

Commercial Space Transportation

QUARTERLY LAUNCH REPORT

Featuring the launch results from the 4th quarter 1999 and forecasts for the 1st quarter 2000 and the 2nd quarter 2000



1st Quarter 2000

United States Department of Transportation • Federal Aviation Administration
Associate Administrator for Commercial Space Transportation
800 Independence Ave. SW Room 331



1ST QUARTER
2000 REPORT

Objectives

This report summarizes recent and scheduled worldwide commercial, civil, and military orbital space launch events. Scheduled launches listed in this report are vehicle/payload combinations that have been identified in open sources, including industry references, company manifests, periodicals, and government documents. Note that such dates are subject to change.

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

- *Internationally competed launch events (i.e., launch opportunities considered available in principle to competitors in the international launch services market),*
- *Any launches licensed by the Office of the Associate Administrator for Commercial Space Transportation of the Federal Aviation Administration under U.S. Code Title 49, Section 701, Subsection 9 (previously known as the Commercial Space Launch Act), and*
- *Certain European launches of post, telegraph and telecommunications payloads on Ariane vehicles.*

Certain industry terms are used in this document that may be unfamiliar to some readers. Such terms along with commonly used acronyms are defined in Appendix A.

Photo credit: Sea Launch (1999). Image is of the Zenit 3SL launch on October 9, 1999, from the Odyssey Sea Launch Platform. It successfully deployed the DirecTV 1R satellite.

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This document was released on January 31, 2000.

SUMMARY

Launch Events
 Fourth Quarter 1999
 (October 1999 – December 1999)

The United States conducted seven successful launches in the fourth quarter of 1999. Three were commercial (one Atlas, one Pegasus, and one Taurus). The four remaining launches were non-commercial: a Delta 2, a Titan 2, an Atlas 2, and a Space Shuttle launch.

There were five Russian launches in this period. Two of these launches were commercial launches of the Soyuz vehicle. The rest were non-commercial launches including one Proton, one Cyclone, and one Molniya. The Proton launch failed while all of the other launches were successful.

Europe conducted five successful launches, four Ariane 4 launches and one Ariane 5. Three of the Ariane 4 launches were commercial while the remaining Ariane 4 and the single Ariane 5 were non-commercial.

China launched two non-commercial Long March vehicles.

The Sea Launch partnership made one successful launch of a Zenit 3SL vehicle.

Japan failed in an attempt to make a non-commercial launch of an H-2 vehicle.

Brazil unsuccessfully attempted to launch the VLS launch vehicle on a non-commercial test flight.

Payload Use Analysis
 Fourth Quarter 1999

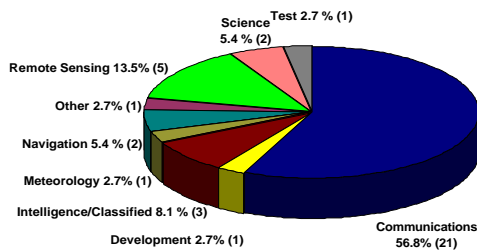


Figure 1: Payload Use Fourth Quarter 1999

In the fourth quarter of 1999, there were 37 payloads launched worldwide. These payloads were divided between communications (56.8 percent), development (2.7 percent), intelligence/classified (8.1 percent), meteorology (2.7 percent), navigation (5.4 percent), other (2.7 percent), remote sensing (13.5 percent), science (5.4 percent), and test (2.7 percent).

Of the nine commercially launched payloads eight were communications payloads. The remaining payload was a remote sensing satellite.

SUMMARY

Launch Log
Fourth Quarter 1999

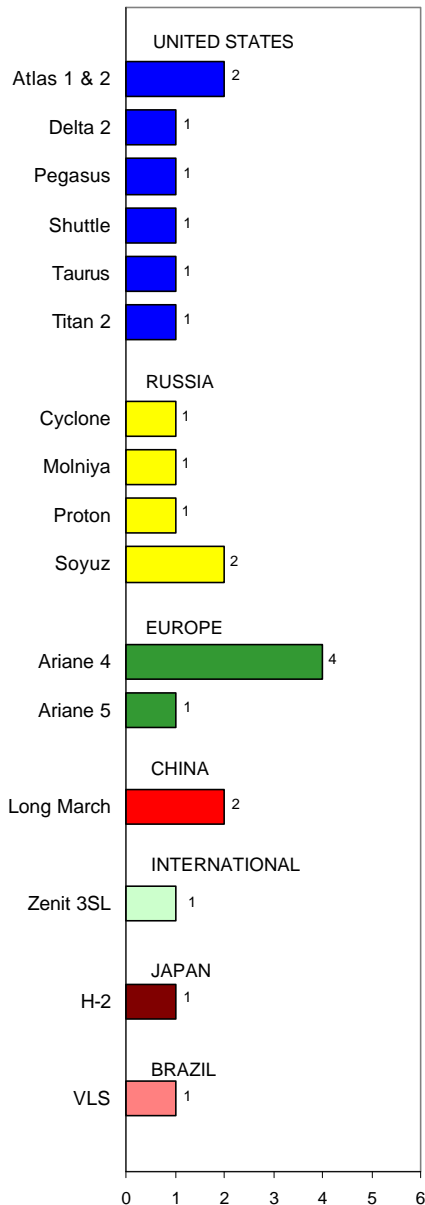


Figure 2: Launch Vehicle Use
Fourth Quarter 1999

Vehicle	Payload	Site
OCTOBER 1999		
Ariane 44LP	Telstar 12	Kourou
Delta 2 7925	Navstar GPS 2R- 3	CCAS
Long March 4B	CBERS/Ziyuan 1	Taiyuan
	SACI 1	
Proton	Express A 1	Baikonur
Zenit 3SL	DirectTV 1R	Sea Launch Platform
Soyuz	Globalstars 31, 56, 57,59	Baikonur
NOVEMBER 1999		
Ariane 44LP	GE 4	Kourou
Atlas 2A	GBS 10	CCAS
H-2	MTSat 1	Tanegashima
Long March 2F	Shenzhou	Jiuquan
Soyuz	Globalstars 29, 34, 39, 61	Baikonur
DECEMBER 1999		
Ariane 40	Helios 1B	Kourou
	Clementine	
Ariane 44L	Galaxy 11	Kourou
Ariane 5	XMM	Kourou
Atlas 2AS	Terra	VAFB
Cyclone 2	Kosmos 2367	Baikonur
Molniya	Kosmos2368	Baikonur
Pegasus XL/HAPS	Orbcomms 30-36	Wallops
Shuttle Discovery	STS 103	KSC
Taurus 1	Kompsat	VAFB
	ACRIMSAT	
	Celestis 3	
Titan 2	DMSP 5D-3-F15	VAFB
VLS	SACI 2	Alcantara

For more information on fourth quarter launches please see Appendix D.

SUMMARY

Scheduled Launch Events
 First and Second Quarter 2000
 (January – June 2000)

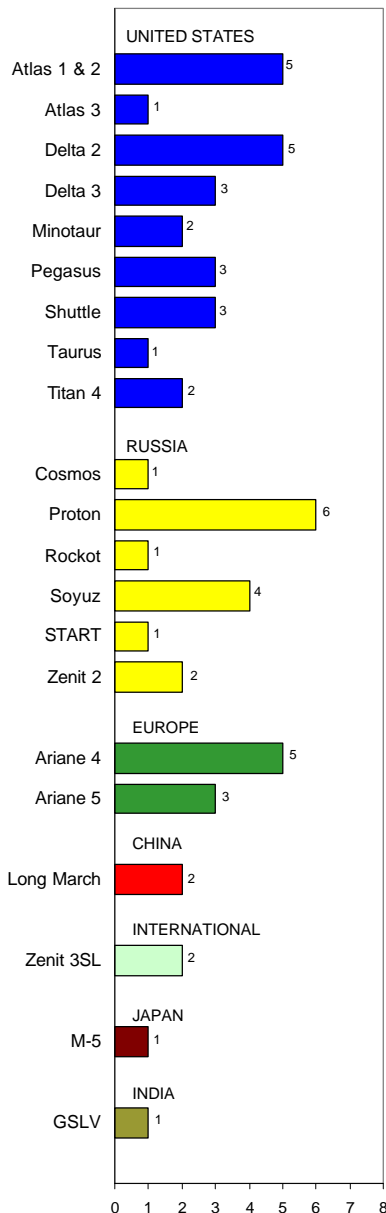


Figure 3: Launch Vehicle Use
 First and Second Quarter 2000

U.S. launch providers intend to make 25 launches in the next two quarters. Eight of these launches will be commercial: one Atlas 2, one Atlas 3, one Delta 2, three Delta 3, and two Pegasus. Non-commercial launches will consist of four Atlas 2, four Delta 2, two Minotaur, one Pegasus, three Space Shuttle, one Taurus, and two Titan 4 vehicles.

Russian launch vehicles are scheduled to make 15 launches, six of which are to be commercial. These commercial launches are scheduled to include one Cosmos, four Proton, and one START vehicle. Non-commercial launches will include two Proton, one Rockot, four Soyuz, and two Zenit 2.

Europe plans eight flights. Five Ariane 4 launches and three Ariane 5 launches (all commercial) make up the Arianespace manifest.

China anticipates the launch of two Long March vehicles, neither of which is commercial.

The Sea Launch international joint venture plans to make two commercial launches of its Zenit 3SL launch vehicle.

Japan has scheduled the launch of one non-commercial M-5 vehicle.

India plans to make the initial, non-commercial launch of its GSLV vehicle.

Scheduled Launch Log
First Quarter 2000

Vehicle	Payload	Site
JANUARY 2000		
Ariane 42L	Galaxy 10R	Kourou
Atlas 2A	DSCS III 3-11	CCAS
Shuttle Endeavour	STS 99	KSC
Soyuz	Progress M-43	Baikonur
Soyuz	Kosmos TBA	Baikonur
FEBRUARY 2000		
Ariane 44LP	Superbird 4	Kourou
Atlas 2AS	Hispasat 1C	CCAS
Delta 2 7326	IMAGE	VAFB
Delta 2 7420	Globalstar Mission 7	CCAS
M 5	Astro E	Kagoshima
Titan 4B/IUS	DSP 20	CCAS
Zenit 3SL	ICO 1	Sea Launch Platform
MARCH 2000		
Ariane 44L	PAS 1R	Kourou
Ariane 5	AsiaStar 1	Kourou
	Insat 3B	
Atlas 2AS	NRO 2000-1	CCAS
Proton	Garuda 1	Baikonur
Proton	Glonass 1999-01	Baikonur
	Glonass 1999-02	
	Glonass 1999-03	
Rockot	Rockot Demo 1	Plesetsk
	Rockot Demo 2	
Shuttle Atlantis	STS 101	KSC
Soyuz	DemoClusters	Baikonur
Zenit 2	Meteor 3M-1	Baikonur
	Badr 2	

Scheduled Launch Log
Second Quarter 2000

Vehicle	Payload	Site
APRIL 2000		
Atlas 3A	Eutelsat W4	CCAS
Cosmos	Champ	Plesetsk
	Mita	Plesetsk
Delta 2 7320	Earth Observing 1	VAFB
	Citizen Explorer	
	Munin	
	SAC C	
Delta 2 7925	Navstar GPS 2R- 4	CCAS
Delta 3	ICO 2	CCAS
Delta 3	ICO 3	CCAS
MAY 2000		
Atlas 2A	GOES L	CCAS
START 1	EROS A1	Svobodny
	Odin	
JUNE 2000		
Ariane 4 TBA	Europe Star	Kourou
Atlas 2A	TDRS F8	CCAS
Delta 2 7925	Navstar GPS 2R- 5	CCAS
Delta 3	CO 4	CAS
Shuttle Discovery	STS 92	KSC
Soyuz	Cluster II 1	Baikonur
	Cluster II 2	

**Additional Launch Events
Expected***
First and Second Quarter 2000

Vehicle	Payload	Site
FIRST QUARTER OF 2000		
GSLV	GSat 1	Sriharikota
Long March 3A	Fenghuo 1	Xichang
Minotaur	Artemis Picosat	California
	DARPA Picosat	Spaceport
	FalconSat	
	Jawsat	
	MASAT	
	OPAL	
	STENSAT	
Minotaur	MightySat 2-1	California
		Spaceport
Pegasus XL	HETE-2	Kwajalein
Pegasus XL	TSX 5	VAFB
Taurus 1	MTI	VAFB
Zenit 2	Tselina 2	Baikonur
SECOND QUARTER OF 2000		
Ariane 5	Brazilsat B4	Kourou
Ariane 5	GE 7	Kourou
Ariane 4 TBA	Astra 2B	Kourou
Long March 3	FY 2B (2000)	Xichang
Pegasus XL	OrbView 3	VAFB
Proton	GE 1A	Baikonur
Proton	CD Radio 1	Baikonur
Proton	Sesat	Baikonur
Proton	Zvezda	Baikonur
Titan 4B/Centaur	Milstar II-F2	CCAS
Zenit 3SL	Galaxy 3C	Sea Launch Platform

* This section summarizes launches and payloads that are expected to occur during the next two quarters. The specific month of launch was not available prior to publication of this report.

SUMMARY

Commercial Products and Services

Three Launch Vehicles Enter Operational Service

During the fourth quarter of 1999, two new launch vehicles entered operational service, the Zenit 3SL and the Ariane 5. The Atlas 3 is scheduled to enter operational service in the second quarter of 2000. These vehicles are important because they will noticeably increase the number of launch vehicles available for geosynchronous orbit bound satellite launches.

Vehicle	Service Provider	Site	LEO Capacity	GTO Capacity
Zenit 3SL	Sea Launch	Pacific Ocean	35000 lb	11050 lb
Ariane 5	Arianespace	Kourou	15000 lb	39600 lb
Atlas 3	ILS	CCAS	8940 lb	19100 lb

The operators of both the Zenit 3SL and the Ariane 5 vehicles conducted test launches before making their commercial operational debut. The Atlas 3 will make its debut launch with a commercial payload.

Sea Launch’s Zenit 3SL vehicle and ocean going launch platform Odyssey were tested with the successful launch of DemoSat (a test article with no functional capabilities) on 3/27/99. Following this successful demonstration, Sea Launch successfully orbited the DirecTV 1R in its first operational launch on 10/9/99.

The initial launch of the Ariane 5 vehicle occurred on 6/4/96 with a scientific payload and was a failure. Two subsequent test launches (on 10/30/97 with Maqsat H and Teamsat 1 and 10/21/98 with Maqsat 3 and ARD) were successful, allowing Arianespace to begin commercial (as opposed to test) launches with the 12/10/99 launch of the European Space Agency’s XMM x-ray telescope.

International Launch Services (ILS) intends to carry a commercial payload (Echostar 6) on the initial launch of its Atlas 3 launch vehicle.

LAUNCH REPORT

Launch Events Fourth Quarter 1999

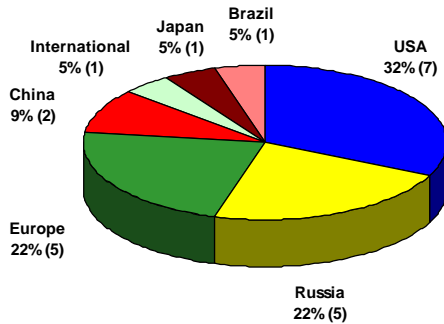


Figure 4: Launch Events
Fourth Quarter 1999

In the fourth quarter of 1999, United States launch vehicles conducted seven of 22 launches worldwide. Three of these launches were commercial: One Atlas 2 with a GEO communications satellite, one Pegasus with seven small LEO communications satellites, and one Taurus with a remote sensing, a scientific, and a funerary payload. The four non-commercial launches were made by an Atlas 2 with a remote sensing payload, a Delta 2 with a navigation satellite, a Shuttle conducting a repair mission to the Hubble Space Telescope, and a Titan 2 carrying a meteorological satellite.

Russia carried out five launches in the fourth quarter, two of which were commercial. The commercial launches were both Soyuz vehicles with four LEO communications satellites each. The non-commercial launches were a Cyclone and a Molniya carrying intelligence payloads, and a Proton with a GEO communications satellite. The Proton launch was a failure.

Europe launched four Ariane 4 and one Ariane 5 vehicles. The three commercial Ariane 4 launches carried a commercial communications satellite each to GTO while the non-commercial Ariane 4 carried an intelligence and a development satellite. The single Ariane 5 flight lofted a scientific payload.

China made two launches of Long March vehicles, both non-commercial. They carried an uncrewed test version of a piloted spacecraft, and a pair of remote sensing satellites.

The Sea Launch international partnership made a single commercial launch with a GEO communications satellite onboard.

The only Japanese launch in this period was the failed launch of an H 2 vehicle with a navigation payload.

Brazil made a second failed attempt to launch its VLS small launch vehicle with a remote sensing payload.

LAUNCH REPORT

Scheduled Launch Events
First Quarter 2000

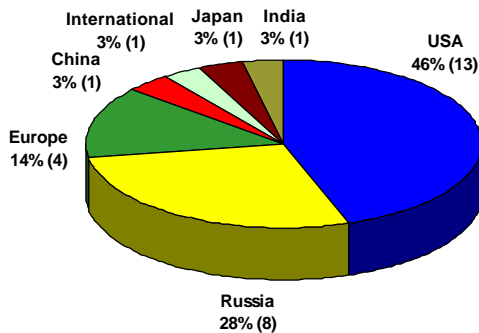


Figure 5: Scheduled Launch Events
First Quarter 2000

Twenty-nine orbital launch events are planned in the first quarter of 2000. Launch providers from the United States plan to conduct 13 of these launches. Three Atlas 2 vehicles are scheduled to carry two communications and one intelligence satellite. Two Delta 2 vehicles will carry one set of four LEO communications satellites on one and a scientific payload on the other. Of two Minotaur vehicles one will carry eight small scientific, communications, and development satellites while the other will loft a military development satellite. Two Pegasus launches will loft development and science payloads (one each). The Shuttle is manifested to launch twice with once with experimental radar (the Shuttle Radar Topography Mission) and once on an assembly flight to the ISS. One Taurus launch with a development payload and a Titan 4 will carry an intelligence payload.

Russia plans to launch eight vehicles in this period one of which will be commercial (a Proton carrying a GEO communications satellite). Another (non-commercial) Proton launch is planned with three Glonass navigation satellites, one Rockot with two dummy satellites. Three Soyuz launches will loft a Progress uncrewed resupply mission to Mir, a set of dummy satellites in preparation for the launch of Europe's Cluster science satellites, and an intelligence satellite for the Russian military. Two Zenit 2 launches with a meteorological and an intelligence payload finish the Russian schedule.

Europe's Ariane 4 is scheduled to orbit three GEO communications satellites on three Ariane 4 vehicles with one Ariane 5 vehicle carrying a pair of GEO communications satellites.

China intends to launch a noncommercial Long March vehicle a communications satellite.

Japan plans the launch of an M-5 with a scientific satellite.

An international launch provider (see page 16 for a definition of this category), Sea Launch, intends to make the commercial launch of a GEO communications satellite on its Zenit 3SL vehicle.

India is planning the initial launch of the GSLV launch vehicle carrying a development satellite.

LAUNCH REPORT

Scheduled Launch Events Second Quarter 2000

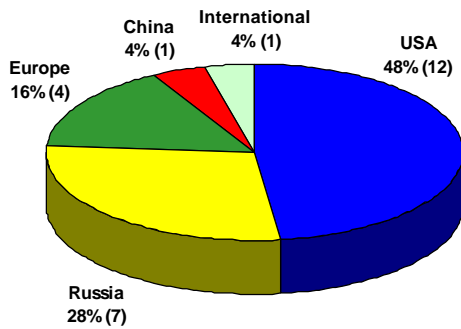


Figure 6: Scheduled Launch Events
Second Quarter 2000

There are 25 orbital launch events scheduled to occur in the second quarter of 2000. United States launch providers plan to conduct 12 of these launches. Two Atlas 2 vehicles are to loft a GEO communications satellite and meteorological satellite (one each) while an Atlas 3A is scheduled to launch another GEO communications satellite. Of three Delta 2 vehicles one will carry a NASA development and two small science satellites while the other two carry one GPS navigation satellite each. Three Delta 3 vehicles will take a communications satellite each to MEO. One Pegasus launch vehicle will orbit a remote sensing satellite. The Shuttle will launch once with an ISS assembly payload and one Titan 4 launch will orbit a military communications payload.

Russia intends to launch seven vehicles in the second quarter of 2000. One will be a Cosmos vehicle with a communications and science payload. Four will be Proton vehicles, three with GEO communications satellites and a fourth with an ISS module. A Soyuz launch will loft the two science satellites and the START 1 vehicle will carry a science and a remote sensing satellite.

Europe plans two Ariane 4 launches each carrying a GEO communications satellite as well as two Ariane 5 vehicles also carrying a GEO communications satellite each.

China is to launch a single meteorological satellite on a Long March booster.

The Sea Launch international joint venture expects to orbit a GEO communications satellite

LAUNCH REPORT

Scheduled Commercial Launch Events
January – June 2000

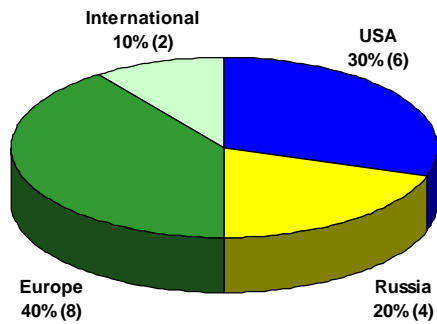


Figure 7: Scheduled Commercial Launch Events
January 2000 – June 2000

Excluding small launch vehicles, there are 20 commercial launch events planned for the next two quarters. Of these launches United States launch providers are to conduct six. These will consist of one Atlas 2 launch of a GEO communications satellite, an Atlas 3 launch of a GEO communications satellite, one Delta 2 carrying four LEO communications satellites, and three communications satellites bound for MEO on three Delta 3 vehicles (one each).

Russia plans to make four of these commercial launches. These launches will be made up of four Proton vehicles with GEO communications satellites onboard (one each).

Europe intends to conduct eight of the 20 launches in the first half of 2000. These launches will include five Ariane 4 vehicles each carrying one GEO communications satellite and three Ariane 5 vehicles carrying four GEO communications satellites between them (one will be dual manifested).

The international launch provider Sea Launch is planing two commercial launches with one GEO communications satellite each in this period.

LAUNCH REPORT

Commercial Launch Market
October 1999 – June 2000

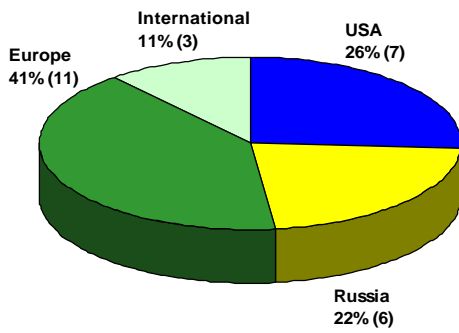


Figure 8: Commercially-Launched Vehicle Market
October 1999 – June 2000
(small vehicles excluded)

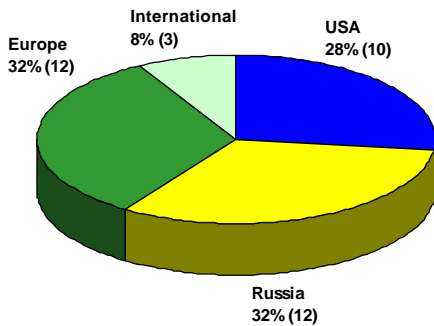


Figure 9: Commercially-Launched Payload Market
October 1999 – June 2000
(small vehicles excluded)

For the period of this report (October 1999 through June 2000), 27 commercial launch events (excluding small launch vehicles) are anticipated. The United States has a 26 percent share (seven launches). There are 37 commercially launched payloads projected for launch in this same period. Launch providers from the United States expect to have launched 10 of these payloads, for a 28 percent share of the period's payloads.

The European portion of the total is 11 launches, for a 41 percent share of launches, and 12 payloads, or 32 percent of total payloads.

Russia expects to have conducted six commercial launches for a 22 percent share and deployed 12 commercially launched payloads for 32 percent of the total.

International launches are expected to comprise 11 percent of the total with three launches, and eight percent of payloads with three commercially launched payloads.

LAUNCH REPORT

Commercial Launch Market
January 1995 – June 2000

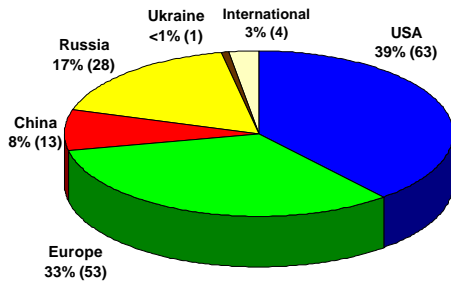


Figure 10: Commercially-Launched Vehicle Market
January 1995 – June 2000
(small vehicles excluded)

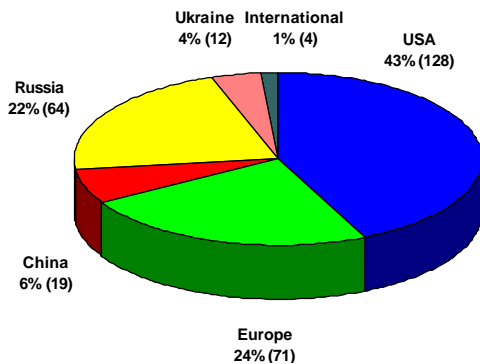


Figure 11: Commercially-Launched Payload Market
January 1995 - June 2000
(small vehicles excluded)

Excluding small launch vehicles, commercial launch events are projected to total 162 for the period between January 1995 and June 2000. The United States has a 39 percent share of these total or 63 launches. In terms of commercially launched payloads (excluding small launch vehicles), the United States will have launched 128 of 298 payloads, for a 43 percent share of payloads.

Europe's portion of the total is 53 launches, for a 33 percent share of launches, and 71 payloads, or 24 percent of total payloads.

China plans to have made 13 launches for eight percent of total launches over the period. These launches are to have carried 19 payloads for six percent of the total.

Russia expects to conduct 28 commercial launches for a 17 percent share and deploy 64 commercially launched payloads or 22 percent of total payloads.

Ukraine has made one commercial launch from Russia's launch site at Baikonur representing just under one percent of launches, to deploy 12 payloads or four percent of total payloads.

International launches by the Sea Launch joint venture comprised three percent of total launches with four launches, and one percent of payloads with four commercially launched payloads.

LAUNCH REPORT

Commercial Launch Revenues
January 1995 – June 2000

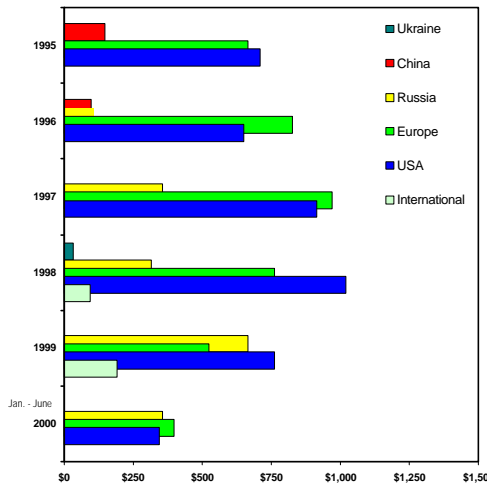


Figure 12: Commercial Launch Revenues by Region (in US \$ Millions)*
January 1995 – June 2000
(revenue from small vehicles excluded)

* Graph reflects approximate revenues based on actual price quotes and historical price averages. Launch vehicle pricing data is currently being verified for historical accuracy, which may affect figures shown in future Quarterly Launch Reports. Figures here are shown in current dollars. Excludes small vehicles.

Revenues for the period between January 1995 and June 2000 are expected to be approximately \$11.2 billion. United States launch providers are expected to achieve a 39 percent share of these revenues (approximately \$4.4 billion) and European launch providers are projected to capture 37 percent (approximately \$4.1 billion). Russian launch providers hold an estimated 16 percent share (approximately \$1.8 billion) and launch service revenues from China should consist of about \$500 million representing a five percent share. Ukraine’s single launch accounts for less than one percent of revenues at roughly \$33 million. International launch providers hold three percent of total revenues with \$285 million.

Historically, the FAA has broken down overall commercial launch revenues by country. The method used has been to attribute the launch revenue of a commercial launch to the country in which the primary vehicle manufacturer is based. This method has worked well because most launch vehicles were manufactured, sold, and launched by the same entity and those entities were entirely of one country. However, with the rise of multinational launch service corporations, a clean division of revenue for particular launches among countries is becoming more difficult.

For example, Russian launch activity is conducted in partnership with American and European launch service providers. Also, Sea Launch represents a partnership among organizations in four countries, and uses its own launch facility outside national borders.

For the purposes of this document, the FAA has continued its historical practice of attributing commercial revenue to the country in which the primary vehicle manufacturer is based, with the exception of Sea Launch which has been given the unique designation of “International.”

Special Report

SR-1

LICENSING OF COMMERCIAL LAUNCH SITES

INTRODUCTION

The Commercial Space Launch Act of 1984 as recodified at 49 U.S.C. Subtitle IX-- Commercial Space Transportation, ch. 701, Commercial Space Launch Activities, 49 U.S.C. §§ 70101- authorizes the Secretary of Transportation to license launches or the operation of launch sites carried out by U.S. citizens or within the United States. The Department of Transportation (DOT) has delegated this authority to the Federal Aviation Administration (FAA).

In order to enable the development and use of private launch sites, the FAA proposed amending its commercial space transportation licensing regulations to include licensing and safety requirements for the operation of launch sites. A Notice of Proposed Rulemaking (NPRM) has been developed and published in the Federal Register on June 25, 1999. The proposed regulations are designed to protect the public from the risks associated with activities at a launch site.

PROPOSED REGULATIONS

The proposed regulations will supercede the existing interim guidelines once they are issued as final rules, codifying the requirements for a launch site license.

ENVIRONMENTAL REVIEW

The FAA is required by law to assess the environmental impacts of constructing and operating a proposed launch site and to determine whether these activities will significantly affect the quality of the environment. Licensing the operation of a launch site is a major federal action for purposes of the National Environmental Policy Act (NEPA) at 42 U.S.C. 4321 et seq. An applicant will typically engage a contractor with specialized experience in the NEPA process to conduct the study underpinning the FAA's environmental analysis.

Site	Location	First Orbital Launch	FAA License Original Effective Date
California Spaceport	Vandenberg Air Force Base	2000	September 19, 1996
Spaceport Florida	Cape Canaveral Air Station	1998	May 22, 1997
Kodiak Launch Complex	Kodiak Island, Alaska	2000 (projected)	September 24, 1998
Virginia Spaceport	Wallops Island, Virginia	2001 (projected)	December 19, 1998

Table 1: US FAA Licensed Commercial Launch Sites

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The FAA must prepare an environmental review that includes consideration of reasonable alternatives to the site. According to the Council on Environmental Quality (CEQ) regulations as interpreted by the courts, an applicant may not use the purchase of a site or construction at the site to limit the array of reasonable alternatives for that site's use. As a result, an applicant must complete the environmental process before construction on, or improvement of, the site. The FAA will not issue a license if an environmental review in accordance with all applicable regulations and guidelines is not concluded.

POLICY REVIEW

The FAA has proposed to conduct a policy review of an application for a license to operate a launch site. This is done to determine whether operation of the proposed launch site would jeopardize national security, foreign policy interests, or international obligations of the United States. The FAA conducts this policy review in coordination with other federal agencies that have responsibility for national and international interests. The Department of Defense is consulted to determine whether a license application presents any issues affecting national security. The Department of State reviews an application for issues affecting foreign policy or international obligations. Other agencies, such as NASA, are consulted as appropriate.

Under the proposed regulations an applicant would be required to supply information relevant to the FAA's policy approval, including, for example, identification of foreign ownership of the applicant. During a policy review, the FAA would consult with an applicant regarding any questions or

issues before making a final determination. An applicant would have the opportunity to address any questions before completion of the review.

EXPLOSIVE SITE PLAN

The FAA has proposed to adopt the explosive safety practice in use at federal launch ranges today. These criteria (referred to as quantity-distance (Q-D) requirements), provide for separation of an explosive source from people and property that may otherwise be exposed to explosive events. They provide minimum separation distances between explosive hazard facilities, surrounding facilities and locations where the public may be present on the basis of the type and quantity of explosive material to be located within the area and have long been used to mitigate explosive hazards to an acceptable level.

The proposed regulations would require an applicant to submit an explosive site plan that shows the location of all explosive hazard facilities and distances between them, as well as the distances to public areas. It would also establish application procedures for an applicant to demonstrate compliance with the siting criteria. Minimum prescribed separation distances are necessary to protect the public from explosive hazards on a launch site so that the effect of an explosion does not reach the public.

An applicant would be required to provide the FAA with an explosive site plan that demonstrates compliance with these proposed Q-D requirements. The FAA must approve this plan, so applicants are cautioned not to begin construction of facilities requiring an explosives site plan

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until obtaining FAA approval. Note also that the proposed Q-D requirements do not address any toxic hazards. Toxic hazards may be mitigated through procedural means, and the FAA will address toxic hazards in a separate rulemaking. If a toxic hazard is a controlling factor in siting, it should be considered along with the explosive hazards when the site plan is prepared.

The requirement to submit an explosive site plan to the FAA would not apply to an applicant applying for a license to operate a launch site at a federal launch range. Federal launch ranges have separate rules which are either identical or similar to the rules proposed, or permit mitigation measures which otherwise ensure safety.

LAUNCH SITE RELOCATION REVIEW

In order to gain launch site location approval, an applicant needs to prove to the FAA that a launch could be conducted from the site in question without jeopardizing public health and safety. This would not normally apply to an applicant who proposes to operate from an existing launch point at a federal launch range. The one exception to this rule is that if the applicant plans to use a launch point different than used previously by the federal launch range, or to use an existing launch point for a different type or larger launch vehicle than used in the past review will be necessary. The fact that launches have taken place safely from any particular launch point at a federal launch range may provide the same demonstration that would be accomplished by the FAA's proposed location review: namely, a showing that launch may occur safely from the site.

The proposed regulations would require an applicant to use specified methods to demonstrate the suitability of the launch site location for launching at least one type of launch vehicle, including orbital, guided sub-orbital, or unguided sub-orbital expendable launch vehicles, and reusable launch vehicles. Each proposed launch point on the launch site must be evaluated for each type of launch vehicle that the applicant wishes to have launched from that launch point.

An applicant will be provided with a choice of methods to develop a flight corridor for a representative launch of an orbital or guided sub-orbital expendable launch vehicle, or to develop a set of impact dispersion areas for a representative launch of an unguided sub-orbital expendable launch vehicle. If a flight corridor or set of impact dispersion areas exists that does not encompass populated areas, no additional analysis would be required. Otherwise a risk analysis must be conducted, which the FAA would review to ensure the applicant's process was correct, and would approve the launch site location if its risk criteria were met.

Under the proposed regulations, limited launch site location review would be needed if the applicant located a launch site at a federal launch range. The fundamental purpose of the FAA's proposed launch site location review, to assure that a launch may potentially take place safely from the proposed launch site, has been amply demonstrated at each of the ranges. As noted, exceptions may occur if a prospective launch site operator plans to use a launch site at a federal launch range for launches markedly different from past federal launch range launches, or if an applicant proposes a new launch point.

Special Report

SR-4

PRIVATE USE LAUNCH SITES

The proposed regulations specify who must obtain a license to operate a launch site, application requirements and licensee responsibilities. Because a launch licensee's license covers ground operations as well as the flight of a launch vehicle, a launch operator is not required to obtain a license to operate a launch site. A launch operator may select a launch site for its own launches and a launch operator only requires a license to launch unless the launch site is to be offered to others. The grant of a license to operate a launch site will not guarantee that a launch license will be granted for any particular launch proposed for the site. All launches are subject to separate FAA review and licensing.

GROUND SAFETY RESPONSIBILITIES

The FAA is proposing to impose specific ground safety responsibilities on a licensed launch site operator, and will require that an applicant demonstrate how those requirements will be met. A launch site operator license will involve responsibilities including: preventing unauthorized public access to the site; properly preparing the public and customers to visit the site; informing customers of limitations on use of the site; scheduling and coordinating hazardous activities conducted by customers. They would also include arranging for the clearing of air and sea routes and notifying adjacent property owners and local jurisdictions of the pending flight of a launch vehicle. Other launch site operator responsibilities would be: record keeping, tracking license transfer, accident investigation and compliance monitoring, and explosives.

Other federal government agencies have jurisdiction over a number of ground safety issues that FAA does not intend to duplicate their efforts. The FAA will, however, revisit ground safety issues in its development of rules for launches from non-federal launch sites.

Flight Safety

The proposed regulations promote ground safety by requiring the submission of an explosive site plan. Flight safety responsibilities are minimal as the FAA assigns almost all responsibility for flight safety (as well as significant ground safety responsibility) to a licensed launch operator.

Although extensive ground and flight safety requirements accompany a launch license, a launch site operator can also offer flight safety services or equipment to its customers. The adequacy of such service and equipment will typically be assessed in the FAA's review of a launch license application.

GLOSSARY

For proper interpretation of the data in this report, the following definitions should be used:

Apogee: Point most distant from Earth in a satellite's orbit.

Commercial Launch Events: A commercial launch event is an internationally competed launch event, as defined below, and/or any launch licensed by the Department of Transportation/Office of Commercial Space Transportation (DoT/OCST), under the Commercial Space Launch Act (CSLA), or certain Post, Telegraph and Telecommunications launches.

Commercial Launch Revenue: Commercial launch revenues are generated from launch services provided by private and government licensed entities. It is understood that commercial launch providers of different countries operate within different economic, policy, and procedural contexts which affect the respective prices for a launch contract. However, this report does not attempt to adjust its data for these factors.

Frequency Bands: Different frequency ranges of the electromagnetic spectrum in which signals are transmitted.

Geosynchronous Orbit (GEO): An orbit approximately 22,300 miles above the equator in which a payload completes one orbit around the Earth every 24 hours.

Geosynchronous Transfer Orbit (GTO): A temporary orbit used to later place payloads in a geosynchronous orbit.

Internationally-Competed Launch Events: An internationally competed launch event results from a launch opportunity which is available in principle to competitors in the international launch services market.

Launch Outcome: Refers to whether the launch vehicle properly deploys its payload.

Low Earth Orbit (LEO): An orbit range on the order of 100-1000 nautical miles.

Market Share: That segment of a commercial market which is captured by a specified entity.

Mission Outcome: Evaluates if the launch mission is achieved (i.e., Does the primary payload achieve a functional orbit).

Payload: The spacecraft that is deployed by a launch vehicle.

Payload Use: This describes the payload's use according to the type of function it performs. Uses include:

Classified - Typically military missions.

Communication - Receives and transmits signals either directly or through a broadcast. Signals may take many different forms: voice, text, or electronic.

Crewed - Payload with a live human crew.

Development - Used for the development of hardware and technology.

Funerary - Carries the remains of deceased humans in space.

Intelligence - Provides images and data specifically to the intelligence communities of different countries.

Meteorological - Payloads primarily used to observe and forecast weather.

Microgravity - Payloads with a platform used to take advantage of the microgravity environment, including scientific and commercial applications.

Navigation - Track location and transmit data regarding location.

Other - Does not fit other categories.

Remote Sensing - Uses sensors to provide imagery (i.e., photographs).

Scientific - Used for the development of knowledge not hardware.

Supply - Carries supplies (for human and hardware maintenance) to space stations in orbit.

Test - Non-functional payloads used to simulate payload characteristics.

Unknown - There is no available information on the function of this payload.

Perigee: Point least distant to Earth in a satellite's orbit.

Power: Amount of projected power generated by spacecraft when it reaches the end of its design life.

Scheduled Launch Events: Future launch events associated with specific dates as reported in open sources.

Secondary Payload: A payload of lesser dimensions and weight than the primary payload(s). These payloads are launched along with primary payload(s) due to excess launch capacity.

Transponder: The piece of hardware on a satellite that receives and transmits data.

Vehicle Mass Class: Vehicle Mass Classes are categorized according to the maximum advertised lift capacity to LEO, in pounds:

Small: Up to 5,000

Medium: 5,001 to 12,000

Intermediate: 12,001 to 25,000

Heavy: Greater than 25,000

ACRONYMS

ACeS	Asia Cellular Satellite	NASA	National Aeronautics and Space Administration
ACRIMSAT	Active Cavity Radiometer Irradiance Monitor Satellite	NEPA	National Environmental Policy Act
ASUsat	Arizona State University satellite	nMI	Nautical Mile
CBERS	China-Brazil Earth Remote Sensing	NOAA	National Oceanic and Atmospheric Administration
CCAS	Cape Canaveral Air Station	NPO	Scientific Production Organization
CEQ	Council on Environmental Quality	NPRM	Notice of Proposed Rulemaking
CNES	Centre National d'Etudes Spacial	NRO	National Reconnaissance Office
DARPA	Defense Advanced Research Projects Agency	OPAL	Orbiting Picosat Automatic Launcher
DASA	Deutsche Aerospace	OSC	Orbital Sciences Corporation
DBS	Direct Broadcast Satellite	PAS	PanAmSat
DGA	Delegation Generale a l'Armement	PM	Prikladnoi Mekhaniki
DMSF	Defense Meteorological Satellite Program	PTT	Post Telegraph and Telecommunications
DoD	Department of Defense	Q-D	Quantity-Distance
DoT	Department of Transportation	RKA	Russian Space Agency
DSCS	Defense Satellite Communication System	RKK Energia	Rocket and Space Company Energia
DSP	Defense Support Program	SAC	Satellite de Aplicaciones Cientificas
ELI	Elliptical	SACI	Satellite Cientifico
ESA	European Space Agency	SESAT	Siberian-European Satellite
FAA	Federal Aviation Administration	SLLP	Sea Launch Limited Partnership
GBS	Global Broadcast System	STS	Space Transportation System
GE	General Electric	TDRS	Tracking and Data Relay Satellite
GEO	Geosynchronous Orbit	TSX	Tri-Service Experiment
GOES	Geostationary Operational Environmental Satellite	U.S.C.	United States Code
GPS	Global Positioning System	VAFB	Vandenberg Air Force Base
GSLV	Geostationary Launch Vehicle	VLS	Veiculo Lancador de Satelites
GTO	Geosynchronous Transfer Orbit	WFF	Wallops Flight Facility
HETE	High Energy Transient Experiment	XL	Extra Long
IKI	Space Research Institute (Russia)	XMM	X-ray Multi-Mirror
ILS	International Launch Services		
IMAGE	Imager for Magnetopaus-to-Aurora Global Exploration		
INPE	National Institute for Space Research		
IRS	Indian Resource Satellite		
ISAS	Institute of Space and Astronautical Science		
ISRO	Indian Space Research Organization		
ISS	International Space Station		
IUS	Inertial Upper Stage		
Jawsat	Joint Academy Weber State Satellite		
KARI	Korea Aerospace Research Institute		
KLC	Kodiak Launch Complex		
KMR	Kwajalein Missile Range		
KSC	Kennedy Space Center		
LEO	Low Earth Orbit		
LMC	Lockheed Martin Corporation		
LMI	Lockheed Martin Intersputnik		
MDC	McDonnell Douglas Corporation		
MEO	Medium Earth Orbit		
MoD	Ministry of Defense		
MTI	Multispectral Thermal Imaging		
MTSat	Multifunctional Transport Satellite		

Characteristics of Cited Vehicles

Vehicle	(Success + Partial) / Attempts	LEO 28 Degrees	GTO	GEO	Price per Launch (Approx.)	Launch Sites
Heavy						
Ariane 5	3/4 75%	39600 lb 18000 kg	15000 lb 6800 kg	N/A	\$150-180 M	Kourou
Long March 2F	1/1 100%	N/A	N/A	N/A	N/A	Jiuquan
Proton (SL-12)	209/234 89.3%	46297 lb 21000 kg	10851 lb 4910 kg	4155 lb 1880 kg	\$75-95 M	Baikonur
Proton (SL-13)	25/28 89.3%	46000 lb 20900 kg	N/A	N/A	\$65-85 M	Baikonur
Shuttle Atlantis	19/19 100%	53924 lb 24400 kg	13007 lb 5900 kg	5203 lb 2360 kg	\$300 M	KSC
Shuttle Discovery	29/29 100%	53924 lb 24400 kg	13007 lb 5900 kg	5203 lb 2360 kg	\$300 M	KSC
Shuttle Endeavour	13/13 100%	53924 lb 24400 kg	13007 lb 5900 kg	5203 lb 2360 kg	\$300 M	KSC
Titan 4B/Centaur	2/3 66.7%	47800 lb 21629 kg	N/A	12700 lb 5747 kg	\$350-450 M	CCAS
Titan 4B/IUS	1/2 50%	47800 lb 21629 kg	N/A	6321 lb 2860 kg	\$350-450 M	CCAS
Zenit 2	26/32 81.3%	30300 lb 13740 kg	N/A	N/A	\$35-50 M	Baikonur
Zenit 3SL	2/2 100%	35000 lb 15876 kg	11050 lb 5000 kg	N/A	\$75-95 M	Sea Launch Platform
Intermediate						
Ariane 42L	7/7 100%	16300 lb 7400 kg	7450 lb 3380 kg	N/A	\$80-100 M	Kourou
Ariane 44L	28/29 96.6%	21100 lb 9600 kg	9965 lb 4520 kg	N/A	\$100-125 M	Kourou
Ariane 44LP	21/22 95.5%	18300 lb 8300 kg	8950 lb 4060 kg	N/A	\$90-110 M	Kourou
Atlas 2A	15/15 100%	16050 lb 7280 kg	6700 lb 3039 kg	3307 lb 1500 kg	\$75-85 M	CCAS, VAFB
Atlas 2AS	19/19 100%	19050 lb 8640 kg	8150 lb 3688 kg	4604 lb 2090 kg	\$90-105 M	CCAS, VAFB
Atlas 3A	First Launch	19097 lb 8641 kg	8940 lb 4055 kg	N/A	\$90-105 M	CCAS
Delta 3	0/2 0%	18408 lb 8350 kg	8360 lb 3800 kg	N/A	\$75-90 M	CCAS
GSLV	First Launch	11000 lb 5000 kg	5500 lb 2500 kg	N/A	\$25-45 M	Sriharikota Range
H-2	5/7 71.4%	23000 lb 10500 kg	8800 lb 4000 kg	4800 lb 2200 kg	\$170-190 M	Tanegashima
Long March 3A	3/3 100%	15800 lb 7200 kg	5500 lb 2500 kg	2700 lb 1230 kg	\$45-55 M	Xichang
Soyuz	964/971 99.3%	15400 lb 7000 kg	N/A	N/A	\$35-40 M	Baikonur, Plesetsk
Medium						
Ariane 40	7/7 100%	10800 lb 4900 kg	4520 lb 2050 kg	N/A	\$65-85 M	Kourou
Cyclone 2	126/128 98.4%	8818 lb 4000 kg	N/A	N/A	\$20-25 M	Baikonur
Delta 2 7320	1/1 100%	4370 lb 1982 kg	2100 lb 952 kg	N/A	\$45-55 M	CCAS, VAFB
Delta 2 7326	1/1 100%	4370 lb 1982 kg	2100 lb 952 kg	N/A	\$45-55 M	CCAS, VAFB
Delta 2 7420	6/6 100%	N/A	N/A	N/A	\$45-55 M	CCAS, VAFB
Delta 2 7925	41/42 97.6%	11330 lb 5139 kg	3965 lb 1799 kg	2000 lb 907 kg	\$50-60 M	CCAS, VAFB
Long March 3	11/12 91.7%	11023 lb 5000 kg	3100 lb 1400 kg	1600 lb 730 kg	\$35-40 M	Xichang
Long March 4B	1/1 100%	N/A	3315 lb 1500 kg	N/A	\$25-35M	Taiyuan
M-5	2/2 100%	5500 lb 2500 kg	2680 lb 1215 kg	1080 lb 490 kg	\$35-45 M	Kagoshima
Molniya	297/312 95.2%	3970 lb 1805 kg	N/A	N/A	\$30-40 M	Plesetsk
Titan 2	21/21 100%	7900 lb 3583 kg	N/A	N/A	\$30-40 M	CCAS, VAFB

Characteristics of Cited Vehicles

Vehicle	(Success + Partial) / Attempts	LEO 28 Degrees	GTO	GEO	Price per Launch (Approx.)	Launch Sites
Small						
Cosmos	412/416 99%	3100 lb 1400 kg	N/A	N/A	\$12-14 M	Baikonur, Plesetsk, Kapustin Yar
Minotaur	First Launch	1472 lb 666 kg	N/A	N/A	\$10-15 M	VAFB
Pegasus XL	12/15 80%	1015 lb 460 kg	322 lb 146 kg	181 lb 82 kg	\$12-15 M	Wallops Flight Facility, VAFB
Pegasus XL/HAPS	4/4 100%	1015 lb 460 kg	N/A	N/A	\$12-15 M	Wallops Flight Facility
Rocket	1/1 100%	4100 lb 1850 kg	N/A	N/A	\$12-15 M	Baikonur
START 1	3/3 100%	790 lb 359 kg	N/A	N/A	\$5-10 M	Svobodny, Plesetsk
Taurus 1	4/4 100%	3100 lb 1400 kg	990 lb 450 kg	N/A	\$18-20 M	VAFB
VLS	0/2 0%	440 lb 200 kg	N/A	N/A	\$6-7 M	Alcantara

Characterisitics of Cited Payloads

Payload	Use	Price	Orbit	Apogee	Perigee	Launch Mass	Freq. Bands & Trans.	Power
Classified								
NRO 2000-1	Classified	Unknown	TBA	N/A	N/A	N/A		N/A
Communications								
AsiaStar 1	Communications	Unknown	GEO 105 E	19305 nMi	19305 nMi	6155 lb 2785 kg	3L, 3X	N/A
Astra 2B	Communications	Unknown	GEO 28.2 E	19400 nMi	19400 nMi	7293 lb 3300 kg	30 Ku	7 W
Brazilsat B4	Communications	Unknown	GEO	19400 nMi	19400 nMi	N/A	28 C	N/A
CD Radio 1	Communications	Unknown	ELI	19305 nMi	19305 nMi	7896 lb 3589 kg	1 S	N/A
DirecTV 1R	Communications	Unknown	GEO 259 E	19400 nMi	19400 nMi	7600 lb 3439 kg		N/A
DSCS III 3-11	Communications	Unknown	GEO	19326 nMi	19323 nMi	2475 lb 1125 kg	6 SHF	1240 W
Europe Star 1	Communications	Unknown	GEO 45 E	19400 nMi	19400 nMi	8022 lb 3630 kg		N/A
Eutelsat W4	Communications	Unknown	GEO 36 E	N/A	N/A	N/A		N/A
Express A 1	Communications	Unknown	GEO 80 E	19400 nMi	19400 nMi	N/A		N/A
Fenghuo 1	Communications	Unknown	LEO	N/A	N/A	N/A		N/A
Galaxy 10R	Communications	Unknown	GEO 237 E	19400 nMi	19400 nMi	8546 lb 3876 kg		N/A
Galaxy 11	Communications	Unknown	GEO 261 E	19400 nMi	19400 nMi	9921 lb 4500 kg	24 Ku, 24 C	N/A
Galaxy 3C	Communications	Unknown	GEO 265 E	19400 nMi	19400 nMi	N/A	24 Ku, 24 C	N/A
Garuda 1	Communications	\$ 377.5 M	GEO 123 E	19400 nMi	19400 nMi	5986 lb 2721 kg	6 C, 88 L	N/A
GBS 10	Communications	Unknown	GEO	19400 nMi	19400 nMi	6305 lb 2866 kg	UHF	2500 W
GE 1A	Communications	Unknown	GEO 97 E	19400 nMi	19400 nMi	N/A	24 Ku, 24 C	N/A
GE 4	Communications	Unknown	GEO 259 E	19400 nMi	19400 nMi	N/A	24 Ku, 24 C	N/A
GE 7	Communications	Unknown	GEO 223 E	19400 nMi	19400 nMi	5687 lb 2585 kg	24 Ku, 24 C	N/A
Globalstar	Communications	\$ 22 M	LEO	764 nMi	764 nMi	988 lb 449 kg	L, C, S	875 W
Hispasat 1C	Communications	Unknown	GEO 330 E	19400 nMi	19400 nMi	6144 lb 2780 kg		N/A
ICO	Communications	Unknown	MEO	5592 nMi	5592 nMi	6050 lb 2750 kg	1C, 1 S	N/A
Insat 3B	Communications	Unknown	GEO	19400 nMi	19400 nMi	5525 lb 2500 kg	6 Ku, 18 C	N/A
MASAT	Communications	Unknown	LEO	N/A	N/A	N/A		N/A
Milstar II-F2	Communications	Unknown	GEO	19400 nMi	19400 nMi	N/A		N/A
Mita	Communications	Unknown	LEO	540 nMi	540 nMi	111 lb 50 kg		N/A
Orbcomm	Communications	Unknown	LEO	446 nMi	446 nMi	87 lb 40 kg		N/A
PAS 1R	Communications	Unknown	GEO 315 E	19400 nMi	19400 nMi	8840 lb 4000 kg	36 Ku, 36 C	N/A
Sesat	Communications	Unknown	GEO 36 E	19400 nMi	19400 nMi	5720 lb 2600 kg	18 Ku	N/A
Superbird 4	Communications	Unknown	GEO 162 E	19400 nMi	19400 nMi	N/A	23 Ku, 6 Ka	N/A
TDRS F8	Communications	Unknown	GEO 319 E	19400 nMi	19400 nMi	6485 lb 2948 kg	1 Ku, 1 S, 1 Ka	N/A
Telstar 12	Communications	Unknown	GEO 345 E	19400 nMi	19400 nMi	8398 lb 3800 kg	34 Ku	N/A

Characteristics of Cited Payloads

Payload	Use	Price	Orbit	Apogee	Perigee	Launch Mass	Freq. Bands & Trans.	Power
Crewed								
STS 101	Crewed	Unknown	LEO	N/A	N/A	4500709 lb 2041508 kg		N/A
STS 103	Crewed	Unknown	LEO	N/A	N/A	4500709 lb 2041508 kg		N/A
STS 92	Crewed	Unknown	LEO	N/A	N/A	4500709 lb 2041508 kg		N/A
STS 99	Crewed	Unknown	LEO	N/A	N/A	4500709 lb 2041508 kg		N/A
Development								
Clementine (France)	Development	Unknown	LEO	N/A	N/A	106 lb 48 kg		N/A
Earth Observing 1	Development	Unknown	LEO	N/A	N/A	939 lb 425 kg		N/A
FalconSat	Development	Unknown	LEO	N/A	N/A	N/A		N/A
GSat 1	Development	Unknown	GEO	19400 nMi	19400 nMi	N/A		N/A
MightySat 2-1	Development	\$ 4 M	LEO	N/A	N/A	275 lb 124 kg		N/A
MTI	Development	Unknown	LEO	N/A	N/A	N/A		N/A
OPAL	Development	\$ 0.1 M	LEO	N/A	N/A	30 lb 14 kg		N/A
TSX 5	Development	\$ 85 M	LEO	N/A	N/A	286 lb 130 kg		N/A
Intelligence								
DSP 20	Intelligence	Unknown	GEO	19400 nMi	19400 nMi	5200 lb 2353 kg		N/A
Helios (European) 1B	Intelligence	Unknown	LEO	459 nMi	N/A	5622 lb 2544 kg		N/A
Kosmos 2367	Intelligence	Unknown	LEO	N/A	N/A	N/A		N/A
Kosmos 2368	Intelligence	Unknown	LEO	N/A	N/A	N/A		N/A
Kosmos TBA	Intelligence	Unknown	LEO	N/A	N/A	N/A		N/A
Tselina 2	Intelligence	Unknown	LEO	N/A	N/A	N/A		N/A
Meteorological								
DMSP 5D-3-F15	Meteorological	\$ 60 M	LEO	462 nMi	438 nMi	2539 lb 1154 kg		N/A
FY 2B (2000)	Meteorological	Unknown	GEO	19400 nMi	19400 nMi	N/A		N/A
GOES L	Meteorological	Unknown	GEO 285 E	19330 nMi	19323 nMi	3991 lb 1814 kg		N/A
Meteor 3M-1	Meteorological	Unknown	LEO	500 nMi	500 nMi	1980 lb 900 kg		N/A
Navigation								
Glonass Replacement	Navigation	Unknown	MEO	10338 nMi	10322 nMi	N/A	1 L	N/A
MTSat 1	Navigation	\$ 109 M	GEO 140 E	19400 nMi	19400 nMi	6380 lb 2900 kg		N/A
Navstar GPS 2R	Navigation	\$ 40 M	MEO	10899 nMi	10899 nMi	4470 lb 2032 kg	L	N/A
Other								
Celestis 3	Other	Unknown	LEO	N/A	N/A	2 lb 1 kg		N/A

Characteristics of Cited Payloads

Payload	Use	Price	Orbit	Apogee	Perigee	Launch Mass	Freq. Bands & Trans.	Power
Remote Sensing								
Badr 2	Remote Sensing	Unknown	LEO	540 nMi	N/A	N/A		N/A
CBERS/Ziyuan 1	Remote Sensing	\$ 75 M	LEO	420 nMi	420 nMi	3190 lb 1450 kg		985 W
EROS A1	Remote Sensing	Unknown	LEO	N/A	N/A	N/A		N/A
Kompsat	Remote Sensing	\$ 92 M	LEO	N/A	N/A	1122 lb 510 kg	S, X	N/A
OrbView 3	Remote Sensing	Unknown	LEO	248 nMi	248 nMi	407 lb 185 kg		N/A
SACI 1	Remote Sensing	Unknown	LEO	420 nMi	420 nMi	132 lb 60 kg		N/A
SACI 2	Remote Sensing	Unknown	LEO	N/A	N/A	N/A		N/A
Terra	Remote Sensing	\$ 1200 M	LEO	381 nMi	381 nMi	11470 lb 5190 kg		N/A
Scientific								
ACRIMSAT	Scientific	\$ 8.3 M	LEO	N/A	N/A	221 lb 100 kg		N/A
Artemis Picosat	Scientific	Unknown	LEO	N/A	N/A	1 lb 0 kg		N/A
Astro E	Scientific	\$ 100 M	LEO	270 nMi	270 nMi	3315 lb 1500 kg		N/A
ASUSat 1	Scientific	Unknown	LEO	N/A	N/A	10 lb 5 kg		N/A
Champ	Scientific	\$ 18 M	LEO	270 nMi	254 nMi	884 lb 400 kg		N/A
Citizen Explorer	Scientific	Unknown	LEO	N/A	N/A	81 lb 37 kg		N/A
Cluster II 1	Scientific	\$ 225 M	Extra GEO	69120 nMi	13770 nMi	2530 lb 1148 kg		N/A
Cluster II 2	Scientific	Unknown	Extra GEO	69120 nMi	13770 nMi	2530 lb 1148 kg		N/A
DARPA Picosat	Scientific	Unknown	LEO	N/A	N/A	2 lb 1 kg		N/A
HETE-2	Scientific	Unknown	LEO	324 nMi	324 nMi	N/A		N/A
IMAGE	Scientific	Unknown	LEO	N/A	N/A	N/A		N/A
Jawsat	Scientific	Unknown	LEO	N/A	N/A	150 lb 68 kg		N/A
Munin	Scientific	Unknown	LEO	N/A	N/A	12 lb 6 kg		N/A
Odin	Scientific	\$ 4.3 M	LEO	324 nMi	324 nMi	550 lb 250 kg		N/A
SAC C	Scientific	Unknown	LEO	N/A	N/A	935 lb 425 kg		N/A
STENSAT	Scientific	Unknown	LEO	N/A	N/A	1 lb 0 kg		N/A
XMM	Scientific	Unknown	ELI	61560 nMi	3780 nMi	8800 lb 4000 kg		N/A
Space Station								
Zvezda	Space Station	Unknown	LEO	N/A	N/A	N/A		N/A
Supply								
Progress M-43	Supply	Unknown	LEO	N/A	N/A	16023 lb 7250 kg		N/A

Characterisitics of Cited Payloads

Payload	Use	Price	Orbit	Apogee	Perigee	Launch Mass	Freq. Bands & Trans.	Power
Test								
DemoClusters	Test	Unknown	LEO	N/A	N/A	N/A		N/A
Rocket Demo 1	Test	Unknown	LEO	N/A	N/A	N/A		N/A
Rocket Demo 2	Test	Unknown	LEO	N/A	N/A	N/A		N/A
Shenzhou	Test	Unknown	LEO	162 nMi	162 nMi	N/A		N/A

**Launch Events
October 1999 - December 1999**

Launch Date	Vehicle	Payload	Payload Operator	Payload Manufacturer	Int'l Comp	Launch Type	Launch Outcome	Mission Outcome
Brazil								
VLS								
December 11, 1999	VLS	SACI 2	INPE	INPE	No	Non-Commercial	Failure	Failure
China								
Long March 4B								
October 14, 1999	Long March 4B	CBERS/Ziyuan 1 SACI 1	China/Brazil INPE	China Academy of Space Tech. INPE	No	Non-Commercial	Success	Success
Long March 2F								
November 20, 1999	Long March 2F	Shenzhou	China National Space Admin.	China Rsrch. Inst. of Rocket Tech.	No	Non-Commercial	Success	Success
Europe (ESA)								
Ariane 4								
October 19, 1999	Ariane 44LP	Telstar 12	Orion Network Services	Space Systems/Loral	Yes	Commercial	Success	Success
November 13, 1999	Ariane 44LP	GE 4	GE Americom	Lockheed Martin Corp.	Yes	Commercial	Success	Success
December 3, 1999	Ariane 40	Helios (European) 1B Clementine (France)	CNES/DGA	Matra Marconi Alcatel Space	No	Non-Commercial	Success	Success
December 21, 1999	Ariane 44L	Galaxy 11	Pan American Satellite Corp.	Hughes	Yes	Commercial	Success	Success
Ariane 5								
December 10, 1999	Ariane 5	XMM	European Space Agency (ESA)	Deutsche Aerospace (DASA)	No	Non-Commercial	Success	Success
International								
Zenit 3SL								
October 9, 1999	Zenit 3SL	DirecTV 1R	DirecTV, Inc.	Hughes	Yes	Commercial	Success	Success

Launch Events October 1999 - December 1999

Launch Date	Vehicle	Payload	Payload Operator	Payload Manufacturer	Int'l Comp	Launch Type	Launch Outcome	Mission Outcome
Japan								
H-2								
November 15, 1999	H-2	MTSat 1	Ministry of Transport	Space Systems/Loral	No	Non-Commercial	Failure	Failure
Russia								
Cyclone								
December 26, 1999	Cyclone 2	Kosmos 2367	Russian MoD	Unknown	No	Non-Commercial	Success	Success
Molniya								
December 27, 1999	Molniya	Kosmos 2368	Russian MoD	Unknown	No	Non-Commercial	Success	Success
Proton								
October 27, 1999	Proton (SL-12)	Express A 1	Russian Space Comm. Corp.	NPO PM	No	Non-Commercial	Failure	Failure
Soyuz								
October 18, 1999	Soyuz	Globalstars 31,56,57,59	Globalstar, Inc.	Space Systems/Loral	Yes	Commercial	Success	Success
November 22, 1999	Soyuz	Globalstars 29,34,39,61	Globalstar, Inc.	Space Systems/Loral	Yes	Commercial	Success	Success
USA								
Atlas								
November 22, 1999	Atlas 2A	GBS 10	DoD	Hughes	No	Commercial	Success	Success
December 18, 1999	Atlas 2AS	Terra	NASA	Lockheed Martin Corp.	No	Non-Commercial	Success	Success
Delta 2								
October 7, 1999	Delta 2 7925	Navstar GPS 2R- 3	DoD	Lockheed Martin Corp.	No	Non-Commercial	Success	Success
Pegasus								
December 4, 1999	Pegasus XL/HAPS	Orbcomms 30-36	Orbital Communications Corp.	Orbital Sciences Corp.	No	Commercial	Success	Success

**Launch Events
October 1999 - December 1999**

Launch Date	Vehicle	Payload	Payload Operator	Payload Manufacturer	Int'l Comp	Launch Type	Launch Outcome	Mission Outcome
USA (cont.)								
Shuttle								
December 19, 1999	Shuttle Discovery	STS 103	NASA	Rockwell International	No	Non-Commercial	Success	Success
Taurus								
December 21, 1999	Taurus 1	Kompsat ACRIMSAT Celestis 3	Korea Aerospace Rsrch. Inst. NASA Celestis, Inc.	TRW/KARI Orbital Sciences Corp. Celestis, Inc.	Yes	Commercial	Success	Success
Titan 2								
December 12, 1999	Titan 2	DMSP 5D-3-F15	DoD	Lockheed Martin Corp.	No	Non-Commercial	Success	Success

Launch Events January 2000 - March 2000

Launch Date	Vehicle	Payload	Payload Operator	Payload Manufacturer	Int'l Comp	Launch Type	Site
China							
Long March							
1st Qtr. 2000	Long March 3A	Fenghuo 1	China	Unknown	No	Non-Commercial	Xichang
Europe (ESA)							
Ariane 4							
January 24, 2000	Ariane 42L	Galaxy 10R	Pan American Satellite Corp.	Hughes	Yes	Commercial	Kourou
February 2000	Ariane 44LP	Superbird 4	Space Communications Corp.	Hughes	Yes	Commercial	Kourou
March 2000	Ariane 44L	PAS 1R	Pan American Satellite Corp.	Hughes	Yes	Commercial	Kourou
Ariane 5							
March 2000	Ariane 5	AsiaStar 1 Insat 3B	WorldSpace, Inc. ISRO	Alcatel Espace ISRO	Yes	Commercial	Kourou
India							
GSLV							
1st Qtr. 2000	GSLV	GSat 1	ISRO	ISRO	No	Non-Commercial	Sriharikota Range (SHAR)
International							
Zenit 3SL							
February 28, 2000	Zenit 3SL	ICO 1	ICO Global Communications	Hughes	Yes	Commercial	Sea Launch Platform
Japan							
M-5							
February 8, 2000	M-5	Astro E	ISAS	ISAS	No	Non-Commercial	Kagoshima

Launch Events January 2000 - March 2000

Launch Date	Vehicle	Payload	Payload Operator	Payload Manufacturer	Int'l Comp	Launch Type	Site
Russia							
Proton							
March 2000	Proton (SL-12)	Garuda 1	ACeS Consortium	Lockheed Martin Corp.	Yes	Commercial	Baikonur
March 2000	Proton (SL-12)	Glonass 1999-01,02,03	Russian MoD	NPO PM	No	Non-Commercial	Baikonur
Rockot							
March 2000	Rockot	Rockot Demo 1 Rockot Demo 2	Eurockot Eurockot	Unknown Unknown	No	Non-Commercial	Plesetsk
Soyuz							
January 24, 2000	Soyuz	Progress M-43	RKK Energia	RKK Energia	No	Non-Commercial	Baikonur
January 27, 2000	Soyuz	Kosmos TBA	Russian MoD	Unknown	No	Non-Commercial	Baikonur
March 2000	Soyuz	DemoClusters	Russia	Unknown	No	Non-Commercial	Baikonur
Zenit 2							
March 2000	Zenit 2	Meteor 3M-1 Badr 2	Russia SUPARCO	VNII Elektromekhaniki SUPARCO	No	Non-Commercial	Baikonur
1st Qtr. 2000	Zenit 2	Tselina 2	Russian MoD	Unknown	No	Non-Commercial	Baikonur
USA							
Atlas 2							
January 20, 2000	Atlas 2A	DSCS III 3-11	DoD	Lockheed Martin Corp.	No	Non-Commercial	CCAS
February 3, 2000	Atlas 2AS	Hispatat 1C	Hispatat	Aerospatiale	Yes	Commercial	CCAS
March 20, 2000	Atlas 2AS	NRO 2000-1	NRO	TBA	No	Non-Commercial	CCAS

Launch Events January 2000 - March 2000

Launch Date	Vehicle	Payload	Payload Operator	Payload Manufacturer	Int'l Comp	Launch Type	Site
USA (cont.)							
Delta 2							
February 6, 2000	Delta 2 7420	Globalstars 62,63,64,66	Globalstar, Inc.	Space Systems/Loral	Yes	Commercial	CCAS
February 15, 2000	Delta 2 7326	IMAGE	NASA	NASA	No	Non-Commercial	VAFB
Minotaur							
1st Qtr. 2000	Minotaur	Jawsat Artemis Picosat ASUSat 1 DARPA Picosat FalconSat MASAT OPAL STENSAT	Air Force Acad. & Weber State Univ. Santa Clara University Arizona State University DARPA USAF Unknown Space Systems Development Lab Radio Amateurs	Air Force Academy Santa Clara University Arizona State University DARPA USAF Unknown Space Systems Development Lab Radio Amateurs	No	Non-Commercial	California Spaceport
1st Qtr. 2000	Minotaur	MightySat 2-1	DoD	Spectrum Astro, Inc.	No	Non-Commercial	VAFB
Pegasus							
1st Qtr. 2000	Pegasus XL	HETE-2	MIT	MIT	No	Commercial	Kwajalein
1st Qtr. 2000	Pegasus XL	TSX 5	DoD	Orbital Sciences Corp.	Yes	Non-Commercial	VAFB
Shuttle							
January 31, 2000	Shuttle Endeavour	STS 99	NASA	Rockwell International	No	Non-Commercial	KSC
March 16, 2000	Shuttle Atlantis	STS 101	NASA	Rockwell International	Yes	Non-Commercial	KSC
Taurus							
1st Qtr. 2000	Taurus 1	MTI	DoD	Ball Aerospace	No	Non-Commercial	VAFB
Titan 4							
February 2000	Titan 4B/IUS	DSP 20	DoD	TRW	No	Non-Commercial	CCAS

Launch Events April 2000 - June 2000

Launch Date	Vehicle	Payload	Payload Operator	Payload Manufacturer	Int'l Comp	Launch Type	Site
China							
Long March							
2nd Qtr. 2000	Long March 3	FY 2B (2000)	China Meteorological Administration	Shanghai Inst. of Satellite Engineering	No	Non-Commercial	Xichang
Europe (ESA)							
Ariane 4							
June 2000	Ariane 4	Europe*Star 1	Europe Star	Space Systems/Loral	Yes	Commercial	Kourou
2nd Qtr. 2000	Ariane 4	Astra 2B	Societe Europeenne des Satellites	Matra Marconi	Yes	Commercial	Kourou
Ariane 5							
2nd Qtr. 2000	Ariane 5	GE 7	GE Americom	Lockheed Martin	Yes	Commercial	Kourou
2nd Qtr. 2000	Ariane 5	Brazilsat B4	Embratel	Hughes	Yes	Commercial	Kourou
International							
Zenit 3SL							
2nd Qtr. 2000	Sea Launch	Galaxy 3C	Pan American Satellite Corp.	Hughes	Yes	Commercial	Sea Launch Platform
Russia							
Cosmos							
April 28, 2000	Cosmos	Champ Mita	DARA Italian Space Agency (ASI)	Jena-Optronik GmbH Carlo Gavazzi Space	Yes	Commercial	Plesetsk
Proton							
2nd Qtr. 2000	Proton (SL-12)	GE 1A	GE Americom/LM Global Telecom	Lockheed Martin Corp.	Yes	Commercial	Baikonur
2nd Qtr. 2000	Proton (SL-12)	CD Radio 1	Sirius Satellite Radio Inc.	Space Systems/Loral	Yes	Commercial	Baikonur
2nd Qtr. 2000	Proton (SL-12)	Sesat	Eutelsat	NPO PM	Yes	Commercial	Baikonur
2nd Qtr. 2000	Proton (SL-13)	Zvezda	Russia	RKK Energia	No	Non-Commercial	Baikonur
Soyuz							
June 15, 2000	Soyuz	Cluster II 1 Cluster II 2	European Space Agency (ESA) European Space Agency (ESA)	Dornier Dornier	No	Non-Commercial	Baikonur

Launch Events April 2000 - June 2000

Launch Date	Vehicle	Payload	Payload Operator	Payload Manufacturer	Int'l Comp	Launch Type	Site
Russia (cont.)							
START							
May 2000	START 1	Odin EROS A1	Swedish National Space Board West Indian Space	Swedish Space Corp. Israel Aircraft Industries (IAI)	Yes	Commercial	Svobodny
USA							
Atlas 2							
May 3, 2000	Atlas 2A	GOES L	NOAA	Space Systems/Loral	No	Non-Commercial	CCAS
June 29, 2000	Atlas 2A	TDRS F8	NASA	Hughes	No	Non-Commercial	CCAS
Atlas 3							
April 14, 2000	Atlas 3A	Eutelsat W4	Eutelsat	Alcatel Espace	Yes	Commercial	CCAS
Delta 2							
April 13, 2000	Delta 2 7320	Earth Observing 1 Citizen Explorer Munin SAC C	NASA Colorado Space Grant Consortium Swedish Institute of Space Physics Argentina	Swales & Associates Inc., MIT Colorado Space Grant Consortium Swedish Institute of Space Physics Bariloche Company Invap.	No	Non-Commercial	VAFB
April 21, 2000	Delta 2 7925	Navstar GPS 2R- 4	DoD	Lockheed Martin Corp.	No	Non-Commercial	CCAS
June 15, 2000	Delta 2 7925	Navstar GPS 2R- 5	DoD	Lockheed Martin Corp.	No	Non-Commercial	CCAS
Delta 3							
April 5, 2000	Delta 3	ICO 2	ICO Global Communications	Hughes	Yes	Commercial	CCAS
April 25, 2000	Delta 3	ICO 3	ICO Global Communications	Hughes	Yes	Commercial	CCAS
June 18, 2000	Delta 3	ICO 4	ICO Global Communications	Hughes	No	Commercial	CCAS
Pegasus							
2nd Qtr. 2000	Pegasus XL	OrbView 3	Orbital Imaging Corp. (Orbimage)	Orbital Sciences Corp.	No	Commercial	VAFB
Shuttle							
June 14, 2000	Shuttle Discovery	STS 92	NASA	Rockwell International	No	Non-Commercial	KSC

Launch Events
April 2000 - June 2000

Launch Date	Vehicle	Payload	Payload Operator	Payload Manufacturer	Int'l Comp	Launch Type	Site
USA (cont.)							
Titan 4							
2nd Qtr. 2000	Titan 4B/Centaur	Milstar II-F2	DoD/USAF	Lockheed Martin Corp.	No	Non-Commercial	CCAS