Federal Aviation Administration

FY 2012 Year in Review

October 1, 2012

Reviewing Launch Results from
October 1, 2011 to September 30, 2012

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/.

NOTICE

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INTRODUCTION

The *Fiscal Year (FY) 2012 Year in Review* summarizes U.S. and international launch activities for FY 2012.

There were 80 orbital launch events worldwide in FY 2012, including commercial, civil, and military missions. Appendix I contains the details of these events.

The Federal Aviation Administration's Office of Commercial Space Transportation (FAA/AST) licensed three commercial orbital launches in FY 2012. The licenses were for the launch of SpaceX's Falcon 9 in May 2012, and two launches of Sea Launch AG's Zenit 3SL rocket in May and August 2012.

Appendix II provides definitions for the terminology of this report.

FY 2012 WORLDWIDE ORBITAL LAUNCH ACTIVITY

In FY 2012, the United States, Russia, Europe, China, India, Japan, North Korea, Iran, and one multinational company conducted a total of 80 launches, 21 of which were commercial (see Table 1 and Figures 1, 2, and 3). This number was unchanged from the previous fiscal year, which also saw 80 launches, of which 20 were commercial. This year two launches resulted in failures: North Korea's Unha-3 in April 2012 and Russia's Proton M in August 2012.

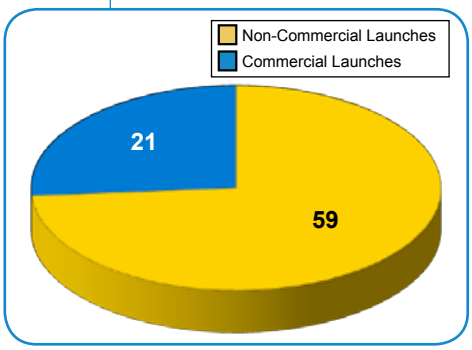

Figure 1. FY 2012 Total Worldwide Launch Activity

	Commercial Launches	Non-Commercial Launches	Total Launches
United States	1	11	12
Russia	10	19	29
Europe	4	4	8
China	3	18	21
India	1	2	3
Japan	0	3	3
North Korea	0	1	1
Iran	0	1	1
Multinational	2	0	2
TOTAL	**21**	**59**	**80**

Table 1. FY 2012 Worldwide Orbital Launch Events

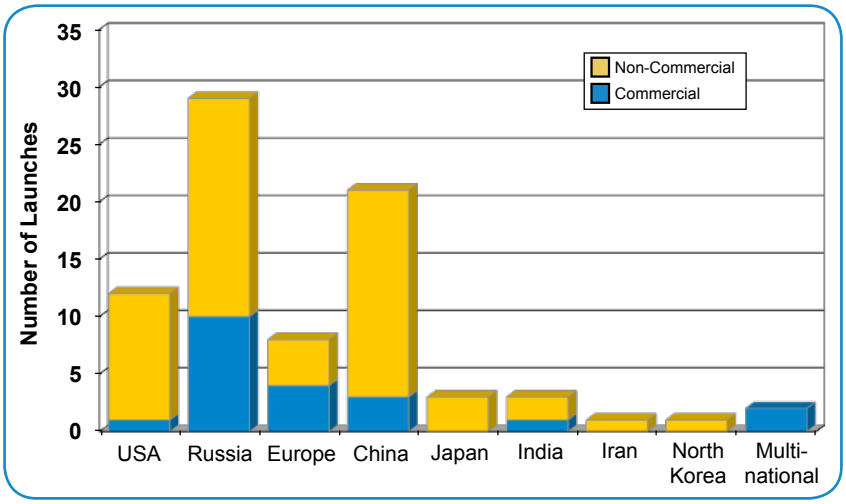

Figure 2. FY 2012 Total Worldwide Launch Activity

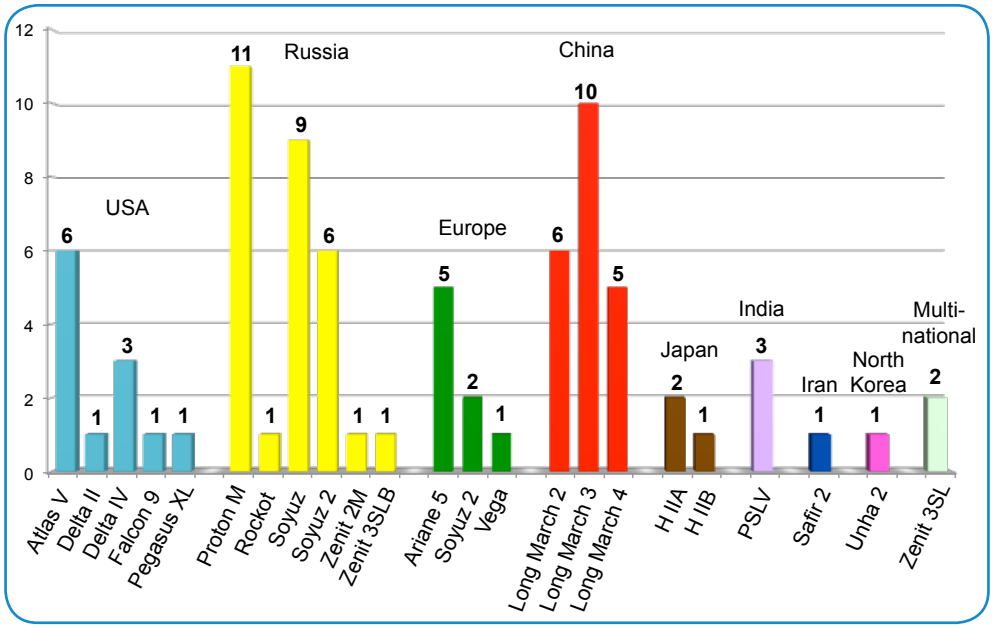

Figure 3. Total Worldwide Launch Vehicle Use for FY 2012

SIGNIFICANT EVENTS

SpaceX Falcon 9/Dragon Launch, ISS Docking, and Reentry

On May 22, 2012, a SpaceX Falcon 9 vehicle carrying a Dragon cargo capsule was launched to the International Space Station (ISS) for a Commercial Orbital Transportation Services (COTS) demonstration flight. The Dragon capsule berthed with ISS on May 25. This launch, which was the United States' only commercial mission for FY 2012, was FAA licensed. The Dragon capsule reentered on May 31, and was successfully recovered. The FAA also licensed the reentry event.

Proton M/Breeze Launch Failure

On August 6, 2012, a Proton M failed shortly after its upper stage separated from the first stage. The failure was attributed to a pressurization system component that was not manufactured to specifications. The failure caused the Breeze-M main engine to shut down. The vehicle had been intended to launch Indonesia's Telkom-3 and Russia's Express-MD2, both communications satellites. International Launch Services (ILS) plans to return the Proton M to flight in mid-to-late October 2012.

Inaugural Launch of European Vega Rocket

On February 13, 2012, the European Space Agency's inaugural Vega flight took place from Europe's launch site in Kourou, French Guiana. The Vega is a small-class launch vehicle that has a launch capacity to low-Earth orbit (LEO) of 1,500 kilograms (3,307 pounds).

FY 2012 WORLDWIDE COMMERCIAL LAUNCH TRENDS

Approximately one quarter of the total launches in FY 2012 were commercial. The following is a summary of the FY 2012 commercial orbital launches by country (see Figures 4 and 5):

- The United States performed a total of 12 launches, including 1 commercial launch to ISS.
- Russia had the highest total orbital (29) and total commercial launches (10).
- Europe conducted eight launches in FY 2012, four of which were commercial.
- China had 21 launches, 3 of which were commercial.
- India had three total launches, one of which was commercial.
- The multinational company, Sea Launch AG, conducted two commercial launches, both FAA-licensed.
- Japan, Iran, and North Korea did not have any commercial launches.

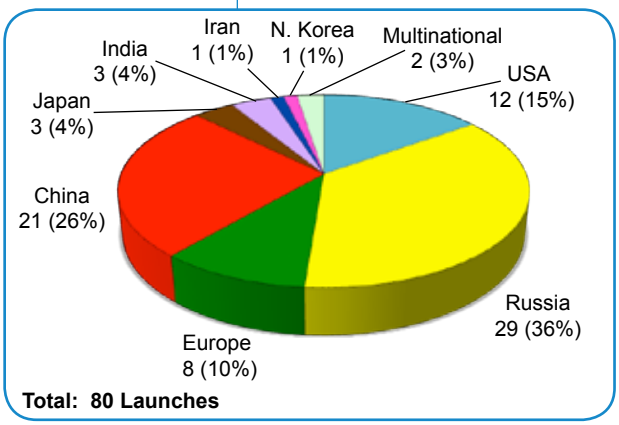

Figure 4. FY 2012 Total Worldwide Orbital Launch Activity

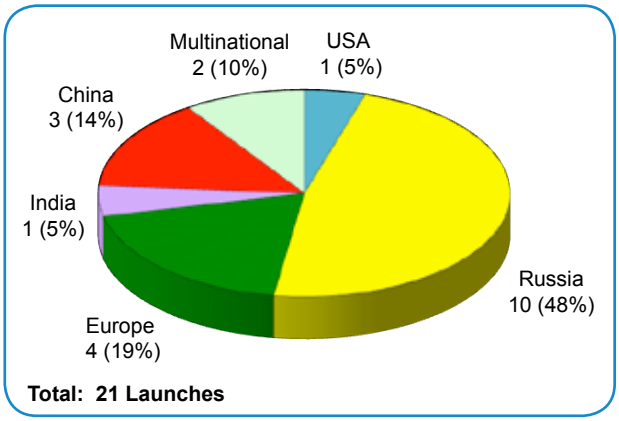

Figure 5. FY 2012 Worldwide Commercial Orbital Launch Activity

The number of launches between FY 2011 and FY 2012 remained relatively steady. In FY 2011, there was a total of 80 worldwide orbital launches, 20 of which were commercial. In FY 2011, the United States conducted 20 orbital launches, 2 of which were commercial. These two commercial launches consisted of the first SpaceX Falcon 9 launch under NASA's COTS program and a Delta II launch of COSMO-Skymed 4.

The decrease of eight U.S. launches in FY 2012, from FY 2011, is primarily related to the retirement of the Space Shuttle in July 2011 and various launch delays. From October to December 2012, six more U.S. launches are planned. Counting by calendar year (CY), there were 18 U.S. launches in CY 2011, and 16 launches are anticipated for CY 2012.

For FY 2013, it is anticipated that the number of overall U.S. launches will remain relatively steady. Although, there is a possibility of a slight increase due to ISS commercial resupply, including a demonstration flight of Orbital Sciences

Corporation's (Orbital) new Antares vehicle from the Mid-Atlantic Regional Spaceport in Virginia, and routine replacement of GEO communication satellites.

In FY 2012, 19 (or 90 percent) of the worldwide commercial launches were for commercial telecommunication satellites: 18 launches deployed GEO communications satellites and one delivered communications satellites to NGSO (LEO). One launch (or five percent of the total launches) was for development purposes, and one (or five percent) was a launch of a remote sensing satellite (see Table 2).

Date	Vehicle	Launching Country/ Region	Payload(s)	Orbit	Launch Outcome
06-Oct-11	Zenit 3SLB	Russia	Intelsat 18	GEO	Success
07-Oct-11	Long March 3B	China	Eutelsat W3C	GEO	Success
19-Oct-11	Proton M	Russia	Viasat 1	GEO	Success
25-Nov-11	Proton M	Russia	Asiasat 7	GEO	Success
11-Dec-11	Proton M	Russia	Luch 5A Amos 5	GEO GEO	Success Success
19-Dec-11	Long March 3B	China	NigComSat 1R	GEO	Success
28-Dec-11	Soyuz 2	Russia	Globalstar 2nd Gen 13 Globalstar 2nd Gen 14 Globalstar 2nd Gen 15 Globalstar 2nd Gen 16 Globalstar 2nd Gen 17 Globalstar 2nd Gen 18	NGSO NGSO NGSO NGSO NGSO NGSO	Success Success Success Success Success Success
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 Success
17-May-12	Proton M	Russia	Nimiq 6	GEO	Success
22-May-12	Falcon 9	USA	Dragon COTS Demo 2/3	NGSO	Success
31-May-12	Zenit 3SL	Multinational	Intelsat 19	GEO	Success
05-Jul-12	Ariane 5	Europe	Echostar XVII (Jupiter) MSG 3	GEO GEO	Success Success
19-Jul-12	Proton M	Russia	SES-5	GEO	Success
02-Aug-12	Ariane 5	Europe	HYLAS 2 Intelsat 20	GEO GEO	Success Success
08-Aug-12	Zenit 3SL	Multinational	Intelsat 21	GEO	Success
09-Sep-12	PSLV	India	SPOT 6 Proiteres mRESINS	NGSO NGSO NGSO	Success Success Success
28-Sep-12	Ariane 5	Europe	GSAT 10 Astra 2F	GEO GEO	Success Success

Table 2. FY 2012 Worldwide Commercial Launch Events

FY 2012 COMMERCIAL LAUNCH REVENUES

Revenues from 21 commercial launches, in FY 2012, are estimated to total $2.2 billion (see Figure 6). Over 75 percent of this revenue was for launches conducted by Russia ($790 million) and Europe ($880 million). Russia's $790 million in revenue represents eight Protons, one Soyuz 2, and one Zenit 3SLB (Land Launch) launches. Europe's revenue represents four Ariane 5 launches. United States' revenue represents a Falcon 9 launch.

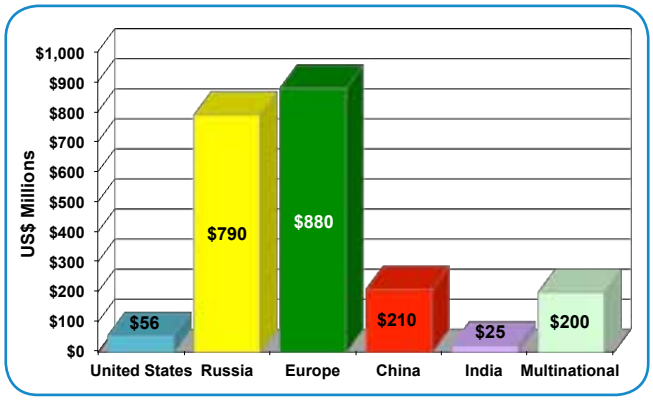

Figure 6. Approximate FY 2012 Commercial Launch Revenues

Payments for launch services are typically spread over one to two years before the launch. For the purposes of this report, however, revenue is shown as earned in the year in which the payload launches. Launch revenues go to the country of the primary vehicle manufacturer. The assessment of the revenues is based on commercial launch price estimates for each launch vehicle from publicly available information. The estimated commercial launch prices are listed in Table 3.

Vehicle	Provider	Provider Country/ Region	Launch Site(s)	LEO Capacity (kg)	GEO Capacity (kg)	FAA Mass Class	FAA Estimated Launch Price ($M)
Ariane 5 ECA	Arianespace	Europe	Kourou	20,000	8,700	Heavy	$220
Falcon 9	SpaceX	USA	CCAFS	10,450	4,680	Intermediate	$56
Long March 3B	CGWIC	China	Xichang	-	5,500	Intermediate	$70
Proton M	ILS	Russia	Baikonur	22,000	6,400	Heavy	$85
PSLV	Antrix	India	Satish Dhawan Space Centre	1,600	1,060	Small	$25
Soyuz 2	Arianespace/ Starsem	Russia	Kourou	4,900	3,150	Medium	$50
Zenit 3SL	Sea Launch AG	Multinational	Pacific Ocean	-	6,000	Heavy	$100
Zenit 3SLB	Land Launch	Russia	Baikonur	-	3,600	Intermediate	$60

Table 3. FY 2012 Estimated Commercial Launch Prices

Most launch vehicles today are manufactured, sold, and launched by the same organization entirely in one country, or in the case of Europe and the former Soviet Union,[1] within a particular economic region. At present, there is one launch service corporation, Sea Launch AG, that is characterized as multinational.

FY 2012 FAA-LICENSED ORBITAL LAUNCH SUMMARY

There were three FAA-licensed launches during FY 2012 as shown in Tables 4 and 5. One was for SpaceX's Falcon 9 COTS flight to ISS and two were for Intelsat satellites launched separately by Sea Launch AG, from its *Odyssey* launch platform in the Pacific Ocean. The FAA issued one reentry license, for the Dragon capsule launched in May 2012, on the SpaceX Falcon 9 flight.

Date	Vehicle	Primary Payload	Orbit	Launch Outcome
22-May-12	Falcon 9	Dragon COTS Demo 2/3	LEO	Success
31-May-12	Zenit 3SL	Intelsat-19	GEO	Success
18-Aug-12	Zenit 3SL	Intelsat-21	GEO	Success

Table 4. FY 2012 FAA-Licensed Orbital Launch Events

Three FAA-licensed U.S. commercial launches are planned for the first quarter of FY 2013. Two are NASA Commercial Resupply Services (CRS) missions to ISS on SpaceX's Falcon 9, and one is the maiden test flight of the new Antares launch vehicle by Orbital.

Revenues for FAA-licensed flights conducted during FY 2012 include: one Falcon 9 ($56M) and two Zenit 3SL ($100M) (see Figures 7 and 8). For FY 2011, revenues for FAA-licensed flights included the Falcon 9 ($56M), Delta II ($95M), and a Zenit 3SL ($100M).

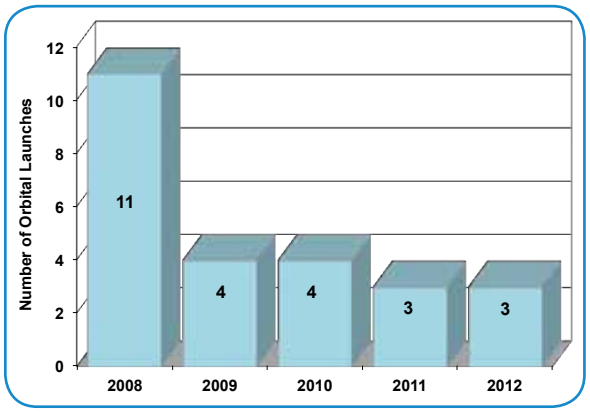

Figure 7. FAA-Licensed Orbital Launch Events, FY 2008-2012

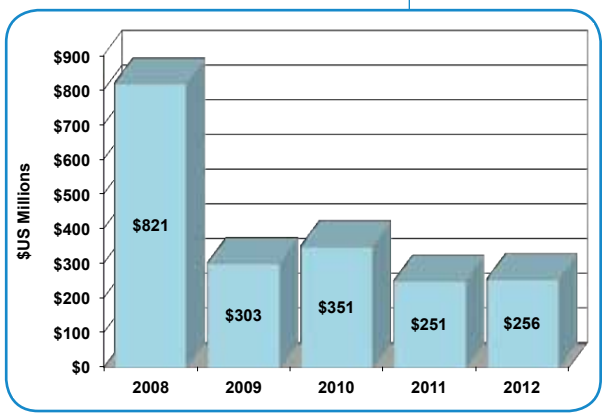

Figure 8. Estimated Revenue for FAA-Licensed Orbital Launch Events, FY 2008-2012

Launch Licenses	UNITED STATES 	MULTI-NATIONAL 	Reentry Licenses	UNITED STATES 
Vehicle	Falcon 9	Zenit 3SL	Vehicle	SpaceX Dragon
FY 2012 Total Launches	1	2	FY 2012 Total Reentries	1
FY 2012 Licensed Launches	1	2	FY 2012 Licensed Reentries	1
FY 2012 Launch Reliability	1/1 (100%)	2/2 (100%)	FY 2012 Reentry Reliability	1/1 (100%)
10-Year Launch Reliability	3/3 (100%)	24/25 (96%)	10-Year Reentry Reliability	2/2 (100%)
Maximum LEO Capacity - kg (lbs)	10,459 (22,990)	15,546 (33,541)	Payload to LEO - kg (lbs)	6,000 (13,228)
Maximum GEO Capacity - kg (lbs)	4,680 (10,296)	6,100 (13,440)	Payload from LEO - kg (lbs)	3,000 (6,614)

Table 5. FAA-Licensed Vehicles Launched and Reentered in FY 2012

OTHER FY 2012 FAA LICENSES AND PERMITS

There was one FAA-licensed reentry by SpaceX's Dragon capsule, which reentered and was successfully recovered on May 31, 2012. A reentry license was issued on September 17, 2012, for the first SpaceX CRS mission to the ISS planned in October 2012. Scaled Composites was issued an experimental flight permit on May 23, 2012, for rocket-powered flight-testing of its SpaceShipTwo suborbital vehicle expected to launch later in the calendar year. This permit will expire on May 23, 2013. There were no FAA-permitted launches performed in FY 2012.

FY 2012 Worldwide Orbital Payload Summary

	Commercial Payloads	Non-Commercial Payloads	Total Payloads
United States	1	30	31
Russia	17	31	48
Europe	6	20	26
China	3	24	27
India	1	7	8
Japan	0	11	11
North Korea	0	1	1
Iran	0	1	1
Multinational	2	0	2
TOTAL	**30**	**125**	**155**

Table 6. Payloads Launched by Country in FY 2012

A total of 155 orbital payloads were launched worldwide in FY 2012. Thirty of these were launched to provide commercial services. The breakdown of the worldwide launch activity by payload is summarized in Table 6 and Figures 9, 10, and 11.

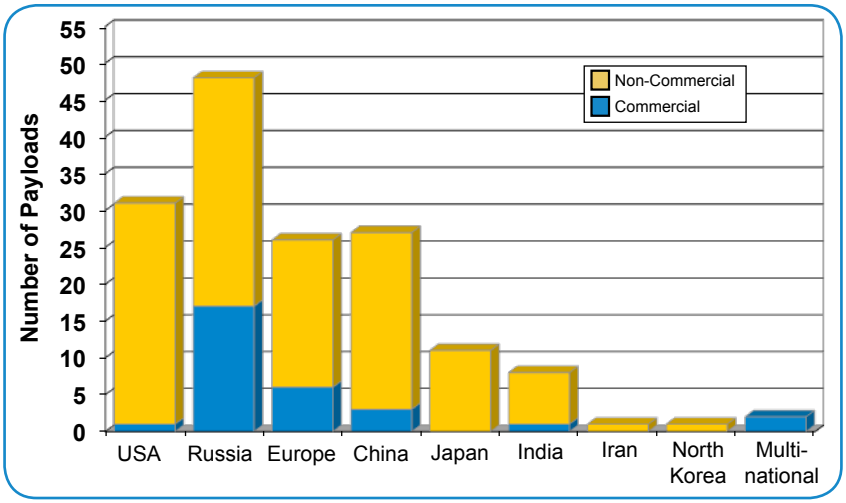

Figure 9. FY 2012 Total Worldwide Launch Activity by Payload

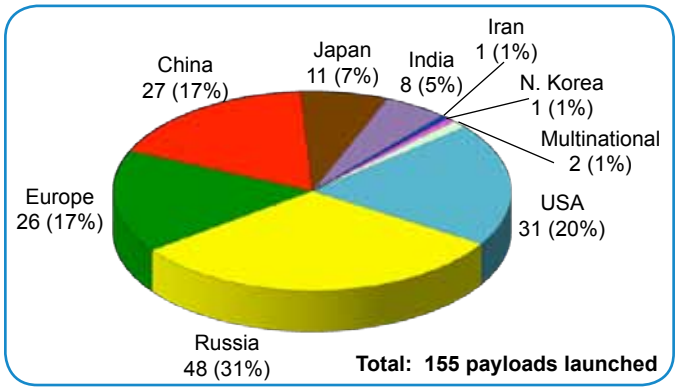

Figure 10. Total Payloads Launched by Country in FY 2012

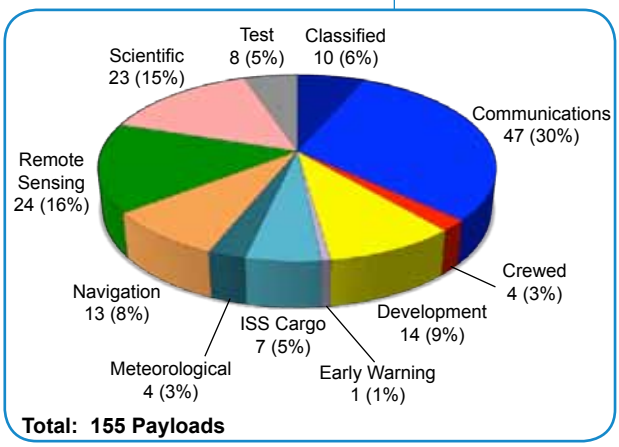

Figure 11. FY 2012 Payload Use

Commercial Orbital Payload Summary

There were 30 payloads launched in FY 2012 to provide commercial services, as shown in Figure 12. Most of these payloads (28) were telecommunications satellites, with one remote sensing satellite (SPOT 6), and one development payload (Dragon COTS Demo 2/3).

Twenty-nine commercial payloads were launched commercially, and one commercial payload, Telkom 3, was launched non-commercially. Of the 28 commercial telecommunications satellites, 22 were launched to GEO and 6 were launched to NGSO. The remote sensing and development satellites were both launched to NGSO.

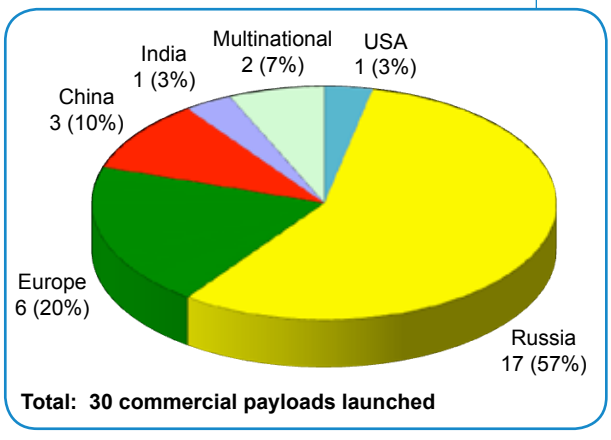

Figure 12. Commercial Payloads Launched by Country in FY 2012

Suborbital Launch Activity

No licensed suborbital launches were conducted during FY 2012.[2] However, testing of commercial suborbital reusable vehicles took place during the fiscal year.

Six glide flights of Virgin Galactic's SpaceShipTwo took place, all conducted from Mojave Air and Space Port. The company was issued an FAA Experimental Permit on May 23, 2012, authorizing powered test flights for one year. Scaled Composites expects these test flights to occur in late CY 2012.

Masten Space Systems continued to flight test its Xaero and Xombie vehicles. In August 2012, Masten used Xombie to conduct a powered, 750-meter (2,460-foot) horizontal translation, believed by Masten to be the longest terrestrial translation flight undertaken by a rocket-powered vertical takeoff, vertical landing craft. Xaero was lost during a flight test in September 2012.

Armadillo Aerospace tested its STIG-A vehicle in January 2012. Though the flight itself was successful, the recovery system failed and the vehicle was lost. The company has since focused its attention on developing the larger and more capable STIG-B. The FAA issued a reusable launch vehicle license to the company, in July 2012, for STIG-B, since the upcoming flight will include commercial payloads. The flight is currently scheduled for late CY 2012.

APPENDIX I: FY 2012 WORLDWIDE ORBITAL LAUNCH EVENTS

Date		Vehicle	Site		Payload(s)	Orbit	Operator	Manufacturer	Use	Comm'l Price	L	M
02-Oct-11		Soyuz 2	Plesetsk		Glonass M42	MEO	Russian Space Forces	Reshetnev Company	Navigation		S	S
06-Oct-11	V	Zenit 3SLB	Baikonur	*	Intelsat 18	GEO	Intelsat	Orbital Sciences Corp.	Communications	$60M	S	S
07-Oct-11	V	Long March 3B	Xichang	*	Eutelsat W3C	GEO	Eutelsat	Thales Alenia Space	Communications	$70M	S	S
12-Oct-11		PSLV	Satish Dhawan		Megha Tropiques	LEO	CNES	ISRO	Remote Sensing		S	S
					Jugnu	LEO	IIT Kapur	IIT Kapur	Remote Sensing		S	S
					SRMSAT	SSO	SRM University	SRM University	Scientific		S	S
					Vesselsat 1	LEO	LuxSpace Sarl	LuxSpace Sarl	Development		S	S
19-Oct-11	V	Proton M	Baikonur	*	ViaSat 1	GEO	ViaSat	Space Systems/Loral	Communications	$85M	S	S
21-Oct-11		Soyuz 2	Kourou		Galileo 1	MEO	European Space Agency	OHB System	Navigation		S	S
					Galileo 2	MEO	European Space Agency	OHB Systems	Navigation		S	S
28-Oct-11		Delta II 7920	VAFB		NPP	SSO	NASA/NOAA	Ball Aerospace	Meteorological		S	S
					RAX 2	LEO	University of Michigan	University of Michigan	Scientific		S	S
					M-Cubed	LEO	University of Michigan	University of Michigan	Remote Sensing		S	S
					AS-1	LEO	Auburn University	Auburn University	Scientific		S	S
					Explorer-1 (PRIME) Unit 2	LEO	Montana State University	Montana State University	Scientific		S	S
					DICE 1	LEO	Utah State University	Utah State University	Scientific		S	S
					DICE 2	LEO	Utah State University	Utah State University	Scientific		S	S
30-Oct-11		Soyuz	Baikonur		Progress M-13M	LEO	Roscosmos	RSC Energia	ISS Cargo		S	S
					Chibis M	LEO	Space Research Insitute (IKI)	Space Research Institute (IKI)	Scientific		S	S
31-Oct-11		Long March 2F	Jiuquan		Shenzhou 8	LEO	China Aerospace Corp.	CAST	Development		S	S
04-Nov-11		Proton M	Baikonur		Glonass M43	MEO	Russian Space Forces	Reshetnev Company	Navigation		S	S
					Glonass M44	MEO	Russian Space Forces	Reshetnev Company	Navigation		S	S
					Glonass M45	MEO	Russian Space Forces	Reshetnev Company	Navigation		S	S
08-Nov-11		Zenit 2M	Baikonur		Phobos-Grunt	EXT	Roscosmos	NPO Lavotchkin	Scientific		S	F
					Yinghuo	EXT	China National Space Academy	Shanghai Institute of Satellite Engineering	Scientific		S	F
09-Nov-11		Long March 4B	Xichang		Yaogan 12	SSO	People's Liberation Army	Shanghai Academy of Space Technology	Remote Sensing		S	S
					Tianxun 1	SSO	Nanjing University of Aeronautics & Astronautics	Nanjing University of Aeronautics & Astronautics	Remote Sensing		S	S
14-Nov-11		Soyuz	Baikonur		Soyuz TMA-22	LEO	Roscosmos	RSC Energia	Crewed		S	S
20-Nov-11		Long March 2D	Jiuquan		Chuang Xing 1-03	SSO	Shanghai Academy of Space Technology	China Academy of Science	Communications		S	S
					Shiyan Wexing 4	SSO	Dongfanghong Satellite Co.	Harbin Institute of Technology	Scientific		S	S
25-Nov-11	V	Proton M	Baikonur	*	Asiasat 7	GEO	Asiasat	Space Systems/Loral	Communications	$85M	S	S
26-Nov-11		Atlas V 541	CCAFS		Mars Science Laboratory	EXT	NASA	NASA/JPL	Scientific		S	S
28-Nov-11		Soyuz 2	Plesetsk		Glonass M46	MEO	Russian Space Forces	Reshetnev Company	Navigation		S	S
29-Nov-11		Long March 2D	Jiuquan		Yaogan 13	SSO	People's Liberation Army	Shanghai Academy of Space Technology	Remote Sensing		S	S
01-Dec-11		Long March 3A	Xichang		Beidou 2-IGS 5	GEO	People's Liberation Army	CAST	Navigation		S	S
11-Dec-11	V	Proton M	Baikonur		Luch 5A	GEO	Roscosmos	Reshetnev Company	Communications	$85M	S	S
				*	Amos 5	GEO	SpaceCom Ltd.	Reshetnev Company	Communications		S	S
12-Dec-11		H IIA	Tanegashima		IGS-4B (Radar)	SSO	Japan Defense Agency	Mitsubishi Electronic Corp.	Classified		S	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.
See Appendix II for definitions of payload orbits.

APPENDIX I (CONTINUED)

Date		Vehicle	Site		Payload(s)	Orbit	Operator	Manufacturer	Use	Comm'l Price	L	M
16-Dec-11		Soyuz 2	Kourou		Pleiades HR 1	LEO	CNES	EADS Astrium	Remote Sensing		S	S
					ELISA 1	LEO	French MoD	EADS Astrium	Classified		S	S
					ELISA 2	LEO	French MoD	EADS Astrium	Classified		S	S
					ELISA 3	LEO	French MoD	EADS Astrium	Classified		S	S
					ELISA 4	LEO	French MoD	EADS Astrium	Classified		S	S
					SSOT	SSO	Government of Chile	EADS Astrium	Classified		S	S
19-Dec-11	V	Long March 3B	Xichang	*	Nigcomsat 1R	GEO	Nigerian Communication Satellite Ltd.	CAST	Communications	$70M	S	S
21-Dec-11		Soyuz	Baikonur		Soyuz TMA-03M	LEO	Roscosmos	RSC Energia	Crewed		S	S
22-Dec-11		Long March 4B	Xichang		Ziyuan 1-2C	SSO	China State Bureau of Surveying and Mapping	CAST	Remote Sensing		S	S
23-Dec-11		Soyuz 2	Plesetsk		Meridian 5	ELI	Russian Space Forces	Reshetnev Company	Communications		F	F
28-Dec-11	V	Soyuz 2	Baikonur	*	Globalstar 2nd Gen 13	LEO	Globalstar, Inc.	Thales Alenia Space	Communications	$50M	S	S
				*	Globalstar 2nd Gen 14	LEO	Globalstar, Inc.	Thales Alenia Space	Communications		S	S
				*	Globalstar 2nd Gen 15	LEO	Globalstar, Inc.	Thales Alenia Space	Communications		S	S
				*	Globalstar 2nd Gen 16	LEO	Globalstar, Inc.	Thales Alenia Space	Communications		S	S
				*	Globalstar 2nd Gen 17	LEO	Globalstar, Inc.	Thales Alenia Space	Communications		S	S
				*	Globalstar 2nd Gen 18	LEO	Globalstar, Inc.	Thales Alenia Space	Communications		S	S
09-Jan-12		Long March 4B	Taiyuan		Ziyuan 3	SSO	China State Bureau of Surveying & Mapping	CAST	Remote Sensing		S	S
					Vesselsat 2	SSO	ORBCOMM	OHB Systems	Communications		S	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	LEO	Roscosmos	RSC Energia	ISS Cargo		S	S
03-Feb-12		Safir 2	Semnan Province		Navid-e Elm-o Sanat	SSO	Government of Iran	Unknown	Remote Sensing		S	S
13-Feb-12		Vega	Kourou		LARES	LEO	Italian Space Agency	Italian Space Agency	Scientific		S	S
					PW-Sat 1	LEO	Warsaw Polytech	Warsaw Polytech	Test		S	S
					XaTcobeo	LEO	University of Vigo	University of Vigo	Test		S	S
					Robusta	LEO	University of Montepellier II	University of Montepellier II	Test		S	S
					e-St@r	LEO	Polytech University of Turin	Polytech University of Turin	Test		S	S
					Goliat	LEO	University of Bucharest	University of Bucharest	Remote Sensing		S	S
					ALMASAT 1	LEO	University of Bologna	University of Bologna	Test		S	S
					MaSat 1	LEO	Budapest Uni. of Tech. & Econ.	Budapest Uni. of Tech. & Econ.	Test		S	S
					Unicubesat	LEO	University of Rome	University of Rome	Scientific		S	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 Cargo		S	S
25-Mar-12	V	Proton M	Baikonur	*	Intelsat 22	GEO	Intelsat	Boeing Satellite Systems	Communications	$85M	S	S
30-Mar-12		Proton M	Baikonur		Cosmos 2479	GEO	Russian Space Forces	Reshetnev Company	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
03-Apr-12		Delta IV Medium-Plus (5, 2)	VAFB		NRO L-25	LEO	NRO	Classified	Classified		S	S
12-Apr-12		Uhna 3	Musudan-ri		Kwangmyongsong 3	LEO	North Korea	North Korea	Remote Sensing		F	F

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Notes: All prices are estimates.
All launch dates are based on local time at the launch site.
See Appendix II for definitions of payload orbits.

APPENDIX I (CONTINUED)

Date		Vehicle	Site		Payload(s)	Orbit	Operator	Manufacturer	Use	Comm'l Price	L	M
20-Apr-12		Soyuz	Baikonur		Progress M-15M	LEO	Roscosmos	RSC Energia	ISS Cargo		S	S
23-Apr-12	V	Proton M	Baikonur		Yahsat 1B	GEO	Yah Satellite Comm. Co.	EADS Astrium	Communications	$85M	S	S
26-Apr-12		PSLV	Satish Dhawan		Risat 1	SSO	ISRO	ISRO	Remote Sensing		S	S
29-Apr-12		Long March 3A	Xichang		Beidou 2C-M3	MEO	People's Liberation Army	CAST	Navigation		S	S
					Beidou 2C-M4	MEO	People's Liberation Army	CAST	Navigation		S	S
05-May-12		Atlas V 531	CCAFS		Advanced EHF 2	GEO	DoD	Lockheed Martin Corp.	Communications		S	S
06-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	SAST	Remote Sensing		S	S
					Tiantuo 1	SSO	People's Liberation Army	National Uni. of Defense Tech.	Scientific		S	S
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	S
15-May-12		Soyuz	Baikonur		Soyuz TMA-04M	LEO	Roscosmos	RSC Energia	Crewed		S	S
17-May-12		Soyuz U	Plesetsk		Cosmos 2480	LEO	Russian Space Forces	RSC Energia	Remote Sensing		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 (Kompsat 3)	SSO	KARI	KARI	Remote Sensing		S	S
					SDS 4	SSO	JAXA	JAXA	Test		S	S
					Horyu 2	SSO	Kyushu Institute of Tech.	Kyushu Institute of Tech.	Communications		S	S
22-May-12	V +	Falcon 9	CCAFS	*	Dragon COTS Demo 2/3	LEO	SpaceX	SpaceX	Development	$56M	S	S
26-May-12		Long March 3B	Xichang		Chinasat 2A	HEO	People's Liberation Army	CAST	Communications		S	S
29-May-12		Long March 4C	Taiyuan		Yaogan 15	SSO	People's Liberation Army	SAST	Remote Sensing		S	S
31-May-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	LEO	China Aerospace Corp.	CAST	ISS Cargo		S	S
20-Jun-12		Atlas V 401	VAFB		NRO L-38	GEO	NRO	Boeing	Communications		S	S
29-Jun-12		Delta IV Heavy	CCAFS		NRO L-15	GEO	NRO	Classified	Classified		S	S
05-Jul-12	V	Ariane 5 ECA	Kourou	*	Echostar XVII (Jupiter)	GEO	Hughes Network Systems	Space Systems/Loral	Communications	$220	S	S
					MSG 3	GEO	Eumetsat	Thales Alenia Space	Meteorological			
09-Jul-12	V	Proton M	Baikonur	*	SES-5 (Astra 4B)	GEO	SES World Skies	Space Systems/Loral	Communications	$85M	S	S
15-Jul-12		Soyuz	Baikonur		Soyuz TMA-05M	LEO	Roscosmos	RSC Energia	Crewed		S	S
22-Jul-12		Soyuz	Baikonur		Kanopus B1	SSO	VNIIEM	VNIIEM	Remote Sensing		S	S
					BelKa 2	SSO	National Academy of Sciences of Belarus	RSC Energia	Remote Sensing		S	S
					Zond PP	SSO	Roscosmos	NPO Lavotchkin	Scientific		S	S
					ADS-1B	SSO	exactEARTH	COM DEV International	Remote Sensing		S	S
					TET-1	SSO	DLR	Kayser-Threde GmbH	Development		S	S
21-Jul-12		H IIB	Tanegashima		HTV 3	LEO	JAXA	Mitsubishi Heavy Industries	ISS Cargo		S	S
					F-1	LEO	Fspace Laboratory	Fspace Laboratory	Communications		S	S
					We-Wish	LEO	Meisei Electric Co. Ltd.	Meisei Electric Co. Ltd.	Communications		S	S
					FitSat-1	LEO	Fukuoka Institute of Tech.	Fukuoka Institute of Tech.	Communications		S	S
					TechEdSat	LEO	NASA Ames Research Center	NASA Ames Research Center	Communications		S	S
					RAIKO	LEO	Wakayama University	Wakayama University	Scientific		S	S

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Notes: All prices are estimates.
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See Appendix II for definitions of payload orbits.

APPENDIX I (CONTINUED)

Date		Vehicle	Site		Payload(s)	Orbit	Operator	Manufacturer	Use	Comm'l Price	L	M
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 Company	Communications		S	S
					Gonets M-03	LEO	SMOLSAT	Reshetnev Company	Communications		S	S
					Gonets M-04	LEO	SMOLSAT	Reshetnev Company	Communications		S	S
					MIR (Yubileyniy 2)	LEO	Reshetnev Company	Reshetnev Company	Remote Sensing		S	S
01-Aug-12		Soyuz	Baikonur		Progress M-16M	LEO	Roscosmos	RSC Energia	ISS Cargo		S	S
					SFERA-53	LEO	Roscosmos	TBD	Development		S	S
02-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	S
08-Aug-12		Proton M	Baikonur	*	Telkom 3	GEO	Telkom Indonesia	Reshetnev Company	Communications		F	F
					Express MD2	GEO	Russian Satellite Communication Co.	Khrunichev State Research & Production Space Center	Communications		F	F
18-Aug-12	V +	Zenit 3SL	Sea Launch Platform	*	Intelsat 21	GEO	Intelsat	Boeing Satellite Systems	Communications	$100M	S	S
30-Aug-12		Atlas V 401	CCAFS		RBSP A	ELI	NASA	APL	Scientific		S	S
					RBSP B	ELI	NASA	APL	Scientific		S	S
09-Sep-12	V	PSLV	Satish Dhawan	*	SPOT 6	SSO	SPOT Image	EADS Astrium	Remote Sensing	$25M	S	S
					Prioteres	SSO	Osaka Institute of Technology	Osaka Institute of Technology	Development		S	S
					mRESINS	SSO	ISRO	ISRO	Test		S	S
13-Sep-12		Atlas V 411	VAFB		NRO L-36/NOSS 3-6A	SSO	NRO	Classified	Classified		S	S
					NRO L-36/NOSS 3-6B	SSO	NRO	Classified	Classified		S	S
					CXBN	SSO	Morehead State University	Morehead State University	Scientific		S	S
					AENEAS	TBD	U.S. Air Force	Uni. Southern California Space Research Center	Development		S	S
					CISSWE	SSO	University of Colorado	University of Colorado	Scientific		S	S
					CP 5	SSO	Cal Poly Aerospace Engineering	Cal Poly Aerospace Engineering	Development		S	S
					CINEMA 1	SSO	University of California, Berkley	University of California, Berkley	Scientific		S	S
					SMDC-ONE 2.1 (ABLE)	LEO	U.S. Army Space & Missile Defense Command	U.S. Army Space & Missile Defense Command	Development		S	S
					SMDC-ONE 2.2 (BAKER)	LEO	U.S. Army Space & Missile Defense Command	U.S. Army Space & Missile Defense Command	Development		S	S
					STARE A	LEO	Lawrence Livermore National Laboratory	Lawrence Livermore National Laboratory	Development		S	S
					AeroCube 4A	LEO	Aerospace Corp.	Aerospace Corp.	Development		S	S
					AeroCube 4B	LEO	Aerospace Corp.	Aerospace Corp.	Development		S	S
					AeroCube 4C	LEO	Aerospace Corp.	Aerospace Corp.	Development		S	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-M2	MEO	People's Liberation Army	CAST	Navigation		S	S
					Beidou 2C-M5	MEO	People's Liberation Army	CAST	Navigation		S	S
28-Sep-12	V	Ariane 5 ECA	Kourou	*	GSAT 10	GEO	ISRO	ISRO	Communications	$220M	S	S
				*	Astra 2F	GEO	SES Astra	EADS Astrium	Communications		S	S
29-Sep-12		Long March 2D	Xichang		VRSS 1 (Francisco Miranda)	SSO	Venezuelan Ministry of Science & Technology	China Great Wall Industries Corp.	Remote Sensing		S	S

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ACRONYMS FOR APPENDIX I

APL	Applied Physics Laboratory
CAST	China Academy for Space Technology
CCAFS	Cape Canaveral Air Force Station
CNES	Centre National d'Etudes Spatiales
COTS	Commercial Orbital Transportation Services
CRS	Commercial Resupply Services
DoD	Department of Defense
ESA	European Space Agency
ISRO	Indian Space Research Organization
ISS	International Space Station
JAXA	Japan Aerospace Exploration Agency
JPL	Jet Propulsion Laboratory
KARI	Korean Advanced Institute of Science and Technology
NASA	National Aeronautics and Space Administration
NOAA	United States National Oceanic and Atmospheric Administration
NRO	National Reconnaissance Office
SAST	Shanghai Academy of Space Technology, China
SpaceX	Space Exploration Technologies
TBD	To Be Determined
VAFB	Vandenberg Air Force Base

APPENDIX II: DEFINITIONS

COMMERCIAL SUBORBITAL OR ORBITAL LAUNCH

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

- The launch is licensed by the 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

The payload did not reach a usable orbit (an orbit where some portion of the mission could be salvaged) or was 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. An internationally competed launch is considered commercial.

COMMERCIAL PAYLOAD

A commercial payload has 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 noncommercial (government civil, government military, or non-profit).

ORBITS

- **Geosynchronous Earth orbit** (GSO): A spacecraft in 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.
- **Geostationary Earth orbit** (GEO): GEO is a broad category used for any circular orbit at an altitude of 35,852 kilometers (22,277 miles) with a low inclination (over the equator).

- **Non-geosynchronous orbit** (NGSO): NGSO satellites are those in orbits other than GEO, including:
  - **Low Earth orbit** (LEO): lowest achievable orbit, about 2,400 kilometers,
  - **Medium Earth orbit** (MEO): 2,400 kilometers to GEO,
  - **Elliptical** (ELI): a highly elliptical orbit,
  - **External** (EXT): used for trajectories beyond GEO (such as interplanetary trajectories), and
  - **Sun-synchronous orbit** (SSO): an orbit that passes over the same part of the Earth at roughly the same time each day.

PAYLOAD USE

- **Classified**: Any system whose purpose is officially deemed classified or cannot be officially verified.
- **Communications**: Any system designed to receive and transmit data for purposes of facilitating communications. This includes fixed satellite services, mobile satellite services, military communications, store-and-forward systems, asset tracking, and similar.
- **Crewed**: Any system designed primarily to transport humans into, through, or back from space.
- **Development**: Any system whose purpose is to advance hardware design as part of a research and development program.
- **ISS**: Any system designed primarily to transport cargo into, through, or back from the International Space Station (ISS).
- **Meteorological**: Any system designed to monitor the Earth's weather for forecasting and issuing weather watches and warnings.
- **Navigation**: Any system designed to provide signals for accurate timing, positioning, and navigation.
- **Remote Sensing**: Any civil and commercial system designed to gather data by means of optical (panchromatic, multispectral, or hyperspectral) or radar sensors.
- **Scientific**: Any system designed to gather data about astrophysics, astronomy, biology, cosmology, celestial bodies, physics, and the space environment. This designation also includes systems designed to monitor the Earth, except those systems designed specifically for meteorology.
- **Test**: Any system designed to provide telemetry and data on launch vehicle performance.
- **Unknown**: Any system whose mission is unknown.
- **Other**: Any system whose purpose does not fit in any of the provided categories.

PAYLOAD MASS CLASS

Payloads are divided into the following mass classes based on mass on the ground (not in orbit):

- **Micro**: Up to 91 kg (200 lbs)
- **Small**: 92 to 907 kg (201 to 2,000 lbs)
- **Medium**: 908 to 2,268 kg (2,001 to 5,000 lbs)
- **Intermediate**: 2,269 to 4,536 kg (5,001 to 10,000 lbs)
- **Large**: 4,537 to 9,072 kg (10,001 to 20,000 lbs)
- **Heavy**: Greater than 9,072 kg (20,000 lbs)

ENDNOTES

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

[2] For purposes of this report, suborbital launches do not include missile tests.