



*Associate Administrator for
Commercial Space Transportation (AST)*

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Commercial Space Transportation: 2001 Year In Review



Cover photo credits (clockwise from upper left):

DigitalGlobe (2001): Image is of the QuickBird satellite launched on October 18, 2001 from Vandenberg Air Force Base aboard a Delta 2 (7320).

International Launch Services (2001): Image is of the Atlas 2AS launch on June 19, 2001, Cape Canaveral Air Force Station that lofted ICO F-1 into orbit.

Boeing Launch Services (2001): Image is of the Delta 2 (7320) that launched DigitalGlobe's QuickBird satellite from VAFB.

Sea Launch Company (2001). Image is of the Zenit 3SL launch on May 8, 2001 sending XM Roll into geosynchronous orbit for XM Satellite Radio, Inc.

INTRODUCTION

The Federal Aviation Administration (FAA) licensed six commercial launches in 2001. This total represents three orbital launches from U.S. ranges for commercial and government customers, two orbital launches by the multinational Sea Launch Company and one suborbital launch from Australia.

Overall, 16 commercial orbital launches occurred worldwide in 2001. This number is significantly less than in prior years (35 in 2000 and 39 in 1999). Arianespace captured half of the world market during 2001, the U.S. and Russia each had 19 percent, and the Sea Launch Company had 12 percent. The number of FAA-licensed launches has declined since 1997-1999 when several mobile communications services satellites were orbited. In 2000, there were 10 FAA-licensed launches.

Of the five FAA-licensed launches in 2001, three were on U.S. built vehicles: a Delta 2, Atlas 2AS and a Taurus. The Boeing Delta 2 (7320) carried DigitalGlobe's QuickBird commercial remote sensing satellite, which now occupies the orbit once reserved for QuickBird 1, lost during a Russian launch failure in 2000. Lockheed Martin Corporation's International Launch Services (ILS) successfully flew the Atlas 2AS, this time carrying aloft ICO F-1, a commercial medium

Earth orbit (MEO) communications satellite operated by ICO Global Communications. A Taurus launch vehicle was selected to deploy OrbView 4, developed by Orbital Sciences Corporation (OSC), NASA's QuikTOMS, and Celestis 4. Unfortunately, the launch vehicle experienced a first stage anomaly and the satellites failed to reach orbit.

Sea Launch launched XM Rock and XM Roll for U.S.-based XM Satellite Radio, Inc., on March 18 and May 8, respectively. XM Satellite Radio provides over 100 digital radio stations for subscribers across the United States.

In addition to the orbital launches, the FAA issued one suborbital license in 2001 for the HyShot suborbital hypersonic test launch from the Woomera Protected Area, Australia. The launch was licensed because U.S.-based Astrotech Space Operations provided the Terrier-Orion sounding rocket for the HyShot flight test through a Memorandum of Agreement with the University of Queensland.

The Commercial Space Transportation: 2001 Year in Review summarizes U.S. and international orbital launch activities for calendar year 2001 and provides a historical look at the past five years of commercial launch activities.

ABOUT THE ASSOCIATE ADMINISTRATOR FOR COMMERCIAL SPACE TRANSPORTATION (AST)

The Federal Aviation Administration's Associate Administrator for Commercial Space Transportation (AST) licenses and regulates U.S. commercial space launch activity as authorized by Executive Order 12465, Commercial Expendable Launch Vehicle Activities, and the Commercial Space Launch Act of 1984, as amended. AST's mission is to license and regulate commercial launch and reentry operations to protect public health and safety, the safety of property, and the

national security and foreign policy interests of the United States. The Commercial Space Launch Act of 1984 and the 1996 National Space Policy also directs the Federal Aviation Administration to encourage, facilitate, and promote commercial launches.

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

2001 FAA-LICENSED LAUNCH SUMMARY

Three of the five FAA-licensed commercial orbital launches for 2001 were conducted from U.S. ranges while the remaining two orbital launches were conducted from the Sea Launch Odyssey platform in the Pacific Ocean. All five orbital flights were for commercial customers, with one carrying a secondary government payload. The five FAA-licensed launches are listed in Table 1. Those launches represent a 50 percent decline from the 10 licensed launches in 2000.

The five FAA-licensed orbital launches included the following characteristics:

- All five launches, worth \$336.5 million in revenue, were conducted for commercial clients¹
- Of the five launches, two were conducted by Sea Launch for approximately \$170 million
- One launch included a secondary U.S. Government payload
- Two launches were to geosynchronous orbit (GEO), and three to non-geosynchronous orbit (NGSO)

The FAA also licensed one suborbital launch from Woomera, Australia in support of the HyShot hypersonic test flight series being conducted by the University of Queensland.

FAA-licensed orbital launches have decreased in frequency each year since a high of 22 in 1998 (see Figure 2). Fewer satellite customers have sought launch vehicles. Major reasons for this include: 1) financial impact on new satellite ventures after bankruptcies of high profile NGSO systems such as Iridium LLC, ORB-COMM, and ICO Global and slow customer growth from those companies that have emerged from bankruptcies, 2) competition from those companies that have emerged from bankruptcies, 3) less than expected growth in the overall satellite telecommunications market for new GEO and NGSO services, 4) weaker U.S. economic conditions for start-up companies and 5) competition from other non-satellite sectors for similar services. In addition, current U.S.-built vehicles are “undersized” to launch increased masses of many GEO satellites.

Table 1. 2001 FAA-Licensed Orbital Launch Events

Date	Vehicle	Payload	Govt/Coml	Launch Outcome	Orbit
Mar 18	Zenit 3SL	XM Rock	Coml	Success	GEO
May 8	Zenit 3SL	XM Roll	Coml	Success	GEO
Jun 19	Atlas 2AS	ICO F-1	Coml	Success	MEO
Sep 21	Taurus	OrbView 4	Coml	Failure	LEO
		QuikTOMS	Govt		LEO
		Celestis 4	Coml		LEO
Oct 18	Delta 2 7320	QuickBird	Coml	Success	LEO

Figure 1. Estimated Revenues for FAA-Licensed Orbital Launch Events

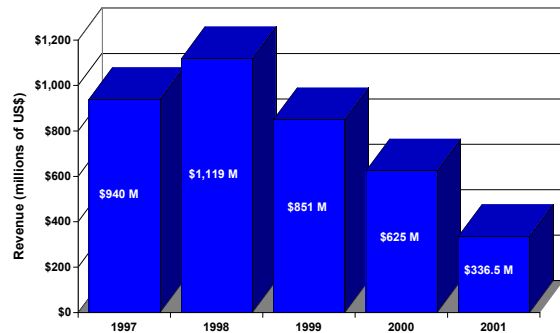
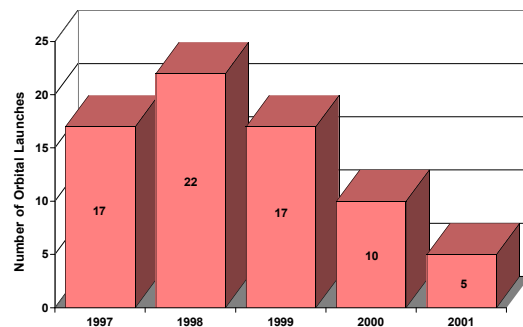


Figure 2. FAA-Licensed Orbital Launch Events



¹Revenues for both U.S. and foreign commercial launches are based on open source information and estimates by AST and are approximations only.

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

INTERNATIONAL LAUNCH SERVICES (ILS)

ILS, a joint U.S.-Russian partnership, successfully conducted four commercial launches in 2001, three of which used the Russian Proton vehicle. The remaining launch was one of the few remaining Atlas 2AS vehicles, launched from Cape Canaveral Air Force Station (CCAFS). This launch successfully placed ICO F-1 into MEO as part of a planned NGSO telecommunications constellation.

BOEING LAUNCH SERVICES (BLS)





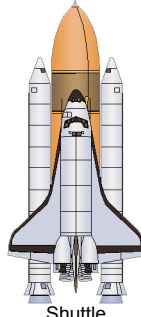
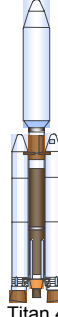
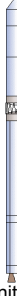
Boeing established BLS in 2001 to market Delta launch vehicles and the Sea Launch Zenit 3SL. Boeing conducted a commercial launch in 2001 using a Delta 2 launch vehicle carrying the QuickBird commercial remote sensing satellite. QuickBird, operated by U.S.-based DigitalGlobe, was successfully placed into LEO on October 18. The satellite replaced QuickBird 1, which was lost when its Russian Cosmos launch vehicle failed in the winter of 2000.

Sea Launch successfully conducted two commercial launches, sending XM Satellite Radio's XM Rock and XM Roll into GEO. Both satellites, which are Boeing 702 models, were launched in the spring. The satellites are currently providing digital radio service to subscribers in the United States. Sea Launch is comprised of commercial partners from the U.S., Ukraine, Russia, and Norway.

ORBITAL SCIENCES CORPORATION (OSC)

OSC launched a Taurus from Vandenberg Air Force Base (VAFB), California. However, due to a first stage guidance problem early in flight, none of the three payloads (OrbView 4, QuikTOMS, and Celestis 4) reached orbit. Telemetry analysis indicates that the launch vehicle was unable to reach the required altitude due to a failed second stage thrust actuator, and the payloads reentered the atmosphere shortly after separation from the third stage.

Table 2. U.S. and FAA-Licensed Launch Vehicle Performance in 2001

	USA						Multinational (Sea Launch)
							
Vehicle	Athena 1	Taurus	Delta 2	Atlas 2	Shuttle	Titan 4	Zenit 3SL
2001 Total Launches	1	1	7	4	6	3	2
2001 Licensed Launches	0	1	1	1	0	0	2
Reliability 2001	1/1	0/1	7/7	4/4	6/6	3/3	2/2
Last 10 Years	100.0%	0%	100.0%	100.0%	100.0%	100.0%	100.0%
First Launch	4/5	5/6	84/85	55/55	70/70	27/31	6/7
Launch Sites	80.0%	83.3%	98.8%	100.0%	100.0%	87.1%	85.7%
Launch Sites	1995	1994	1990	1991	1981	1989	1999
Launch Sites	Wallops, Kodiak, VAFB	VAFB	CCAFS, VAFB	CCAFS, VAFB	KSC	CCAFS, VAFB	Odyssey Pacific Ocean Platform
LEO kg (lb)	360 (792)	1,437 (3,161)	4,887 (10,751)	8,298 (18,256)	23,435 (51,557)	20,822 (45,808)	15,246 (33,541)
GTO kg (lb)	--	562 (1,236)	1,769 (3,892)	3,833 (8,433)	5,663 (12,459)	8,276 (18,207)	5,700 (12,540)

2001 WORLDWIDE LAUNCH ACTIVITY

Launch providers from the United States, Europe, Russia, and the multinational consortium Sea Launch conducted a total of 16 commercial orbital launches in 2001. The United States and Russia each captured 19 percent of the world's commercial launch market, and Europe's eight launches represented a 50 percent market share. Sea Launch's two commercial launches claimed 13 percent of the market. China did not conduct any commercial launches in 2001.

A detailed list of foreign commercial orbital launches appears in Table 4 on the right. In addition, the Appendix at the end of this report shows all 59 orbital launches worldwide in 2001 for commercial, civil and military missions.

Table 4. 2001 Foreign Commercial Launch Events

Date	Vehicle	Payload(s)	Launch Outcome	Orbit
Jan 10	Ariane 44P	Eurasiasat 1	Success	GEO
Feb 7	Ariane 44L	Skynet 4F	Success	GEO
		Sicral 1		GEO
Feb 20	START 1	Odin	Success	LEO
Mar 8	Ariane 5G	EUROBIRD	Success	GEO
		BSat 2A		GEO
May 15	Proton	PAS 10	Success	GEO
Jun 9	Ariane 44L	Intelsat 901	Success	GEO
Jun 16	Proton	Astra 2C	Success	GEO
Jul 12	Ariane 5G	Artemis	Failure	GEO
		BSat 2B		GEO
Aug 30	Ariane 44L	Intelsat 902	Success	GEO
Sep 25	Ariane 44P	Atlantic Bird 2	Success	GEO
Nov 27	Ariane 44LP	DirecTV 4S	Success	GEO

Figure 3. 2001 Total Worldwide Launch Activity

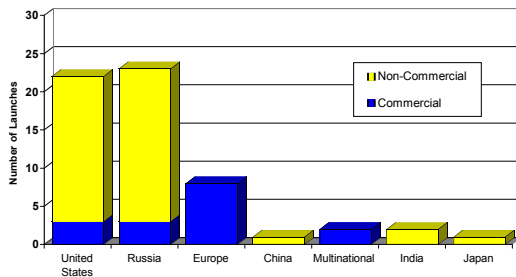


Table 3. 2001 Orbital Launch Events

	Commercial Launches	Non-Commercial Launches	TOTAL Launches
United States	3	19	22
Russia	3	20	23
Europe	8	0	8
China	0	1	1
Multinational	2	0	2
India	0	2	2
Japan	0	1	1
TOTAL	16	43	59

WORLDWIDE LAUNCH REVENUES

Revenues from the 16 commercial launch events in 2001 were an estimated \$1.5 billion, a 44 percent decrease from the 2000 total of approximately \$2.7 billion. European revenues were estimated at about \$948 million, Russian revenues were about \$178 million, Sea Launch earned approximately \$170 million, and U.S. commercial launch revenues were about \$167 million. China did not conduct any commercial launches during the year and therefore recorded no revenues (see Figure 5).

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

With the rise of multinational launch service corporations, however, a clean division of revenue for particular launches among countries is more difficult to calculate. For example, some Russian launch activity is conducted in partnership with American and European launch service providers through a number of joint ventures. ILS markets launches of the Russian Proton vehicle, and Starsem, the Franco-Russian partnership, conducts launches of the Soyuz vehicle. Sea Launch represents a partnership among four organizations in four countries and uses its own launch facility located, at the time of launch, in international waters.

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

Therefore, it should be recognized that the data presented in Figure 5 do not necessarily represent all of the payments a country might make or receive in the course of its launch activities. Also, prices for individual launches to GEO have dropped significantly during 2000-2001 compared to prior years. As a result, revenue estimates may be somewhat high.

Figure 4. 2001 Worldwide Commercial Market Share

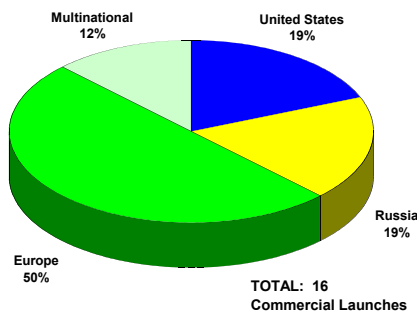
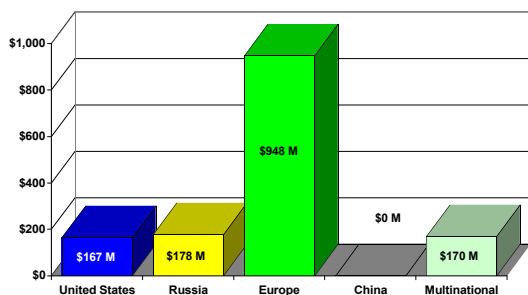


Figure 5. 2001 Commercial Launch Revenues (approximate)



WORLDWIDE PAYLOAD SUMMARY

A total of 81 payloads were launched on 59 launch vehicles in 2001. Of the 81, 20 were for commercial purposes (including four captive satellites from Russia) and 61 were for government or scientific purposes.

Sixteen commercially procured or internationally competed launches were used to send 21 payloads into orbit:

- Twelve payloads were commercially-operated GEO telecommunications satellites
- Five payloads represented a variety of government missions
- Two payloads were commercial remote sensing satellites
- One payload was a MEO telecommunications satellite
- One payload was a LEO burial canister

The United States successfully launched a New ICO satellite (ICO F-1), and QuickBird, a commercial remote sensing satellite with 0.6-meter resolution imaging capability. The third commercial launch from a U.S. launch site used OSC's Taurus launch vehicle, which failed when the vehicle did not reach the proper altitude to deploy its payloads.

Intelsat added two satellites to its fleet with the launch of Intelsats 901 and 902, both by Arianspace. Eutelsat extended its service capabilities with the launch of Atlantic Bird 2 and EUROBIRD, both launched aboard Ariane vehicles. Eurasiasat (Eurasiasat 1), PanAmSat (PAS 10), SES Global (Astra 2C) and Japan's Broadcasting Satellite Systems Corporation (BSat 2A) each added an additional satellite to their operating inventories. Japan's BSat 2B did not reach orbit when its Ariane 5G launch vehicle failed to achieve the necessary altitude for a transfer orbit to GEO. The primary payload on that flight, the European Space Agency's (ESA) experimental Artemis, was salvaged using onboard fuel assets. Unlike Artemis, BSat 2B was designed with only enough fuel to maneuver

Figure 6. 2001 Total Worldwide Launch Activity by Payloads

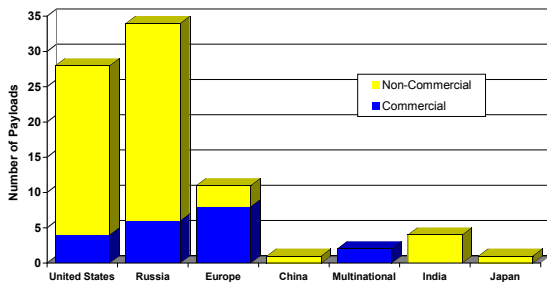


Figure 7. Total Payloads Launched by Country in 2001

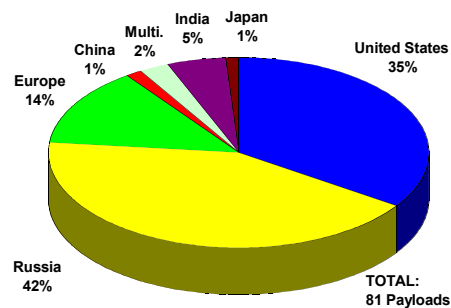
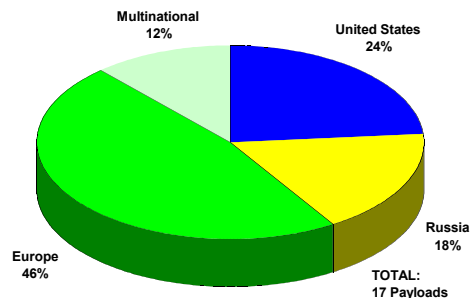


Table 5. Payloads Launched in 2001

	Commercial Payloads	Non-Commercial Payloads	TOTAL Payloads
United States	4	24	28
Russia	6	28	34
Europe	8	3	11
China	0	1	1
Multinational	2	0	2
India	0	4	4
Japan	0	1	1
TOTAL	20	61	81

Figure 8. Commercial Payloads Launched by Country in 2001



in GEO and could not move itself from the lower orbit to GEO. As a result, the satellite was considered a total loss. The British Ministry of Defence, which internationally competed a launch for its Skynet 4F, and the Italian Ministry of Defense (Sicral 1) both had their satellites successfully launched as a pair aboard an Ariane 44L. Finally, DIRECTV welcomed the successful launch of DIRECTV 4S, which was placed into GEO by an Ariane 44LP launch vehicle.

Russia launched Sweden's Odin science satellite aboard a START 1 launch vehicle in early 2001, and two commercial GEO satellites (PAS 10 and Astra 2C) using separate Proton vehicles were launched in May and June, respectively.

Four commercially-operated payloads were deployed on launch vehicles that were not internationally procured; one, Ekran M16, was launched aboard a Proton with a Briz M upper stage to GEO while the others were three LEO store-and-forward Gonet satellites launched together aboard a Cyclone 3 vehicle.

LAUNCH ACTIVITIES BY COUNTRY

Russia - In 2001, Russia launched 23 vehicles; of these, two were commercial launches using ILS Proton vehicles (sending PanAmSat's PAS 10 and SES Global's Astra 2C into GEO) and a third commercial launch was of a START 1 vehicle, which placed Sweden's Odin science satellite into LEO.





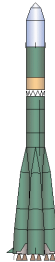
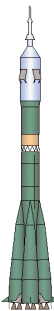

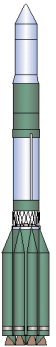
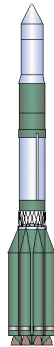
Russia also conducted eight launches dedicated to the International Space Station (ISS), sending two crewed Soyuz replacement modules, five Progress supply modules and an airlock compartment called Pirs. Mission ISS 2S, the first Soyuz module launched in 2001, included the world's first paying space tourist, Dennis Tito. Tito paid an estimated \$20 million for a seat on the Soyuz and a week aboard the International Space Station. Of the remaining 12 launches, two involved captive commercial satellites (the aforementioned Ekran M16 and Gonets satellites, the latter set launched with a trio of identical military satellites), two sent Molniya communications satellites into highly-elliptical orbits, four placed

unspecified Kosmos military payloads into a variety of orbits (not including the ones multi-manifested with the Gonets launch), one lofted three Glonass navigation satellites into MEO, and three launch events sent a host of civil science payloads into LEO for operators in Sweden, Pakistan, Morocco, and Germany.

Europe - Europe conducted eight launches, all of which were commercially procured. Six of the launches involved the Ariane 4 series vehicles, which successfully lofted Eurasiasat 1, Sicral 1 and Skynet 4F (dual-manifested), Intelsat 901, Intelsat 902, Atlantic Bird 2, and DIRECTV 4S.

Only two Ariane 5G launches were conducted in 2001, with one success (BSat 2A and EUROIRD were dual-manifested) and one failure. In the latter case, an upper stage (EPS) engine problem during the launch of ESA's Artemis and Japan's BSat 2B on July 12 halted use of the Ariane 5G vehicle until an investigation determined the cause of the fault (a period

Table 6. Russian and Ukrainian Vehicle Performance in 2001

									
Vehicle	START	Cosmos	Cyclone 2	Cyclone 3	Molniya	Soyuz	Zenit 2	Proton	Proton M
2001 Total Launches	1	1	1	2	2	9	1	5	1
Reliability 2001	1/1	1/1	1/1	2/2	2/2	9/9	1/1	5/5	1/1
Last 10 Years	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
First Launch	1993	1964	1977	1977	1960	1963	1985	1967	2001
Launch Sites	Svobodny	Plesetsk	Plesetsk, Baikonur	Plesetsk	Plesetsk	Baikonur, Plesetsk	Baikonur	Baikonur	Baikonur
LEO kg (lb)	607 (1,335)	1,350 (2,970)	2,820 (6,204)	3,929 (8,644)	1,800 (3,960)	6,708 (14,758)	13,199 (29,038)	19,254 (42,359)	21,000 (46,297)
GTO kg (lb)	--	--	--	--	1,600 (3,520)	--	--	4,421 (9,726)	2,920 (6,424)

lasting through the end of the year). Ariespace officials stated that “combustion instability” during the upper stage Aestus engine’s ignition reduced thrust and also led to the premature shutdown of the engine when it exhausted its propellants. The Ariane 5 has been launched successfully eight times since it was introduced in 1996.

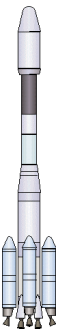
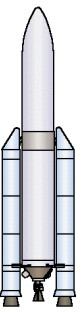

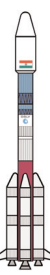
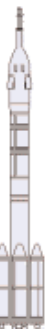

China - China did not conduct any commercial launches in 2001, and has not conducted one since 1999. In 2001, China launched only one payload into orbit, the lowest number since 1993. The single payload was the Shenzhou 2, a space vehicle designed to carry a crew and based loosely on Russian Soyuz designs that were exchanged under certain technology agreements. Shenzhou 2 was launched aboard the Long March 2F vehicle, without a crew, in the second successful launch of that vehicle out of two attempts. China has indicated that several Shenzhou spacecraft will be launched without a crew until the launch vehicle and spacecraft have been declared safe.

India - The Indian Space Research Organization (ISRO) performed two launches in 2001 from its Sriharikota Range launch site. On April 18, India

conducted the successful inaugural launch of its Geosynchronous Satellite Launch Vehicle (GSLV), carrying GSat 1 into orbit. Due to a premature shutdown of the upper stage engine, GSat 1 was placed into a lower-than-desired orbit. The second launch carried ISRO’s TES, Germany’s BIRD, and ESA’s PROBA into orbit using India’s Polar Satellite Launch Vehicle (PSLV).

Japan - The initial launch of the H 2A was successfully conducted by Japan’s National Space Development Agency (NASDA) on August 29. The vehicle, launched from Tanegashima Space Center, placed a vehicle evaluation payload into LEO.

Table 7. European, Chinese, Indian, and Japanese Launch Vehicle Performance in 2001

	Europe		India		China	Japan
						
Vehicle	Ariane 4	Ariane 5	PSLV	GSLV	LM- 2F	H 2A 202
2001 Total Launches	6	2	1	1	1	1
Reliability 2001	6/6	1/2	1/1	1/1	1/1	1/1
	100.0%	50.0%	100.0%	100.0%	100.0%	100.0%
Last 10 Years	92/95	8/10	2/2	1/1	2/2	1/1
	96.8%	80.0%	100.0%	100.0%	100.0%	100.0%
First Launch	1988	1996	2000	2001	1999	2001
Launch Sites	Kourou	Kourou	Sriharikota	Sriharikota	Jiuquan	Tanegashima
LEO kg (lb)	9,191 (20,220)	17,250 (37,950)	3,700 (8,140)	5,000 (11,000)	9,500 (20,900)	9,940 (21,868)
GTO kg (lb)	4,748 (10,446)	6,534 (14,375)	800 (1,760)	2,500 (5,500)	3,500 (7,700)	4,100 (9,020)

FIVE-YEAR SPACE TRANSPORTATION TRENDS

From 1997 to 2000, total annual launches worldwide have remained essentially constant, with the proportion of commercial launches declining steadily. In 2001, however, total launches dropped by about 31 percent from 85 in 2000 to 59. Commercial launches dropped 55 percent from 35 in 2000 to 16 in 2001. The average for total launches per year between 1997 and 2001 is about 79, with the average number of commercial launches approximately 34.

Revenues worldwide for commercial orbital launches have also shown a gradual decline, with the exception of 2000, the peak year since 1997. Market share for the United States has decreased since 1998, with Europe, Russia, and the multinational Sea Launch Company remaining relatively steady during the five-year period.

Figure 11. Launch Revenues for Commercial Launch Events (approximate, in \$US millions)

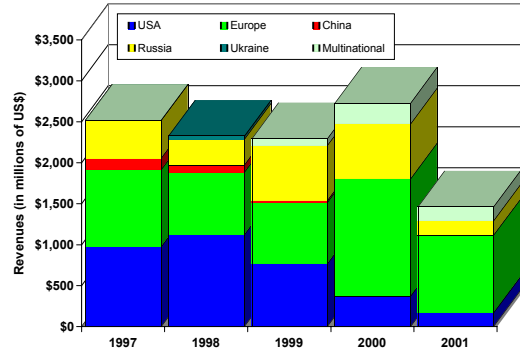


Table 8. Launch Revenues for Commercial Launch Events (approximate, in \$US millions)

	1997	1998	1999	2000	2001	Total
United States	\$974	\$1,120	\$766	\$370	\$167	\$3,397
Europe	\$940	\$763	\$750	\$1,433	\$948	\$4,834
Russia	\$464	\$313	\$670	\$671	\$178	\$2,296
China	\$143	\$90	\$23	\$0	\$0	\$256
Ukraine	\$0	\$40	\$0	\$0	\$0	\$40
Multinational	\$0	\$0	\$85	\$255	\$170	\$510
TOTAL	\$2,521	\$2,326	\$2,294	\$2,729	\$1,462	\$11,332

Figure 9. Five-Year Summary (1997-2001) of Launch Events by Commercial/Non-commercial

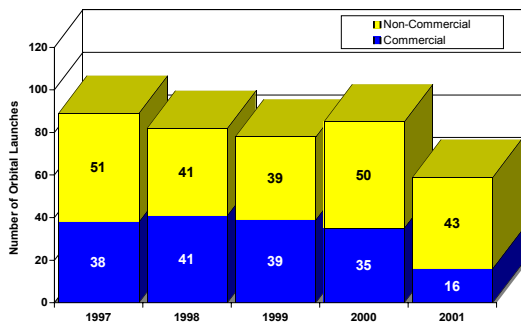


Figure 12. Five-Year Summary (1997-2001) of Commercial Payloads Launched by Orbit

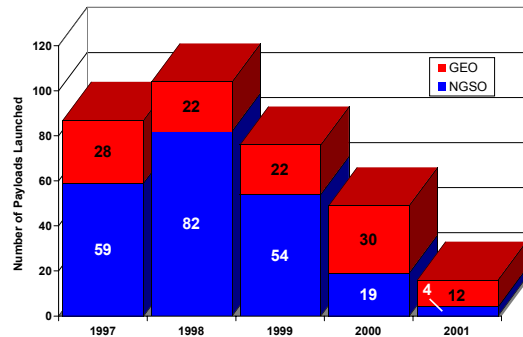


Figure 10. Five-Year Worldwide Commercial GEO and NGSO Launch Events (1997-2001)

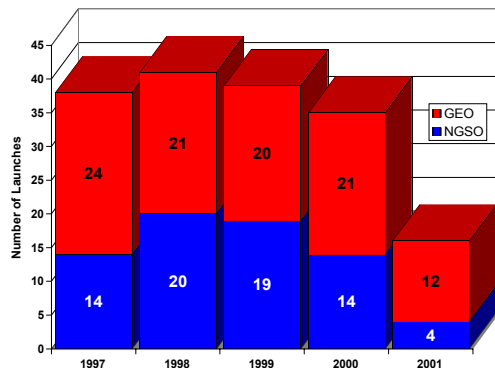


Figure 13. Five-Year Worldwide Orbital Launch Share (1997-2001)

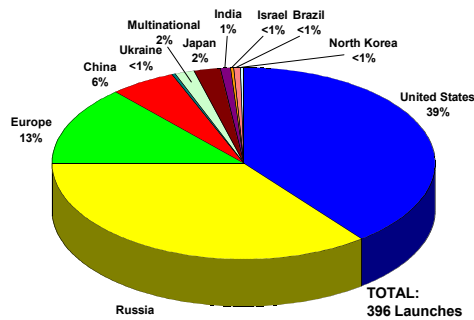
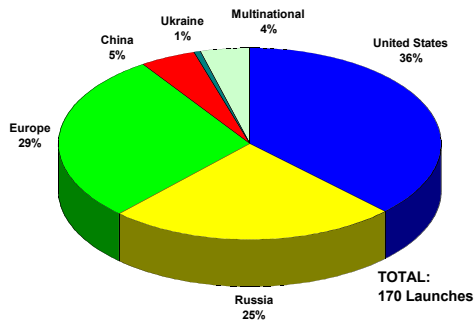


Figure 14 shows all worldwide commercial orbital launches from 1997 to 2001, which totaled 170 launch events. A commercial launch is defined as any launch that is internationally competed or FAA-licensed, or represents privately-financed launch activity.

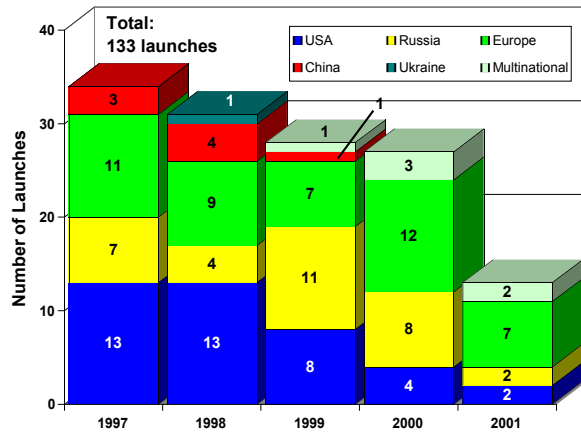
Figure 14. Five-Year Worldwide Commercial Launch Share (1997-2001)



As commercial space business increases and replaces various forms of traditionally government-operated activities, the definitions of “commercial payload” and “commercial launch” become more complex and open to interpretation. Another way to measure commercial launch activity is how companies compete against each other for non-government payloads. Figure 15 reflects launch service providers competing in the international marketplace for open-bid launch services contracts issued by commercial entities. This particular measurement precludes government-sponsored payloads launched commercially (some have been licensed by the FAA) and payloads captive to a countries’ or companies’ own launch providers. It also does not include test or dummy payloads or small secondary payloads.

Using the definition above, from 1997 to 2001, 79 payloads were launched “commercially” and but were not internationally competed; most of these had NGSO destinations. Because of multi-manifesting, this equates to 37 launches. These 37 launches are counted in Figure 14, but not in Figure 15. During this five-year period, Figure 15 shows that Europe captured 35 percent of all internationally competed launches, the United States had 30 percent, Russia 24 percent, China six percent, Sea Launch about four percent, and Ukraine less than one percent.

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



*An internationally competed launch event is defined as one involving payloads open to international launch service procurement. This chart precludes government-sponsored payloads launched commercially or payloads captive by countries or companies to their own launch providers. It also does not include dummy payloads or small secondary payloads.

The significant reduction in the number of commercial launches during 2001 is due in part to the trend away from LEO communications constellations. This reduction was partially mitigated by launches dedicated to other services such as direct radio broadcasting and commercial remote sensing. In addition, some payloads were not delivered on time due to manufacturing delays, further reducing the number of launches expected to occur during the year.

The commercial space transportation market is driven largely by the demand for launches of telecommunications satellites and, therefore, developments in the industry over the next five years will parallel developments in satellite systems, including:

- Anticipated steady demand for launch of GEO communications satellite systems with a small but steady demand for remote sensing systems.
- A continued trend toward heavier GEO communications satellites supplemented by an emerging market for small GEO satellites.
- Continued lower than originally anticipated demand for LEO deployments due to impact of business difficulties faced by first constellations.

These satellite industry trends will be augmented by new developments in the launch industry within five years, including:

- The introduction of larger launch vehicles to meet the demand for launches of heavier GEO spacecraft (Delta 4 and Atlas 5), and capacity upgrades to existing vehicles (Ariane 5G and others).
- Continued international competition to provide launch services by Europe, Russia, Ukraine, and China. Possible new entrants in the international launch services market include India, Japan, and Brazil.

2001 WORLDWIDE ORBITAL LAUNCH EVENTS

Date	Vehicle	Site	Payload(s)	Operator	Manufacturer	Use	Comml Price	L	M
1/10/2001	Long March 2F	Jiuquan	Shenzhou 2	China National Space Administration	China Research Institute of Carrier Rocket Technology	Development		S	S
1/10/2001	/ Ariane 44P	Kourou	* Eurasiasat 1	Eurasiasat SM	Alcatel Espace	Communications	\$80-100 M	S	S
1/24/2001	Soyuz	Baikonur	Progress M1-5	RKK Energia	RKK Energia	Mir		S	S
1/30/2001	Delta 2 7925-10	CCAFS	Navstar GPS 2R-7	DoD	Lockheed Martin Corp.	Navigation		S	S
2/7/2001	/ Ariane 44L	Kourou	Skyнет 4F	British Ministry of Defence	Matra Marconi Space	Communications	\$100-125 M	S	S
			Sicral 1	Italian Ministry of Defense	Alenia Spazio	Communications			S
2/7/2001	Shuttle Atlantis	KSC	STS 98	NASA	N/A	Crewed		S	S
			ISS 5A	NASA	Boeing	ISS			S
2/20/2001	/ START 1	Svobodny	Odin	Swedish National Space Board	Swedish Space Corp.	Scientific	\$8-10 M	S	S
2/26/2001	Soyuz	Baikonur	Progress ISS 3P	RKK Energia/NASA	RKK Energia	ISS		S	S
2/27/2001	Titan 4B/Centaur	CCAFS	Milstar F4	DoD/USAF	Lockheed Martin Corp.	Communications		S	S
3/8/2001	Shuttle Discovery	KSC	STS 102	NASA	N/A	Crewed		S	S
			ISS 5A.1	NASA	Italian Space Agency-ASI	ISS			S
3/8/2001	/ Ariane 5G	Kourou	* EUROIRD	Eutelsat	Alcatel Espace	Communications	\$150-180 M	S	S
			* BSat 2A	Broadcasting Satellite System Corp. (BSAT)	Orbital Sciences Corp.	Communications			S
3/18/2001	/ Zenit 3SL	Sea Launch Platform	* XM Rock	XM Satellite Radio, Inc.	Boeing	Communications	\$75-95 M	S	S
4/7/2001	Proton M	Baikonur	* Ekran M16	Russia/CIS PTT	NPO Prikladnoi Mekhaniki	Communications		S	S
4/7/2001	Delta 2 7925-10	CCAFS	2001 Mars Odyssey	NASA	NASA	Scientific		S	S
4/18/2001	GSLV	Sriharikota Range (SHAR)	Gsat 1	Indian Space Research Organization	Indian Space Research Organization	Communications		P	P
4/19/2001	Shuttle Endeavour	KSC	STS 100	NASA	N/A	Crewed		S	S
			ISS 6A	NASA	Italian Space Agency-ASI	ISS			S
4/28/2001	Soyuz	Baikonur	Soyuz ISS 2S	ROSAVIKOSMOS/INASA	RKK Energia	ISS		S	S
5/8/2001	/ Zenit 3SL	Sea Launch Platform	* XM Roll	XM Satellite Radio, Inc.	Boeing	Communications	\$75-95 M	S	S
5/15/2001	/ Proton	Baikonur	* PAS 10	Pan American Satellite Corp.	Boeing	Communications	\$75-95 M	S	S
5/18/2001	Delta 2 7925-10	CCAFS	GeoLite	NRO	TRW	Development		S	S
5/20/2001	Soyuz	Baikonur	Progress ISS 4P	RKK Energia/NASA	RKK Energia	ISS		S	S
5/29/2001	Soyuz	Plesetsk	Kosmos 2377	Russian MoD	TsSKB Progress	Classified		S	S
6/8/2001	Cosmos	Plesetsk	Kosmos 2378	Russia	NPO Prikladnoi Mekhaniki	Navigation		S	S
6/9/2001	/ Ariane 44L	Kourou	* Intelsat 901	Intelsat	Space Systems/Loral	Communications	\$100-125 M	S	S
6/16/2001	/ Proton	Baikonur	* Astra 2C	SES Astra	Boeing	Communications	\$75-95 M	S	S
6/19/2001	/ Atlas 2AS	CCAFS	* ICO F-1	New ICO	Boeing	Communications	\$90-105 M	S	S
6/30/2001	Delta 2 7425-10	CCAFS	MAP	NASA	NASA Goddard	Scientific		S	S
7/12/2001	Shuttle Atlantis	KSC	STS 104	NASA	N/A	Crewed		S	S
			ISS 7A	NASA	Boeing	ISS			S
7/12/2001	/ Ariane 5G	Kourou	Artemis	European Space Agency (ESA)	Alenia Spazio	Communications	\$150-180 M	F	S
			* BSat 2B	Broadcasting Satellite System Corp. (BSAT)	Orbital Sciences Corp.	Communications			F
7/20/2001	Molniya	Plesetsk	Molniya 3K	Russia	NPO PM	Communications		S	S
7/23/2001	Atlas 2A	CCAFS	GOES 12	NOAA	Space Systems/Loral	Meteorological		S	S
7/31/2001	Cyclone 3	Plesetsk	Coronas F	Izmiran and Lebedev Physical Institute	NPO Yuzhnoye	Scientific		S	S
8/6/2001	Titan 4B/IUS	CCAFS	DSP 21	USAF	TRW	Intelligence		S	S
8/8/2001	Delta 2 7326-10	CCAFS	Genesis	NASA/JPL	Lockheed Martin Corp.	Scientific		S	S
8/10/2001	Shuttle Discovery	KSC	STS 105	NASA	N/A	Crewed		S	S
			ISS 7A.1	NASA	Italian Space Agency-ASI	ISS			S
8/21/2001	Soyuz	Baikonur	Progress ISS 5P	RKK Energia/NASA	RKK Energia	ISS		S	S
8/24/2001	Proton	Baikonur	Kosmos 2379	Russian MoD	NPO Lavotchkin	Classified		S	S
8/29/2001	H 2A 202	Tanegashima	Vehicle Evaluation Payload 2	NASDA	NASDA	Test		S	S

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

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

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

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

2001 WORLDWIDE ORBITAL LAUNCH EVENTS

Date	Vehicle	Site	Payload(s)	Operator	Manufacturer	Use	Comml Price	L	M
8/30/2001	/ Ariane 44L	Kourou	* Intelsat 902	Intelsat	Space Systems/Loral	Communications	\$100-125 M	S	S
9/8/2001	Atlas 2AS	VAFB	NRO A1	NRO	Boeing	Classified		S	S
9/15/2001	Soyuz	Baikonur	Pirs	ROSAVIAKOSMOS/NASA	Russian Space Agency	ISS		S	S
9/21/2001	/ Taurus	VAFB	* OrbView 4	Orbital Imaging Corp. (Orbimage)	Orbital Sciences Corp.	Remote Sensing	\$20-25 M	F	F
			* Celestis 4	Celestis, Inc.	Celestis, Inc.	Other			F
			QuikTOMS	NASA	Orbital Sciences Corp.	Scientific			F
9/25/2001	/ Ariane 44P	Kourou	* Atlantic Bird 2	Eutelsat	Alcatel Espace	Communications	\$80-100 M	S	S
9/29/2001	Athena 1	Kodiak Launch Complex	Starshine 3	NASA	Utah State University	Scientific		S	S
			PICOSAT 1	USAF	Surrey Satellite Technology Ltd.	Development			S
			PCSat	US Naval Academy	US Naval Academy	Communications			S
			SAPPHIRE	Stanford University	Stanford University	Scientific			S
10/5/2001	Titan 4B	VAFB	NRO T3	NRO	Boeing	Intelligence		S	S
10/6/2001	Proton	Baikonur	Raduga 1-06	Russian MoD	TsSKB Progress	Communications		S	S
10/11/2001	Atlas 2AS	CCAFS	NRO A2	NRO	TBA	Communications		S	S
10/18/2001	/ Delta 2 7320	VAFB	* QuickBird	DigitalGlobe	Ball Aerospace and Technologies Corp.	Remote Sensing	\$45-55 M	S	S
10/21/2001	Soyuz	Baikonur	Soyuz ISS 3S	NASA	RKK Energia	ISS		S	S
10/22/2001	PSLV	Sriharikota Range (SHAR)	PROBA	European Space Agency (ESA)	Verhaert	Development		S	S
			BIRD	DLR	DLR	Development			S
			TES	ISRO	ISRO	Remote Sensing			S
10/25/2001	Molniya	Plesetsk	Molniya 3-51	Russia	NPO PM	Communications		S	S
11/26/2001	Soyuz	Baikonur	Progress ISS 6P	RKK Energia/NASA	RKK Energia	ISS		S	S
11/26/2001	/ Ariane 44LP	Kourou	* DirecTV 4S	DirecTV, Inc.	Boeing	Communications	\$90-110 M	S	S
12/1/2001	Proton	Baikonur	Kosmos 2380	Russian MoD	NPO PM	Navigation		S	S
			Kosmos 2381	Russian MoD	NPO PM	Navigation		S	S
			Kosmos 2382	Russian MoD	NPO PM	Navigation		S	S
12/5/2001	Shuttle Endeavour	KSC	STS 108	NASA	N/A	Crewed		S	S
			ISS UF-1	NASA	Italian Space Agency-ASI	ISS		S	S
12/7/2001	Delta 2 7920	VAFB	Jason 1	NASA/CNES	Aerospatiale	Remote Sensing		S	S
			TIMED	NASA	Applied Physics Lab./Johns Hopkins	Scientific			S
12/10/2001	Zenit 2	Baikonur	Meteor 3M N1	Russia	VNII Elektromekhaniki	Meteorological		S	S
			Kompass	Russia	Russia	Scientific			S
			Badr 2	SUPARCO	SUPARCO	Development			S
			Maroc-Tubsat	Royal Center for Remote Sensing (Morocco)	Technical University of Berlin	Remote Sensing			S
			Reflektor	SRIPDE (Russia)	SRIPDE (Russia) and USAF	Development			S
12/21/2001	Cyclone 2	Baikonur	Kosmos 2383	Russian MoD	KB Arsenal	Classified		S	S
12/28/2001	Cyclone 3	Plesetsk	* Gonets D1 9	Smolsat (NPO PM, et. al)	NPO Prikladnoi Mekhaniki	Communications		S	S
			* Gonets D1 7	Smolsat (NPO PM, et. al)	NPO Prikladnoi Mekhaniki	Communications			S
			* Gonets D1 8	Smolsat (NPO PM, et. al)	NPO Prikladnoi Mekhaniki	Communications			S
			Kosmos 2384	Russian MoD	NPO Prikladnoi Mekhaniki	Communications			S
			Kosmos 2385	Russian MoD	NPO Prikladnoi Mekhaniki	Communications			S
			Kosmos 2386	Russian MoD	NPO Prikladnoi Mekhaniki	Communications			S

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