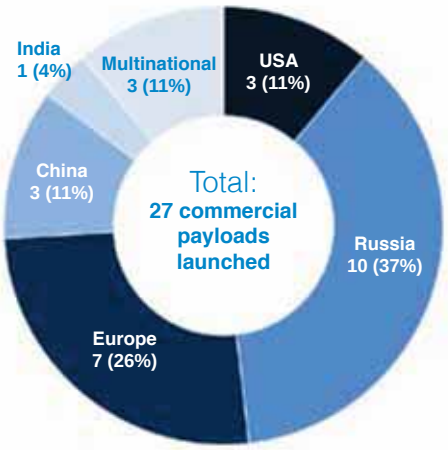


Figure 8. Commercial Payloads Launched by Country in 2012

Non-Commercial Launches

In 2012, there were 58 non-commercial launches carrying a total of 112 payloads. Fifty-five payloads were for civil government purposes, 37 payloads were for military use, and 14 payloads were for non-profit missions (universities). Six payloads were commercial: five communications satellites—ORBCOMM's Vesselsat 2, Indonesia's Telkom 3, APT Satellite's APStar 7B (Chinasat 12), and Gazprom Space System's Yamal 300K and 402—and one remote sensing satellite, France's SPOT 6. (See Figure 9 and Table 5.)

In 2012, all five launch failures were non-commercial launches. Iran's Safir vehicle failed twice, in May and September, and North Korea's Unha 3 rocket failed once. The other two failures were with Russia's Proton M vehicle. The August Proton failure resulted in the loss of Indonesia's Telkom 3 and Russia's Express MD2 communications satellites. The December failure was considered partial because the Yamal 402 satellite used its own propulsion system to reach its target orbit. The Proton M also experienced failures in 2010 and 2011.

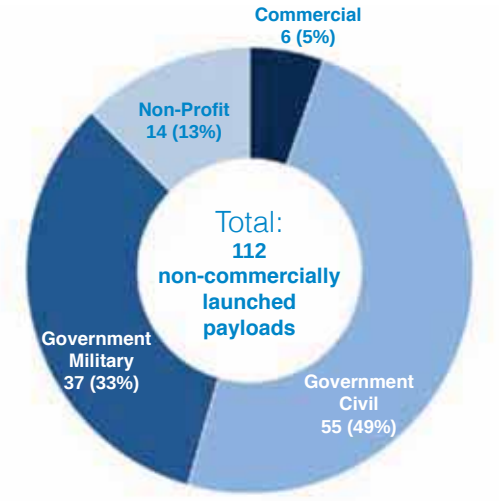


Figure 9. Non-commercially Launched Payloads by Service Type

Country	Service Type	Payload(s)
United States	Civil (8)	Aerocube 4A, 4B, and 4C; NuSTAR; OUTSAT; STARE A; and Van Allen Probe A and B
	Military (13)	AEHF 2; AENEAS; MUOS 1; Navstar GPS 2F-03; NRO L-15, L-25, L-36/NOSS 3-6A, L-36/NOSS 3-6B, L-38; SMDC-ONE 2.1, -ONE 2.2; WGS 4; and X-37B/OTV 3
	Non-Profit (4)	CINEMA 1; CISSWE; CP 5; and CXBN
Russia	Civil (20)	Belka 2; ExactView 1; Express MD 2; Gonets M-03 and M-04; Kanopus B1; Luch 5B; MetOp B; MIR; Progress M-14M, -15M, -16M, and -17M; SFERA-53; Soyuz TMA-04M, -05M, -06M, and -07M; TET-1; and Zond PP
	Military (4)	Cosmos 2479, 2480, 2481; and Meridian 6
Europe	Civil (5)	ATV 3; LARES; Galileo 3 and 4; and Pleiades HR 2
	Non-Profit (8)	ALMASat 1; E-ST@R; GOLIAT; MaSat; PW-Sat 1; ROBUSTA; UNICUBESAT GG; and XATCOBEO
China	Civil (11)	Fengniao 1B and 1A; Feng Yun 2F; Huan Jing 1C; Shenzhou 9 Decent Module and Orbital Module; Tian Hui 1B; Tianlian-1C; VRSS 1; Xinyan-1; and Zi Yuan 3
	Military (15)	Beidou 2C-M3, -M4, -M5, and -M6; Beidou 2-G5 and -G6; Chinasat 2A; Shijian 9A and 9B; Tiantuo 1; Yaogan 14, 15, 16 Main, 16 Subsat 1, and 16 Subsat 2
India	Civil (2)	mRESINS and Proiteres
	Military (1)	Risat 1
Japan	Civil (8)	F-1; FitSat-1; GCOM-W1; HTV-3; Kompsat 3; SDS-4; TechEdSat; and We-Wish
	Non-Profit (2)	Horyu 2 and RAIKO
Iran	Civil (1)	Navid-E Elm-O Sanat
	Military (2)	Fajr and Unknown Iranian Satellite
North Korea	Military (2)	Kwangmyongsong 3 and Kwangmyongsong 3-2

Table 5. Non-commercially Launched Payloads for Government Civil, Military, or Non-Profit Use

U.S. AND FAA-LICENSED ORBITAL LAUNCH AND REENTRY ACTIVITY

FAA-Licensed Orbital Launch Summary

There were five FAA-licensed orbital launches in 2012. SpaceX's Falcon 9 vehicle made two licensed launches to the ISS. In May, SpaceX completed its second flight under NASA's COTS program, and in October, the company launched its first flight under NASA's CRS program. Sea Launch's Zenit 3SL vehicle performed three licensed launches, which carried Intelsat 19, Intelsat 21, and Eutelsat 70B communications satellites to GEO (see Table 6).

Date	Vehicle	Primary Payload	Orbit	Launch Outcome
22-May-12	Falcon 9	Dragon COTS Demo 2/3	LEO	Success
1-Jun-12	Zenit 3SL	Intelsat 19	GEO	Success
18-Aug-12	Zenit 3SL	Intelsat 21	GEO	Success
7-Oct-12	Falcon 9	Dragon ISS 1D	LEO	Success
03-Dec-12	Zenit 3SL	Eutelsat 70B	GEO	Success

Table 6. 2012 FAA-Licensed Orbital Launch Events

Over the past five years, FAA has on average licensed four or five launches per year. However, in 2008, FAA licensed 11 launches, including 5 Sea Launch Zenit 3SL launches of commercial GEO communications satellites. A Sea Launch Zenit 3SL performed the only FAA-licensed launch in 2011, which launched a commercial GEO communications satellite, Atlantic Bird 7, for Eutelsat. Figures 10 and 11 summarize the number of FAA-licensed orbital launches and revenue from 2008-2012.

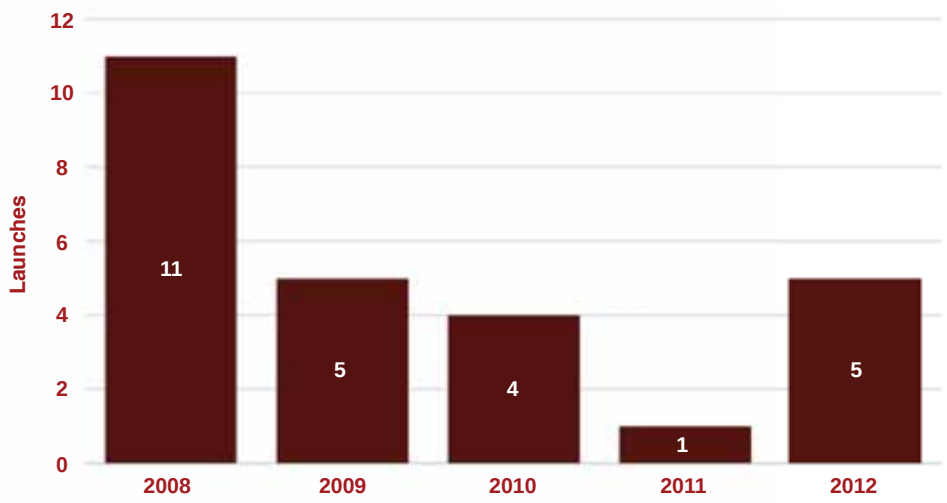


Figure 10. FAA-licensed Orbital Launch Events, 2008-2012

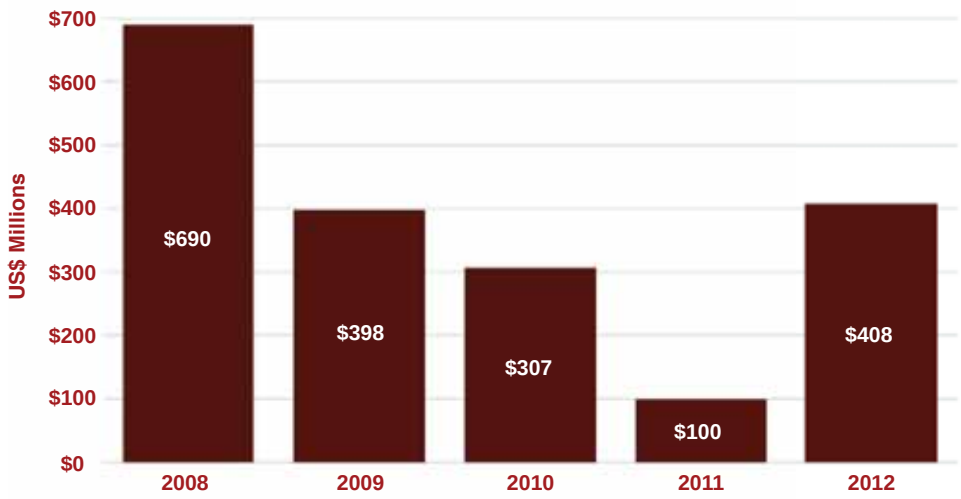


Figure 11. Estimated Revenue for FAA-licensed Orbital Launch Events, 2008-2012

FAA Reentry License Summary

There were two reentries conducted under FAA reentry licenses in 2012. SpaceX's Dragon spacecraft performed both licensed reentries, in May and October, completing its final COTS and first CRS missions to the ISS. (See Table 7 for details.)

Vehicle	SpaceX Dragon
2012 Total Reentries	2
2012 Licensed Reentries	2
Launch Reliability (2012)	2/2 100%
Reentry Reliability (Last 10 Years)	3/3 100%
Year of First Reentry	2010
Reentry Sites	Pacific Ocean
Payload to LEO, kg (lbs)	6,000 (13,228)
Payload from LEO, kg (lbs)	3,000 (6,614)

Table 7. FAA-Licensed Reentry Vehicles Active in 2012

United States

U.S. launch vehicles provided 11 U.S. government launches and 2 commercial launches in 2012. The U.S. Department of Defense (DoD) had nine launches, which was the same number as last year. These nine missions carried four National Reconnaissance Office (NRO) payloads and five DoD or DoD-sponsored payloads, including payloads for the U.S. Navy and U.S. Air Force. NASA had two launches in 2012, down from last year's unusually high number of nine. (NASA's two launches do not count the two commercial SpaceX launches to the ISS, which NASA paid for.) Table 8 summarizes U.S. and FAA-licensed launch vehicles active in 2012.

The following is a list of U.S.-based launch service providers, highlighting their launch activity in 2012. It includes all companies that launch from the United States or under the regulatory oversight of the FAA/AST.

Vehicle	Pegasus XL	Delta IV Medium+ (4,2)	Delta IV Medium+ (5,2)	Delta IV Medium+ (5,4)	Delta IV Heavy	Atlas V 401	Atlas V 501	Atlas V 531	Atlas V 551	Falcon 9 Dragon	Zenit 3SL
2012 Total Launches	1	1	1	1	1	3	1	1	1	2	3
2012 Licensed Launches	0	0	0	0	0	0	0	0	0	2	3
Launch Reliability (2012)	1/1 100%	1/1 100%	1/1 100%	1/1 100%	1/1 100%	3/3 100%	1/1 100%	1/1 100%	1/1 100%	2/2 100%	3/3 100%
Launch Reliability (Last 10 Years)	11/11 100%	9/9 100%	1/1 100%	2/2 100%	5/6 83%	14/14 100%	4/4 100%	2/2 100%	3/3 100%	4/4 100%	26/27 96%
Year of First Launch	1994	2002	2012	2009	2004	2002	2010	2011	2006	2010	1999
Active Launch Sites	CCAFS, Kwajalein Island, VAFB	CCAFS, VAFB	CCAFS, VAFB	CCAFS, VAFB	CCAFS, VAFB	CCAFS, VAFB	CCAFS, VAFB	CCAFS, KSC	CCAFS	CCAFS	Odyssey Pacific Ocean Platform
LEO kg (lbs)	443 (976)	10,430 (22,974)	11,062 (25,387)	13,774 (30,365)	22,560 kg (49,740 lb)	9,797 (21,598)	8,123 (17,908)	--	--	10,450 (21,586)	15,246 (33,541)
GTO kg (lbs)	--	5,845 (12,874)	5,433 (11,978)	7,434 (16,389)	12,980 kg (28,620 lb)	4,750 (10,470)	3,775 (8,320)	7,980 (17,593)	8,670 (19,114)	4,540 (10,296)	6,100 (13,440)

Table 8. U.S. and FAA-Licensed Launch Vehicles Active in 2012

Orbital Sciences Corporation

Orbital provides the Minotaur, Pegasus, and Taurus vehicles for orbital launch. In 2013, Orbital plans to launch a new vehicle, Antares, as part of NASA's commercial cargo program.

Orbital performed one launch in 2012. In June, a Pegasus XL launched NASA's X-ray telescope, NuSTAR, from Kwajalein Island.

Space Exploration Technologies Corporation

SpaceX performed two Falcon 9 launches in 2012, in May and October, carrying supplies to the ISS in the Dragon capsule. These missions were performed under NASA's COTS and CRS programs and were the first commercial missions to the ISS.

United Launch Alliance

United Launch Alliance (ULA) conducts launches for the non-commercial U.S. government launch market. ULA manufactures and operates Boeing-heritage Delta vehicles and Lockheed Martin-heritage Atlas vehicles. ULA is a partnership between Boeing and Lockheed Martin.

In 2012, ULA conducted 10 non-commercial U.S. government launches:

- Delta IV vehicles placed four DoD payloads into orbit: WGS 4, NRO L-25, NRO L-15, and Navstar GPS 2F-3.
- Atlas V vehicles placed six payloads, five DoD and one NASA, into orbit: MUOS 1, AEHF 2, NRO L-38, NRO L-36, X-37B/OTV 3, and Van Allen Probe A and B.

FAA-Licensed Multinational Launches: Sea Launch AG

Zenit 3SL, a launch vehicle operated by multinational commercial launch provider Sea Launch AG, deployed three commercial GEO communications satellites for commercial operators Intelsat and Eutelsat. These launches were performed under FAA licenses.

NON-U.S. ORBITAL LAUNCH ACTIVITIES

The following section of the report highlights non-U.S. launch activity on a country-by-country basis.

Russia

In 2012, there were 24 Russian launches. Twenty-two of these were successful, one Proton M failed, and one Proton M experienced a partial failure. Eleven launches were with Proton vehicles, 12 with Soyuz vehicles, and 1 with a Rockot vehicle. Twenty-two of the missions launched from Baikonur Cosmodrome, and two Russian Space Forces missions launched from Plesetek. Table 9 summarizes 2012 Russian launch activity by vehicle.

Seven launches were commercial and 17 were non-commercial. The non-commercial missions are detailed below:

- Eight Soyuz launches were dedicated ISS missions, involving four Progress M cargo missions and four Soyuz spacecraft crew exchange missions.
- Russian military conducted four missions. A Proton vehicle launched communications satellite Cosmos 2479. Two Soyuz vehicles launched two communications satellites, Cosmos 2480 and Meridian 6. A Rockot vehicle launched communications satellite Cosmos 2481 (with three government civil secondary payloads co-manifesting).
- Russia executed three launches for civil purposes. Two Soyuz vehicles launched a remote sensing satellite, Kanopus B1, and a meteorological satellite, MetOp B. A Proton M launched Luch 5B (co-manifested with a commercial payload, the communications satellite Yamal 300K.)
- One non-commercial launch with a Proton M deployed a communications satellite, Yamal 402.
- One more Proton M vehicle attempted to launch two communications satellites, Express MD2 for Russian Satellite Communications Company (RSCC) and Telkom 2 for PT Telkom of Indonesia. The launch attempt resulted in a failure.

International Launch Services (ILS) provided launch services for eight Proton M launches. All eight missions were telecommunications satellites to GEO. Two of the satellites were for SES, two for Intelsat, and one each for Telesat Canada, Echostar Communications, and United Arab Emirates Yahsat. Under FAA's definition for a commercial launch, seven of these launches are considered commercial missions. The launch of the Yamal 402 satellite for Gazprom Space Systems is not considered commercial because it did not meet FAA's criteria of an internationally competed launch. Typically, all Russian commercial Proton launches are under a contract with ILS.

Vehicle	Rockot	Soyuz	Soyuz 2	Soyuz U	Proton K	Proton M
Country/Region	Russia	Russia	Russia	Russia	Russia	Russia
2012 Total Launches	1	9	2	1	1	10
Launch Reliability (2012)	1/1 100%	9/9 100%	2/2 100%	1/1 100%	1/1 100%	9/10 90%
Launch Reliability (Last 10 Years)	14/15 93%	92/95 97%	15/17 88%	4/4 100%	18/18 100%	60/67 90%
Year of First Launch	1994	1963	2004	2009	1967	2000
Active Launch Sites	Baikonur, Plesetsk	Baikonur, Plesetsk	Baikonur, Plesetsk	Plesetsk	Baikonur	Baikonur
LEO kg (lbs)	1,850 (4,075)	6,708 (14,758)	7,800 (17,100)	6,700 (14,740)	19,760 (43,570)	21,000 (46,305)
GTO kg (lbs)	--	1,350 (2,975)	1,700 (3,800)	--	4,430 (9,770)	5,500 (12,125)

Table 9. Russian Launch Vehicles Active in 2012

Europe

Europe conducted 10 launches in 2012 from its spaceport in French Guiana. Seven were with Ariane 5 vehicles, two with Soyuz vehicles, and the Vega rocket made its inaugural launch. Six of the Ariane 5 launches were commercial. The other four European launches were non-commercial, carrying payloads for the European Space Agency, French Space Agency, and Italian Space Agency. Table 10 summarizes 2012 European launch activity by vehicle. More details on European launches are below:

- Six Ariane 5 ECA launch vehicles placed 12 satellites in GEO, including seven commercial telecommunications satellites, one military communications satellite, three civil government communications satellites, and a meteorological satellite. All Ariane 5 ECA launches were dual manifests of GEO satellites.
- An Ariane 5 ES launched the third Automated Transfer Vehicle bringing cargo to the ISS.
- The first Soyuz 2 launched two Galileo satellites.
- The second Soyuz 2 carried the Pleiades 1B remote sensing satellite.
- Vega launched nine satellites to LEO, including one civil and eight non-profit payloads.

Vehicle	Vega	Ariane 5 ECA	Ariane 5 ES-ATV	Soyuz 2
Country/Region	Europe	Europe	Europe	Europe
2012 Total Launches	1	6	1	2
Launch Reliability (2012)	1/1 100%	6/6 100%	1/1 100%	2/2 100%
Launch Reliability (Last 10 Years)	1/1 100%	38/39 97%	3/3 100%	4/4 100%
Year of First Launch	2012	2002	2008	2011
Active Launch Sites	Kourou	Kourou	Kourou	Kourou
LEO kg (lbs)	1,500 (3,307)	17,250 (37,950)	21,000 (46,297)	7,800 (17,100)
GTO kg (lbs)	--	10,500 (23,127)	8,000 (17,637)	1,700 (3,800)

Table 10. European Launch Vehicles Active in 2012

China

China conducted 19 orbital launches, including 2 commercial launches, in 2012—the same number as in 2011. Nine launches were conducted from the Xichang Satellite Launch Center, five from the Jiuquan Satellite Launch Center, and five from the Taiyuan Satellite Launch Center. Table 11 summarizes 2012 Chinese launch activity by vehicle. More details on Chinese launches are below.

- Nine launches were for China's military. These launches deployed five Beidou navigation satellites, five Yaogan remote sensing satellites, three scientific and development satellites, and one communications satellite, Chinasat 2A.
- Six launches were for China's civil government agencies. One was a human misson: the Shenzhou 9 vehicle launched three crew, including China's first female astronaut, and docked for the first time with the Tiangong 1 space module. The other five civil launches deployed satellites, including one meteorological satellite, three remote sensing satellites, and one communications satellite for CAST. A communications microsatellite, Vesselsat 2, for ORBCOMM was launched as a piggyback payload co-manifesting with one of the three remote sensing satellites (Ziyuan 3).
- Two launches were commercial. One launch deployed the APSTAR 7 satellite for APT Satellite Holdings Ltd. of Hong Kong. The second commercial launch deployed the Gökturk-2 satellite for Turkey's Ministry of Defense.
- One non-commercial launch deployed the VRSS 1 satellite built by China for Venezuela, and another non-commercial launch deployed APSTAR 7B, the second satellite for APT Satellite Holdings Ltd. APSTAR 7B was originally ordered as a back-up to APSTAR 7. It was transferred to the Chinese Government and will be operated as Chinasat 12.

Vehicle	Long March 2C	Long March 2D	Long March 2F	Long March 3A	Long March 3B	Long March 3C	Long March 4B	Long March 4C
Country/Region	China	China	China	China	China	China	China	China
2012 Total Launches	2	3	1	1	5	3	2	2
Launch Reliability (2012)	2/2 100%	3/3 100%	1/1 100%	1/1 100%	5/5 100%	3/3 100%	2/2 100%	2/2 100%
Launch Reliability (Last 10 Years)	16/17 94%	15/15 100%	8/8 100%	17/17 100%	18/18 100%	10/10 100%	16/16 100%	8/8 100%
Year of First Launch	1975	1992	1999	1994	1996	2008	1999	2007
Active Launch Sites	Jiuquan, Taiyuan, Xichang	Jiuquan	Jiuquan	Taiyuan, Xichang	Xichang	Xichang	Taiyuan	Taiyuan
LEO kg (lbs)	3,200 (7,048)	3,500 (7,700)	8,400 (18,500)	7,200 (15,859)	13,562 (29,900)	3,700 (8,200)	2,500 (5,512)	4,595 (10,130)
GTO kg (lbs)	1,000 (2,203)	1,250 (2,750)	--	2,500 (5,506)	4,491 (9,900)	--	1,500 (3,300)	1,500 (3,300)

Table 11. Chinese Launch Vehicles Active in 2012

Japan

Japan had two launches this year: one H-IIA launch of payloads to sun-synchronous orbit (SSO) and one H-IIB ISS cargo resupply mission. Japan also had two launches in 2011, one H-IIA and one H-IIB. In September, the Japan Aerospace Exploration Agency (JAXA) and Mitsubishi Heavy Industries LTD. (MHI) announced an effort to privatize the H-IIB launch service. Under the new arrangement, JAXA will procure the H-IIB transportation and launch service from MHI when it launches a payload on the H-IIB.

India

The Indian Space Research Organization (ISRO) performed two PSLV launches in 2012. The primary payloads were remote sensing satellites to SSO. In April, ISRO launched its C-band synthetic aperture Radar RISAT 1, which is intended primarily for natural resource planning. The second PSLV launch deployed France's remote sensing satellite, SPOT 6. India had three PSLV launches in 2011.

Iran

Iran's Safir 2 rocket attempted to launch three times. The February launch deployed Navid-e Elm-o Sanat, a remote sensing satellite, in LEO. Two other attempts in May and September resulted in failures.

North Korea

The North Korean Unha 3 rocket made two launch attempts. The first, in April, failed. The second launch, in December, appeared to put a payload in LEO, a first for North Korea.

Table 12 summarizes the launch vehicles of Japan, India, Iran, and North Korea that were active in 2012.

Vehicle	H IIA	H IIB	PSLV CA	PSLV XL	Safir 2	Unha
Country/Region	Japan	Japan	India	India	Iran	North Korea
2012 Total Launches	1	1	1	1	3	2
Launch Reliability (2012)	1/1 100%	1/1 100%	1/1 100%	1/1 100%	1/3 33%	1/2 50%
Launch Reliability (Last 10 Years)	19/20 95%	3/3 100%	2/2 100%	1/1 100%	3/6 50%	1/3 33%
Year of First Launch	2001	2009	2009	2012	2009	2009
Active Launch Sites	Tanegashima	Tanegashima	Satish Dhawan	Satish Dhawan	Semnan Providence	Musudan-ri
LEO kg (lbs)	11,730 (25,860)	19,000 (42,000)	2,100 (4,630)	1,800 (3,968)	27 (60)	100 (220)
GTO kg (lbs)	5,800 (12,800)	8,000 (17,600)	--	1,140 (2,513)	--	--

Table 12. Japanese, Indian, Iranian, and North Korean Launch Vehicles Active in 2012

FAA SUBORBITAL FLIGHT SUMMARY

On October 6 and November 4, Armadillo Aerospace conducted the first ever licensed launches out of Spaceport America with their STIG-B suborbital reusable vehicle (SRV). The October STIG-B flight was the first licensed launch from Spaceport America. The launch experienced an in-flight abort, meaning it did not reach its planned altitude, but the vehicle was successfully recovered intact and later used to conduct launch tests in November. Armadillo successfully launched its STIG-A vehicle as a class 3 amateur rocket in January 2012, but the vehicle was lost during recovery.

Due to the changes in the amateur rocket regulations in 2009 that removed the 15 second burn time limit, Armadillo Aerospace, Blue Origin, SpaceX, Masten, and UP Aerospace were all able to conduct some of their launches under the amateur rocket regulations. An amateur rocket is an unmanned rocket that has less than 200,000 pound-seconds of total impulse and cannot reach an altitude greater than 150 kilometers above the earth's surface. There are three different amateur rocket classes in 14 CFR Part 101. Class 1 is a model rocket that uses no more than 4.4 ounces of propellant; uses a slow-burning propellant; is made of paper, wood, or breakable plastic; contains no substantial metal parts; and weighs no more than 53 ounces including the propellant. Class 2 is a high-power rocket, other than a model rocket, that is propelled by a motor or motors having a combined total impulse of 9,208 pound-seconds or less. Class 3 is an advanced high-power rocket, other than a model rocket or high-power rocket.

SpaceX successfully tested its Grasshopper vehicle three times during in 2012 at the company's testing facilities in McGregor, Texas. The first test was conducted under the amateur rocket regulations and all subsequent tests were conducted under an FAA experimental permit because of the size and power of the Merlin 1D engine. Its third test, on December 17, lifted off vertically to an altitude of 40 meters (131 feet) before successfully landing vertically back on the pad. The Grasshopper is a flight test vehicle that supports the company's program to develop a reusable Falcon 9 first stage.

Operator	Type of FAA Authorization	Launch Date	Vehicle
Armadillo Aerospace	Launch Operator License	6-Oct 4-Nov	STIG-B
Scaled Composites	Airworthiness Certificate	19-Dec 11-Aug 7-Aug 2-Aug 8-Jul 29-Jun 26-Jun	SpaceShipTwo
SpaceX	Experimental Permit	17-Dec 1-Nov	Grasshopper

Table 13. FAA 2012 Suborbital License and Flight Summary

Blue Origin successfully tested its launch escape system for the New Shepard SRV at its launch facility in West Texas under the amateur rocket regulations.

Masten Space Systems conducted several tests from its location at Mojave Air and Space Port. The company successfully fired its Katana engine (KA5S) that will be used for its Xogdor SRV and Xeus lunar lander demonstrator. Masten's Xaero SRV succeeded in reaching an altitude of 444 meters (1,457 feet) in July, and topped one kilometer in altitude in September. A throttle valve failure occurred during the last flight, ultimately destroying the vehicle upon impact with the ground. The company is constructing the Xaero-B, which will be powered by Masten's new Scimitar engine. Finally, Masten successfully conducted a translation flight using its Xombie vehicle, which launched vertically to an altitude of 477 meters (1,565 feet), translated horizontally 750 meters (2,460 feet), and landed vertically on another pad. So far, all Masten flights have launched as amatuer rockets.

On April 5, UP Aerospace conducted its tenth launch from Spaceport America, carrying payloads for DoD, NASA, the FAA Center of Excellence for Commercial Space Transportation, and the University of Texas. The company launches its SpaceLoft vehicle as a class 3 amateur rocket.

Scaled Composites continues to conduct flight tests of SpaceShipTwo and its carrier aircraft WhiteKnightTwo from its base at Mojave Air and Space Port in California. While not technically launches, seven unpowered flight tests of SpaceShipTwo were conducted during 2012 under an FAA experimental airworthiness certificate. The final glide test of SpaceShipTwo in 2012 featured a fully integrated propulsion system. Scaled Composites was granted an Experimental Permit in May 2012 for rocket-powered flights. Scaled Composites was the first commercial company to fly humans in space in 2004 and is now the first to exercise the new human space flight regulations that were issued in response to the Commercial Space Launch Amendments Act of 2004.

2012 SPACE TRANSPORTATION TRENDS

FIVE-YEAR WORLDWIDE SPACE TRANSPORTATION TRENDS

There were 383 orbital launches in the past five years. Between 2008 and 2012, there has been an average of 77 orbital launches per year worldwide. (See Figure 12.)

Russia and the United States have conducted the most orbital launches, followed by China and Europe (see Figure 13). Russia and Europe have conducted the most commercial launches. There were 113 commercial orbital launches from 2008 to 2012, with the highest number of launches, 28, occurring in 2008, and the lowest number of launches, 18, in 2011. In 2012, there were 21 commercial launches. (See Figure 14.)

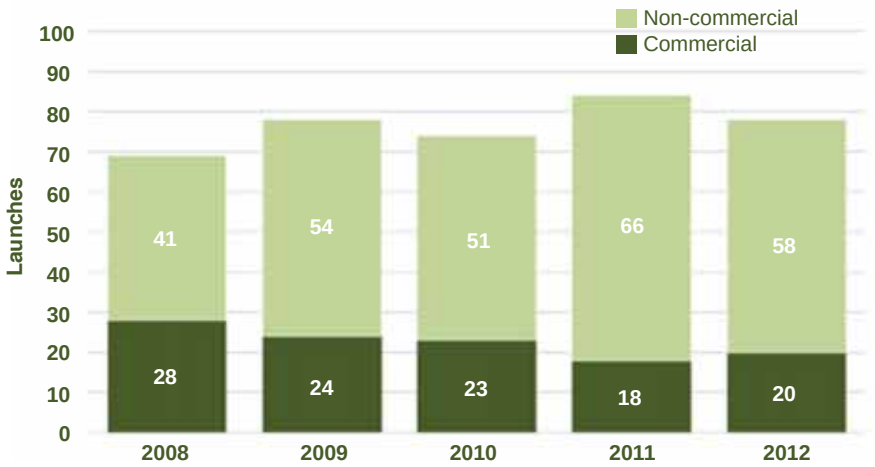


Figure 12. Five-Year Summary (2008-2012) of Commercial and Non-Commercial Launch Events

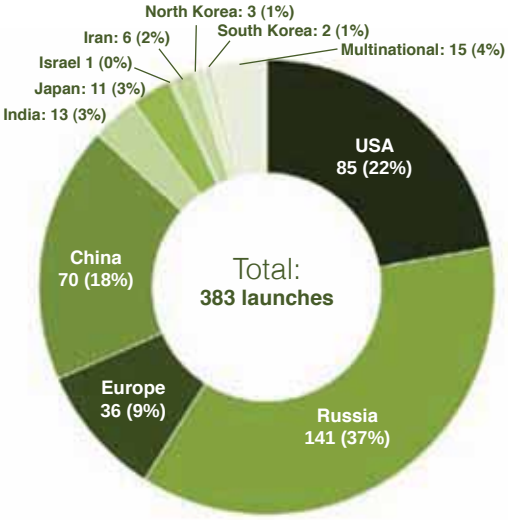


Figure 13. Five-Year Worldwide Total Orbital Launch Market Share (2008-2012)

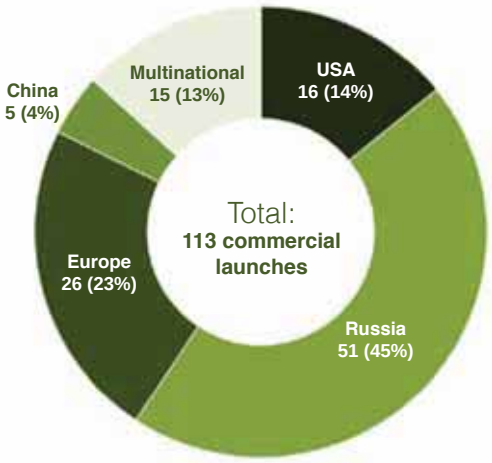


Figure 14. Five-Year Worldwide Commercial Orbital Launch Market Share (2008-2012)

Sea Launch has re-entered the market place and appears to have taken market share from Russia. Commercial launches overall have been steady, but dipped slightly in 2012. After having no commercial launches in 2011, the United States had two commercial launches in 2012, both launches were part of NASA's program to encourage the development of commercial cargo and crew services to the ISS.

There have been at least three launch failures per year over the last five years. (The definition of a launch failure is in Appendix II.) Five launches failed in 2012, and six failed in 2011. The only recent year with a higher number of failures was 1999, in which eight failures occurred. The 2012 launch failures included two Russian launches (including one partial), two Iranian, and one North Korean launch failure. Over the past five years, the overall failure rate for commercial launches is 3.5 percent, compared to a slightly higher failure rate of 6 percent for all launches. If one removes launches by North Korea and Iran, the failure rate drops to slightly under 5 percent. Figure 15 presents a five-year trend of orbital launch successes and failures. Launch failures from the last five years are broken down by launch vehicle in Figure 16.

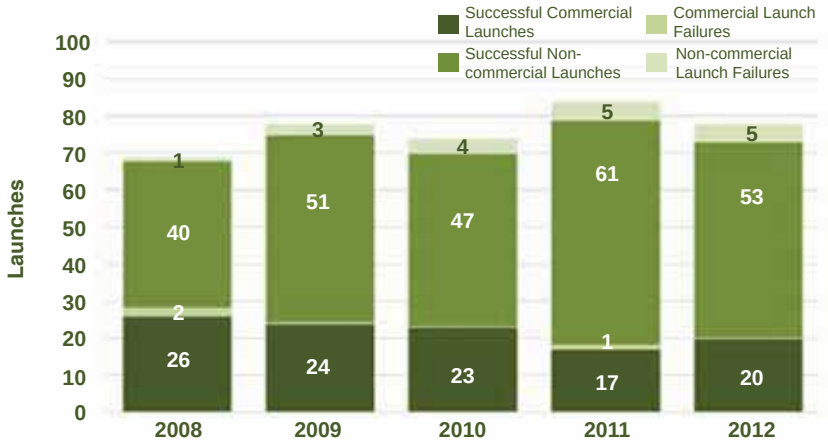


Figure 15. Five-Year Summary (2008-2012) of Commercial and Non-Commercial Launch Events, Successes and Failures

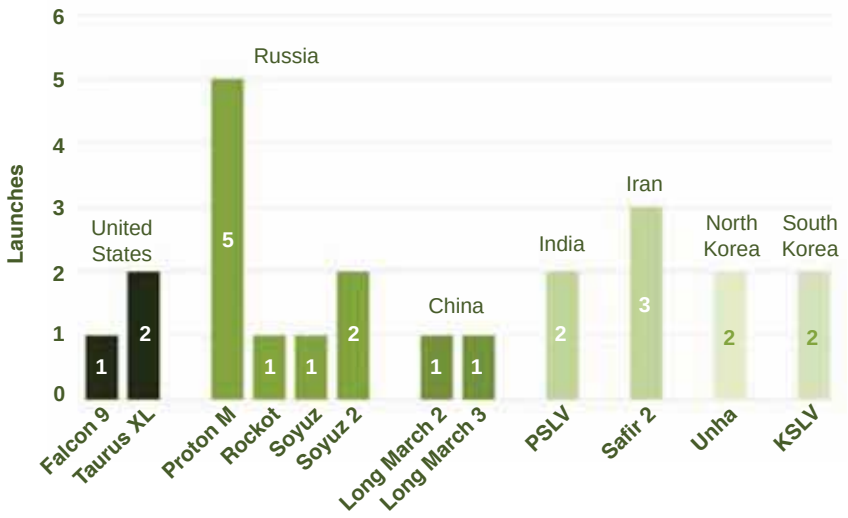


Figure 16. Launch Failures by Vehicle, 2008 - 2012

Table 14 lists commercial and non-commercial launch failures of the most actively launching countries and regions from 2008 to 2012. The United States, Russia, and China experienced both commercial and non-commercial launch failures in this five-year period, while Europe had none. Russia had the largest number of launches, commercial and non-commercial, and the largest number of failures. The United States and China had occasional launch failures that did not follow any particular pattern.

Country/ Region	Launches	2008	2009	2010	2011	2012
United States	Total/Failed: Non-commercial	9/0	20/1	11/0	18/1	11/0
	Total/Failed: Commercial	6/1	4/0	4/0	0/0	2/0
Russia	Total/Failed: Non-commercial	15/0	19/0	18/1	21/3	17/2
	Total/Failed: Commercial	11/1	10/0	13/0	10/1	7/0
Europe	Total/Failed: Non-commercial	1/0	2/0	0/0	3/0	4/0
	Total/Failed: Commercial	5/0	5/0	6/0	4/0	6/0
China	Total/Failed: Non-commercial	11/0	5/0	15/0	17/1	16/0
	Total/Failed: Commercial	0/0	1/1	0/0	2/0	3/0

Table 14. Five-Year Summary of Orbital Launch Failures by Country and Launch Type, 2008-2012

Commercial launch revenues increased almost $1 billion between 2006 and 2010, from $1.4 billion to about $2.4 billion. Revenues dropped in 2011 to approximately $2 billion, due to several commercial launches being pushed back. In 2012, revenue returned to the $2.4 billion level. (See Figure 17 and Table 15.) With the number of commercial launches relatively constant or slightly decreasing, the commercial launch revenues have increased, with less small class launch vehicles used and more launches performed by more expensive larger vehicles, including those providing dual manifest services to GEO.

The five-year average of commercial GSO launches is 17 and has remained fairly consistent, while the number of commercial NGSO launches per year has fluctuated significantly. The demand for commercial NGSO launches, which peaked in the late 1990s, was low until a sharp increase in 2007, 2008, and again in 2010. These high levels were mostly driven by the launch of replacement satellites for existing constellations, such as ORBCOMM and Globalstar, and by the launch of new constellations, such as SAR-Lupe and COSMO-SkyMed. (Figure 18 breaks down commercial launches by orbit type for the last five years.) The demand for commercial NGSO launches is also affected by NASA's Commercial Crew and Cargo Program, which has ordered 20 commercial cargo flights to the ISS under CRS contracts and will eventually charter crewed flights as well. SpaceX conducted its first cargo flight this year, and Orbital plans to begin flying to the ISS next year. The number of NGSO launches is expected to slightly increase in 2013 as NASA's COTS and CRS flights continue, and Globalstar continues to replace its constellation.

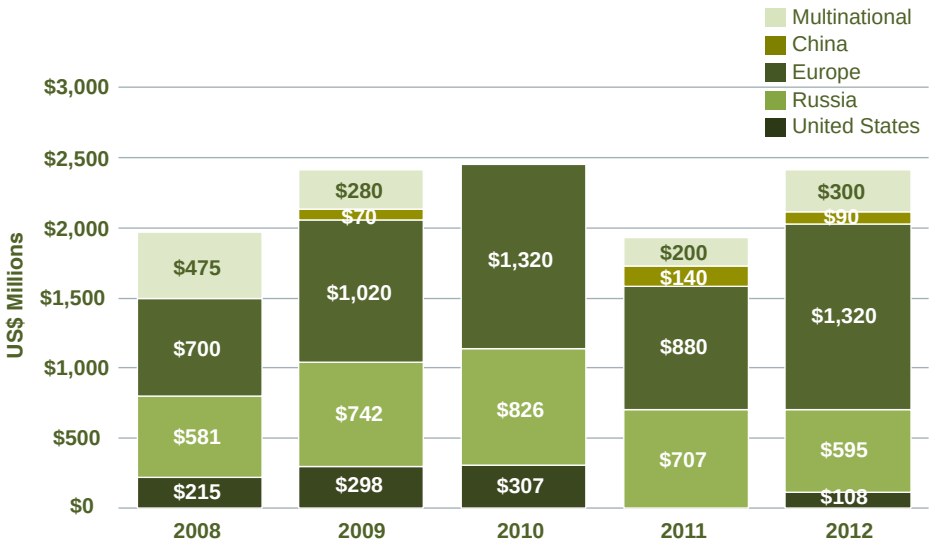


Figure 17. Approximate Launch Revenues for Commercial Launch Events (2008-2012)

Country/Region	2008	2009	2010	2011	2012
United States	$215	$298	$307	$0	$108
Russia	$581	$742	$826	$707	$595
Europe	$700	$1,020	$1,320	$880	$1,320
China	$0	$70	$0	$140	$90
Multinational	$475	$280	$0	$200	$300
TOTAL	***$1,971***	***$2,410***	***$2,453***	***$1,927***	***$2,413***

Table 15. Estimated Commercial Launch Revenues, 2008-2012 (US$ Millions)

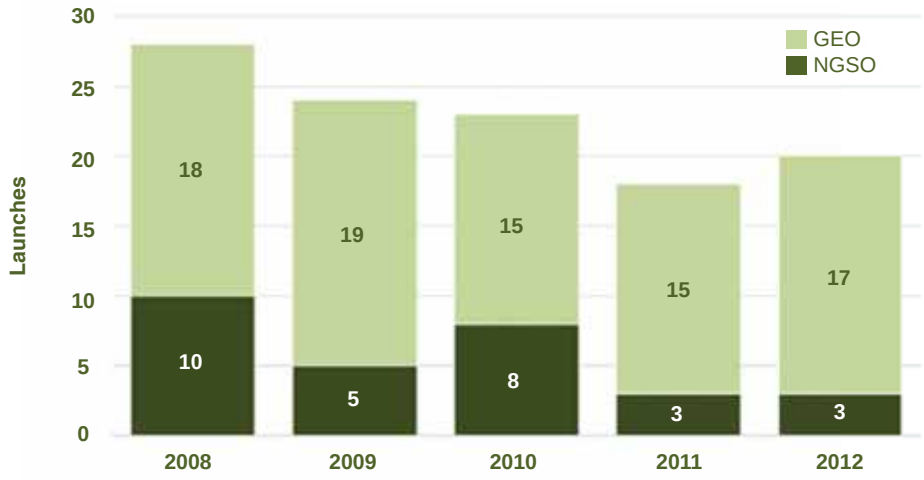


Figure 18. Five-Year Global Commercial Launch Events by Orbit (2008-2012)

Figure 19 shows the number of payloads providing commercial services launched on commercial and non-commercial vehicles over the past five years. The number of commercial NGSO satellites launched per year fluctuates significantly, mostly because NGSO satellites often are launched on a single vehicle. The launches of Globalstar (6 in 2010 and 12 in 2011), ORBCOMM (6 in 2008) and RapidEye constellation satellites (5 in 2008) account for the increase in the number of payloads launched in 2008, 2010, and 2011.

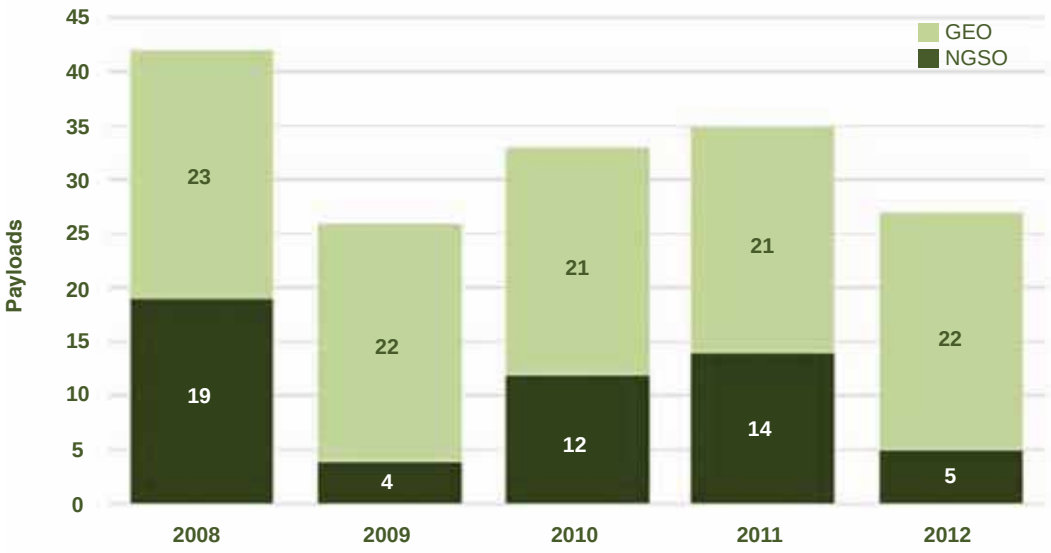


Figure 19. Five-Year Global Commercial Payloads by Orbit (2008-2012)

Commercial Satellite and Launch Trends

The commercial space transportation market is driven largely by the demand for launches of GEO telecommunications satellites and to a lesser, but potentially growing, extent by a variety of NGSO payloads. Historically, the majority of commercial launches have been to GEO. Usually, GEO launches deploy larger payloads and require larger launch vehicles, thus generating more revenue than launches to NGSO.

The supply of launch vehicle options continues to increase, despite only a marginal increase in demand for launches. Competition remains strong between United States, Russian, European, and multinational providers, while new entrants are entering, reentering, or advancing toward the commercial market. For example, the Land Launch version of the Zenit, the Dnepr, the Soyuz (launched and marketed by Arianespace), and the Falcon 9 are all competing for commercial launches. The Japanese are marketing the H-IIB commercially, and Indian and Chinese providers, although limited by United States export control policies, also target commercial launch customers. The newly introduced Vega and Orbital's Antares vehicle, which has yet to make its first flight, are both set to join this diverse set of launch vehicles offered on a commercial basis, with commercial launches planned for each in 2013.

Small Vehicle Commercial Launch Trends

The commercial use of small launch vehicles has declined in the last five years. In 2008, there were eight such launches; that number was cut in half to four in 2009 and 2010; in 2011, there was a single launch; and there was none in 2012. However, in 2013, two commercial Dnepr launches for primary payloads Dubaisat and Kompsat are expected. Vega also intends to launch commercial payloads in 2013. The recent decrease in the number of commercial launches on small vehicles is due to some small vehicles no longer being offered, such as the Falcon 1 and Kosmos 3M, and the increased opportunity for small payloads, especially micro and nano-satellites (cubesats), to fly inexpensively as piggyback payloads on the Atlas V or Falcon 9. The Antares inaugural flight later this year will also fly cubesats as secondary payloads.

New vehicles are expected to become available within the next two to three years. They include Athena and Super Strypi/SPARK (United States), Epsilon (Japan), and Long March 6 (China). These vehicles are designed to launch several micro- and small-class payloads at a time. With many small NGSO satellites launching as piggyback payloads on larger vehicles, existing and upcoming small-class launch vehicles may be limited to the smaller market of time-sensitive delivery of payloads in orbit.

Internationally Competed Launches

The terms "commercial payload" and "commercial launch" are complex and open to interpretation. (See Appendix II for definitions of these terms.) Figure 20 shows trends for each country whose launch providers compete in the international marketplace. The chart reflects only launch service providers competing in the international marketplace for open-bid launch service contracts. From 2008 to 2012, there were 103 internationally competed launch events. Over the past five years, national satellite operators in countries such as Russia and China more often turn directly to the services of their domestic launch providers. NASA's commercial crew and cargo program will result in additional commercial launches; however, since those launches are competed only within the United States, the additional launches will not increase the total number of internationally competed launches.

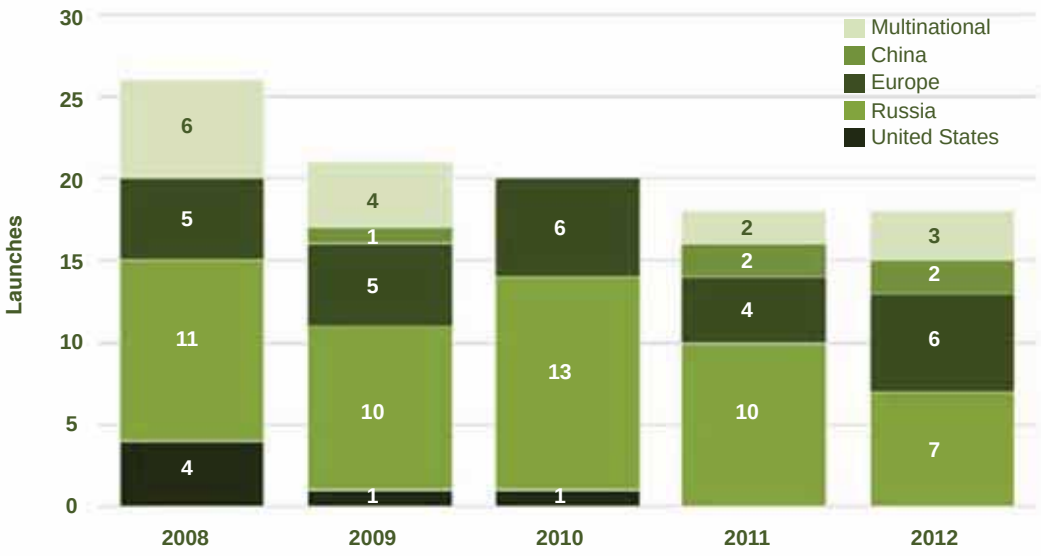


Figure 20. Five-Year Worldwide Internationally Competed Launch Events (2008-2012)

APPENDIX I: 2012 WORLDWIDE ORBITAL LAUNCH EVENTS

Date		Vehicle	Site		Payload(s)	Orbit	Operator	Manufacturer	Use	Comm'l Price	L	M
9-Jan-12		Long March 4B	Taiyuan		Ziyuan 3	SSO	China State Bureau of Surveying & Mapping	CAST	Remote Sensing		S	S
				*	Vesselsat 2	LEO	ORBCOMM	LuxSpace Sarl (OHB)	Communications			S
13-Jan-12		Long March 3A	Xichang		Feng Yun 2F	GEO	China State Meteorological Administration	Shanghai Institute of Satellite Engineering	Meteorological		S	S
20-Jan-12		Delta IV Medium +(5, 4)	CCAFS		WGS 4	GEO	U.S. Air Force	Boeing	Communications		S	S
25-Jan-12		Soyuz	Baikonur		Progress M-14M (ISS 46P)	LEO	Roscosmos	RSC Energia	ISS		S	S
3-Feb-12		Safir 2	Semnan Providence		Navid-e Elm-o Sanat	LEO	Government of Iran	Sharif University of Technology	Remote Sensing		S	S
13-Feb-12		Vega	Kourou		LARES	LEO	Italian Space Agency	CGS S.p.A.	Scientific		S	S
					PW-Sat 1	LEO	Warsaw Polytech	Warsaw Polytech	Development			S
					XaTcobeo	LEO	University of Vigo	University of Vigo	Development			S
					Robusta	LEO	University of Montepellier II	University of Montepellier II	Development			S
					e-St@r	LEO	Polytechnic University of Turin	Polytechnic University of Turin	Development			S
					Goliat	LEO	University of Bucharest	University of Bucharest	Remote Sensing			S
					ALMASAT	LEO	University of Bologna	University of Bologna	Development			S
					MaSat 1	LEO	Budapest University of Technology and Economics	Budapest University of Technology and Economics	Development			S
					Unicubesat GG	LEO	University of Rome	University of Rome	Scientific			S
14-Feb-12	V	Proton M	Baikonur	*	SES 4	GEO	SES World Skies	Space Systems/Loral	Communications	$85M	S	S
24-Feb-12		Atlas V 551	CCAFS		MUOS 1	GEO	U.S. Navy	Lockheed Martin Corp.	Communications		S	S
24-Feb-12		Long March 3C	Xichang		Beidou 2-G5	GEO	People's Liberation Army	Dongfanghong Satellite Co.	Navigation		S	S
23-Mar-12		Ariane 5 ES-ATV	Kourou		ATV 3	LEO	European Space Agency	European Space Agency	ISS		S	S
25-Mar-12	V	Proton M	Baikonur	*	Intelsat 22	GEO	Intelsat	Boeing Satellite Systems	Communications	$85M	S	S
30-Mar-12		Proton K	Baikonur		Cosmos 2479	GEO	Russian Space Forces	NPO Lavotchkin	Early Warning		S	S
31-Mar-12	V	Long March 3B	Xichang	*	APSTAR 7	GEO	APT Satellite Co., Ltd.	Thales Alenia Space	Communications	$70M	S	S
3-Apr-12		Delta IV Medium-Plus (5, 2)	Vandenberg AFB		NRO L-25	SSO	NRO	Classified	Classified		S	S
12-Apr-12		Unha 3	Musudan-ri		Kwangmyongsong 3	LEO	Democratic People's Republic of Korea	Institute for Electronic War	Remote Sensing		F	F
20-Apr-12		Soyuz	Baikonur		Progress M-15M (ISS 47P)	LEO	Roscosmos	RSC Energia	ISS		S	S
23-Apr-12	V	Proton M	Baikonur	*	Yahsat 1B	GEO	Yah Satellite Communications Co.	EADS Astrium	Communications	$85M	S	S
26-Apr-12		PSLV XL	Satish Dhawan		Risat 1	SSO	ISRO	ISRO	Remote Sensing		S	S
29-Apr-12		Long March 3B	Xichang		Beidou 2C-M3	MEO	People's Liberation Army	CAST	Navigation		S	S
					Beidou 2C-M4	MEO	People's Liberation Army	CAST	Navigation			S
4-May-12		Atlas V 531	CCAFS		Advanced EHF 2	GEO	U.S. Department of Defense	Lockheed Martin Corp.	Communications		S	S
6-May-12		Long March 2D	Jiuquan		Tian Hui 1B	SSO	China National Space Administration	Dongfanghong Satellite Co.	Remote Sensing		S	S
10-May-12		Long March 4B	Taiyuan		Yaogan 14	SSO	People's Liberation Army	Shanghai Academy of Space Technology	Remote Sensing		S	S
					Tiantuo 1	SSO	People's Liberation Army	National University of Defense Technology	Scientific			S

Date		Vehicle	Site		Payload(s)	Orbit	Operator	Manufacturer	Use	Comm'l Price	L	M
15-May-12	V	Ariane 5 ECA	Kourou	*	JCSAT 13	GEO	Sky Perfect JSAT Group	Lockheed Martin Corp.	Communications	$220M	S	S
					Vinasat 2	GEO	Vietnam Telecom International	Lockheed Martin Corp.	Communications			S
15-May-12		Soyuz	Baikonur		Soyuz TMA-04M (ISS 30S)	LEO	Roscosmos	RSC Energia	Crewed		S	S
17-May-12		Soyuz U	Plesetsk		Cosmos 2480	LEO	Russian Space Forces	RSC Energia	Intelligence		S	S
17-May-12	V	Proton M	Baikonur	*	Nimiq 6	GEO	Telesat Canada	Space Systems/Loral	Communications	$85M	S	S
17-May-12		H IIA	Tanegashima		GCOM W1	SSO	JAXA	NEC Corp.	Scientific		S	S
					Arirang 3	SSO	KARI	KARI	Remote Sensing			S
					SDS 4	SSO	JAXA	JAXA	Development			S
					Horyu 2	SSO	Kyushu Institute of Technology	Kyushu Institute of Technology	Communications			S
22-May-12	V +	Falcon 9	CCAFS	*	Dragon COTS Demo 2/3	LEO	SpaceX	SpaceX	Development	$54M	S	S
23-May-12		Safir 2	Semnan Providence		Fajr	LEO	Iranian Ministry of Defense	Iranian Ministry of Defense	Development		F	F
26-May-12		Long March 3B	Xichang		Chinasat 2A	GEO	People's Liberation Army	CAST	Communications		S	S
29-May-12		Long March 4C	Taiyuan		Yaogan 15	SSO	People's Liberation Army	Shanghai Academy of Space Technology	Remote Sensing		S	S
1-Jun-12	V +	Zenit 3SL	Sea Launch Platform	*	Intelsat 19	GEO	Intelsat	Space Systems/Loral	Communications	$100M	S	S
13-Jun-12		Pegasus XL	Kwajalein Island		NuSTAR	LEO	NASA/JPL	Orbital Sciences Corp.	Scientific		S	S
16-Jun-12		Long March 2F	Jiuquan		Shenzhou 9 Descent Module	LEO	China Aerospace Corp.	CAST	Crewed		S	S
					Shenzhou 9 Orbital Module	LEO	China Aerospace Corp.	CAST	Development			S
20-Jun-12		Atlas V 401	Vandenberg AFB		NRO L-38	GEO	NRO	Boeing	Communications		S	S
29-Jun-12		Delta IV Heavy	CCAFS		NRO L-15	GEO	NRO	Unknown	Intelligence		S	S
5-Jul-12	V	Ariane 5 ECA	Kourou	*	Echostar XVII	GEO	Hughes Network Systems	Space Systems/Loral	Communications	$220M	S	S
					MSG 3	GEO	Eumetsat	Thales Alenia Space	Meteorological			S
9-Jul-12	V	Proton M	Baikonur	*	SES 5	GEO	SES World Skies	Space Systems/Loral	Communications	$85M	S	S
15-Jul-12		Soyuz	Baikonur		Soyuz TMA-05M (ISS 31S)	LEO	Roscosmos	RSC Energia	Crewed		S	S
21-Jul-12		H IIB	Tanegashima		HTV 3	LEO	JAXA	Mitsubishi Heavy Industries Ltd.	ISS		S	S
					F-1	LEO	Fspace Laboratory, FTP Tech Research	Fspace Laboratory, FTP Tech Research	Remote Sensing			S
					We-Wish	LEO	Meisei Electric Co. Ltd.	Meisei Electric Co. Ltd.	Development			S
					FitSat-1	LEO	Fukuoka Institute of Technology	Fukuoka Institute of Technology	Development			S
					TechEdSat	LEO	NASA Ames Research Center	NASA Ames Research Center	Communications			S
					RAIKO	LEO	Wakayama University	Wakayama University	Development			S
22-Jul-12		Soyuz	Baikonur		Kanopus B1	SSO	Roscosmos	VNIIEM	Remote Sensing		S	S
					Zond PP	SSO	Roscosmos	NPO Lavotchkin	Scientific			S
					ExactView 1	SSO	exactEARTH	COM DEV International	Remote Sensing			S
					TET-1	SSO	DLR	Kayser-Threde GmbH	Development			S
					Belka 2	SSO	National Academy of Sciences of Belarus	VNIIEM	Remote Sensing			S
25-Jul-12		Long March 3C	Xichang		Tianlian-1C	GEO	CAST	CAST	Communications		S	S
28-Jul-12		Rockot	Plesetsk		Cosmos 2481	LEO	Russian Space Forces	Reshetnev Co.	Communications		S	S
					Gonets M-03	LEO	SMOLSAT	Reshetnev Co.	Communications			S
					Gonets M-04	LEO	SMOLSAT	Reshetnev Co.	Communications			S
					MIR (Yubileyniy 2)	LEO	Reshetnev Co.	Reshetnev Co.	Communications			S

Date		Vehicle	Site		Payload(s)	Orbit	Operator	Manufacturer	Use	Comm'l Price	L	M
1-Aug-12		Soyuz	Baikonur		Progress M-16M (ISS 48P)	LEO	Roscosmos	RSC Energia	ISS		S	S
					SFERA-53	LEO	Roscosmos	Unknown	Development			S
2-Aug-12	V	Ariane 5 ECA	Kourou	*	HYLAS 2	GEO	Avanti Screenmedia Group	Orbital Sciences Corp.	Communications	$220M	S	S
				*	Intelsat 20	GEO	Intelsat	Space Systems/Loral	Communications			S
6-Aug-12		Proton M	Baikonur	*	Telkom 3	GEO	Telkom Indonesia	Reshetnev Co.	Communications	$85M	F	F
					Express MD2	GEO	Russian Satellite Communication Co.	Khrunichev State Research & Production Space Center	Communications			F
18-Aug-12	V +	Zenit 3SL	Sea Launch Platform	*	Intelsat 21	GEO	Intelsat	Boeing Satellite Systems	Communications	$85M	S	S
30-Aug-12		Atlas V 401	CCAFS		Van Allen Probe A	ELI	NASA	APL	Scientific		S	S
					Van Allen Probe B	ELI	NASA	APL	Scientific			S
9-Sep-12		PSLV CA	Satish Dhawan	*	SPOT 6	SSO	SPOT Image	EADS Astrium	Remote Sensing		S	S
					mResins	SSO	ISRO	ISRO	Test			S
					Proiteres	SSO	Osaka Institute of Technology	Osaka Institute of Technology	Development			S
13-Sep-12		Atlas V 401	Vandenberg AFB		NRO L-36/NOSS 3-6A	LEO	NRO	Lockheed Martin Corp.	Intelligence		S	S
					NRO L-36/NOSS 3-6B	LEO	NRO	Lockheed Martin Corp.	Intelligence			S
					CXBN	LEO	Morehead State University	Morehead State University	Scientific			S
					AENEAS	LEO	U.S. Air Force	University of Southern California Space Research Center	Development			S
					CISSWE	LEO	University of Colorado	University of Colorado	Scientific			S
					CP 5	LEO	Cal Poly Aerospace Engineering	Cal Poly Aerospace Engineering	Development			S
					CINEMA 1	LEO	University of California, Berkeley	University of California, Berkeley	Scientific			S
					SMDC-ONE 2.1 (ABLE)	LEO	U.S. Army Space & Missile Defense Command	MILTECH	Development			S
					SMDC-ONE 2.2 (BAKER)	LEO	U.S. Army Space & Missile Defense Command	MILTECH	Development			S
					STARE A	LEO	Lawrence Livermore National Laboratory	Lawrence Livermore National Laboratory	Development			S
					AeroCube 4A	LEO	Aerospace Corp.	Aerospace Corp.	Development			S
					AeroCube 4B	LEO	Aerospace Corp.	Aerospace Corp.	Development			S
					AeroCube 4C	LEO	Aerospace Corp.	Aerospace Corp.	Development			S
					OUTSAT	LEO	NASA	NASA	Development			S
17-Sep-12		Soyuz 2 1A	Baikonur		MetOp B	SSO	Eumetsat	EADS Astrium	Meteorological		S	S
18-Sep-12		Long March 3B	Xichang		Beidou 2C-M5	MEO	People's Liberation Army	CAST	Navigation		S	S
					Beidou 2C-M6	MEO	People's Liberation Army	CAST	Navigation			S
22-Sep-12		Safir 2	Semnan Providence		Unknown	LEO	Iran	Iran	Unknown		F	F
28-Sep-12	V	Ariane 5 ECA	Kourou	*	Astra 2F	GEO	SES Astra	EADS Astrium	Communications	$220M	S	S
					GSAT 10	GEO	ISRO	ISRO	Communications			S
29-Sep-12		Long March 2D	Xichang		VRSS 1	SSO	Venezuelan Ministry of Science and Technology	China Great Wall Industry Corp.	Remote Sensing		S	S
4-Oct-12		Delta IV Medium+ (4,2)	CCAFS		Navstar GPS 2F-03	MEO	U.S. Air Force	Boeing	Navigation		S	S
7-Oct-12	V +	Falcon 9	CCAFS	*	Dragon ISS 1D	LEO	SpaceX	SpaceX	ISS	$54M	S	S
				*	ORBCOMM OG2-01	LEO	ORBCOMM	Microsat Systems	Communications			F
12-Oct-12		Soyuz 2 1B	Kourou		Galileo 3	MEO	European Space Agency	EADS Astrium	Navigation		S	S
					Galileo 4	MEO	European Space Agency	EADS Astrium	Navigation			S

Date		Vehicle	Site		Payload(s)	Orbit	Operator	Manufacturer	Use	Comm'l Price	L	M
14-Oct-12	V	Proton M	Baikonur	*	Intelsat 23	GEO	Intelsat	Orbital Sciences Corp.	Communications	$85M	S	S
14-Oct-12		Long March 2C	Taiyuan		Shijian 9A	SSO	People's Liberation Army	Shanghai Academy of Space Technology	Development		S	S
					Shijian 9B	SSO	People's Liberation Army	Shanghai Academy of Space Technology	Development			S
23-Oct-12		Soyuz	Baikonur		Soyuz TMA-06M (ISS 32S)	LEO	Roscosmos	RSC Energia	Crewed		S	S
25-Oct-12		Long March 3C	Xichang		Beidou 2-G6	GEO	People's Liberation Army	Dongfanghong Satellite Co.	Navigation		S	S
31-Oct-12		Soyuz	Baikonur		Progress M-17M (ISS 49P)	LEO	Roscosmos	RSC Energia	ISS		S	S
2-Nov-12		Proton M	Baikonur		Luch 5B	GEO	Roscosmos	Reshetnev Co.	Communications	$85M	S	S
				*	Yamal 300K	GEO	Gazprom Space Systems	Reshetnev Co.	Communications			S
10-Nov-12	V	Ariane 5 ECA	Kourou	*	Star One C3	GEO	Star One	Orbital Sciences Corp.	Communications	$220M	S	S
				*	Eutelsat 21B	GEO	Eutelsat	Thales Alenia Space	Communications			S
14-Nov-12		Soyuz 2 1A	Plesetsk		Meridian 6	LEO	Russian Space Forces	Reshetnev Company	Communications		S	S
19-Nov-12		Long March 2C	Taiyuan		Huan Jing 1C	SSO	China National Space Administration	CAST	Remote Sensing		S	S
					Fengniao 1A	SSO	China National Space Administration	CAST	Development			S
					Fengniao 1B	SSO	China National Space Administration	Dongfanghong Satellite Co.	Development			S
					Xinyan-1	LEO	China National Space Administration	Dongfanghong Satellite Co.	Development			S
20-Nov-12	V	Proton M	Baikonur	*	Echostar XVI	GEO	Echostar Communications Corp.	Space Systems/Loral	Communications	$85M	S	S
25-Nov-12		Long March 4C	Jiuquan		Yaogan 16 Main	LEO	People's Liberation Army	CAST	Remote Sensing		S	S
					Yaogan 16 Subsat 1	LEO	People's Liberation Army	CAST	Remote Sensing			S
					Yaogan 16 Subsat 2	LEO	People's Liberation Army	CAST	Remote Sensing			S
27-Nov-12		Long March 3B	Xichang	*	APSTAR 7B (Chinasat 12)	GEO	APT Satellite Co., Ltd.	Thales Alenia Space	Communications		S	S
1-Dec-12		Soyuz 2 1B	Kourou		Pleiades 1B (Pleiades HR 2)	SSO	CNES	Astrium Satellite Ltd.	Remote Sensing		S	S
3-Dec-12	V +	Zenit 3SL	Sea Launch Platform	*	Eutelsat 70B	GEO	Eutelsat	EADS Astrium	Communications	$100M	S	S
8-Dec-12		Proton M	Baikonur	*	Yamal 402	GEO	Gazprom Space Systems	Thales Alenia Space	Communications	$85M	P	P
11-Dec-12		Atlas V 501	CCAFS		X-37B/OTV 3	LEO	U.S. Air Force	Boeing	Test		S	S
12-Dec-12		Unha 3	Musudan-ri		Kwangmyongsong 3-2	SSO	Democratic People's Republic of Korea	Institute for Electronic War	Remote Sensing		S	S
18-Dec-12	V	Long March 2D	Jiuquan		Gökturk 2	SSO	Turkish Military	TUBITAK-UZAY	Intelligence	$20M	S	S
19-Dec-12		Soyuz	Baikonur		Soyuz TMA-07M (ISS 33S)	LEO	Roscosmos	RSC Energia	Crewed		S	S
19-Dec-12	V	Ariane 5 ECA	Kourou		MexSat 3	GEO	Government of Mexico	Boeing	Communications	$220M	S	S
					SkyNet 5D	GEO	U.K. Ministry of Defense	Astrium Satellite Ltd.	Communications			S

V Denotes commercial launch, defined as a launch that is internationally competed or FAA-licensed, or privately financed launch activity. 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.
L and M refer to the outcome of the Launch and Mission: S=Success, P=Partial Success, F=Failure.

Notes: All prices are estimates.
All launch dates are based on local time at the launch site.

APPENDIX II: DEFINITIONS

Commercial Suborbital or Orbital Launch

A commercial suborbital or orbital launch has one or more of these 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.
- The launch is privately financed without government support.

Launch Failure

A launch failure happens when the payload does not reach a usable orbit (an orbit where some portion of the mission can be salvaged) or is destroyed as the result of a launch vehicle malfunction.

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.

Commercial Payload

A commercial payload has one or both of these 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 telecommunications satellites whose transponders are partially or totally leased to a variety of organizations, some or all of which generate revenues. Examples include Russia's Express and Ekran series of spacecraft.

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

Orbits

A spacecraft in geostationary Earth orbit (GSO) 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. Geosynchronous (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., near or on the equator).

Non-geosynchronous orbit (NGSO) satellites are those in orbits other than GEO. They are located in low Earth orbit (LEO, lowest achievable orbit to about 2,400 kilometers, or 1,491 miles), medium Earth orbit (MEO, 2,400 kilometers to GEO), SSO (Sun Synchronous Orbit), and all other orbits or trajectories. ELI ("elliptical") describes a highly elliptical orbit (such as those used for Russian Molniya satellites), and EXT ("external") describes trajectories beyond GEO (such as interplanetary trajectories).

Vehicle Mass Class

Small launch vehicles are defined as those with a payload capacity of less than 2,268 kilograms (5,000 pounds) at 185 kilometers (100 nautical miles) altitude and a 28.5-degree inclination. Medium to heavy launch vehicles are capable of carrying more than 2,269 kilograms at 185 kilometers altitude and a 28.5-degree inclination.

ACRONYMS

CAST	China Academy for Space Technology
CCAFS	Cape Canaveral Air Force Station
CNES	Centre National d'Etudes Spatiales (French Space Agency)
CNSA	China National Space Administration
CONAE	National Commission on Space Activities, Argentina
COTS	Commercial Orbital Transportation Services
CRS	Commercial Resupply Services
CSA	Canadian Space Agency
DoD	Department of Defense
EADS	European Aeronautic Defense and Space Company
ELI	Elliptical Orbit
ESA	European Space Agency
EXT	External Orbit
FAA/AST	Federal Aviation Administration, Office of Commercial Space Transportation
GEO	Geosynchronous Orbit
GSFC	Goddard Space Flight Center
GSO	Geostationary Earth Orbit
ILS	International Launch Services
ISRO	Indian Space Research Organization
ISS	International Space Station
JAXA	Japan Aerospace Exploration Agency
KARI	Korean Advanced Institute of Science and Technology
KSLV	Korean Space Launch Vehicle
KSC	Kennedy Space Center
LEO	Low Earth Orbit
MEO	Medium Earth Orbit
NASA	National Aeronautics and Space Administration
NGSO	Non-Geosynchronous Orbit
NOAA	United States National Oceanic and Atmospheric Administration
NRO	National Reconnaissance Office
Orbital	Orbital Sciences Corporation
PSLV	Polar Satellite Launch Vehicle
RSCC	Russian Satellite Communications Company
Russian MoD	Ministry of Defense of the Russian Federation
SAS	Shanghai Academy of Space Technology
SBA	Shanghai Bureau of Astronautics, China
SES	Société Européenne des Satellites
SpaceX	Space Exploration Technologies Corporation
SPOT	Satellite Pour l'Observation de la Terre
SRV	Suborbital Reusable Vehicle
SSO	Sun Synchronous Orbit
ULA	United Launch Alliance
USAF	United States Air Force
USEF	Institute for Unmanned Space Experiment Free Flyer (USEF), Japan
VAFB	Vandenberg Air Force Base