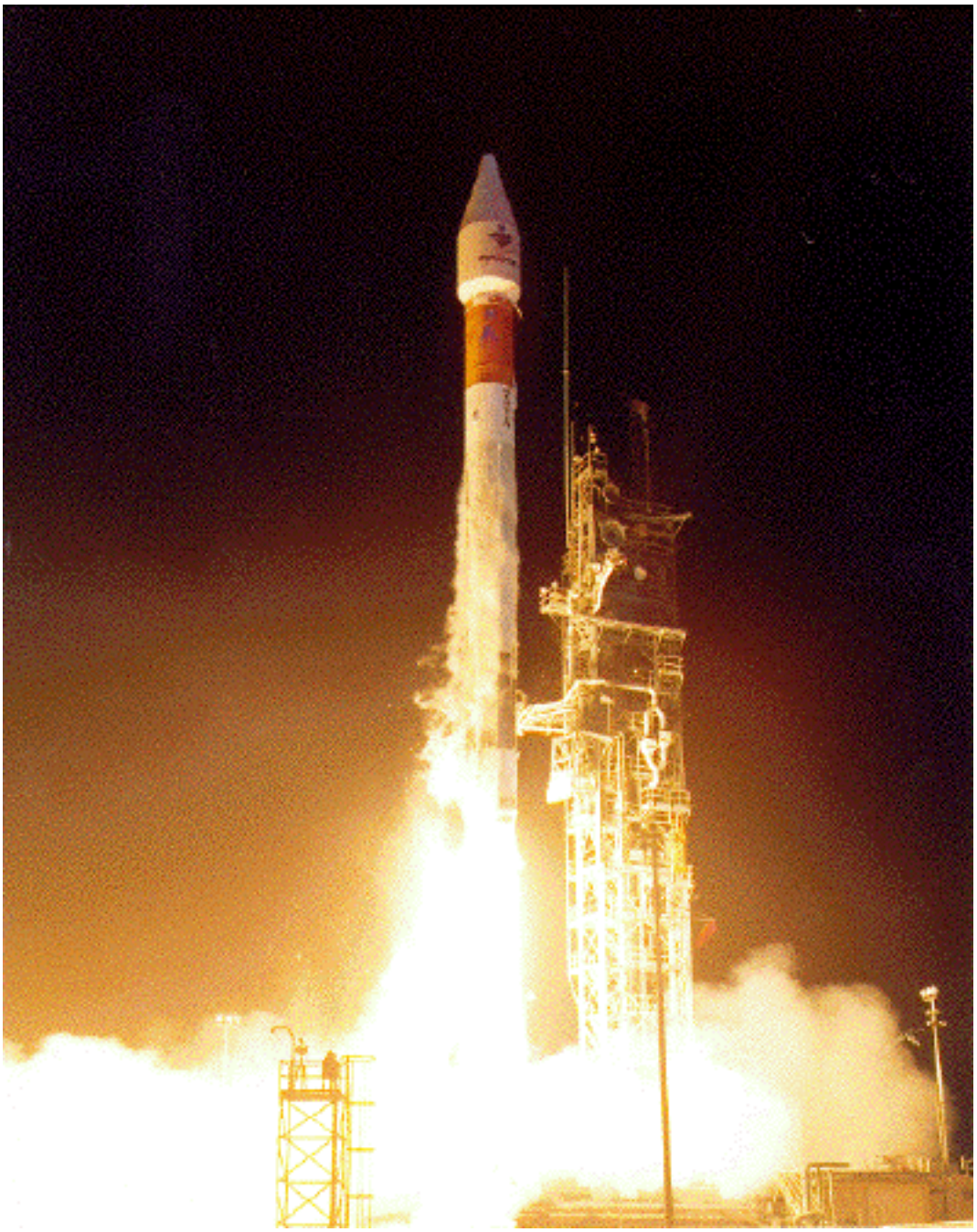
Commercial Space Transportation

QUARTERLY LAUNCH REPORT

Featuring the launch results from the previous quarter and forecasts for the next two quarters.



1st Quarter 1997

United States Department of Transportation • Federal Aviation Administration

Associate Administrator for Commercial Space Transportation

1ST QUARTER 1997 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.***

Photo credit: International Launch Services (1996). Image is of the Atlas 2A launch on December 17, 1996, from Cape Canaveral Air Station. It successfully orbited the Lockheed Martin Astro Space-built Inmarsat-3 F3 satellite.

CONTENTS

This document was prepared by Futron Corporation and was released on February 20, 1997.

SUMMARY

Fourth Quarter 1996 Launch Events

- In the fourth quarter of 1996, the United States made seven launches. Four of these (one shuttle, one Titan 4, and two Deltas) were non-commercial. The remaining three commercial launches were two Atlas and one Pegasus. The only US launch failure during this period was a Pegasus launch in which two government scientific satellites were lost when they failed to detach from the launch vehicle.
- The Russian Republic/CIS conducted six launches, all non-commercial. These consisted of one Cosmos, one Cyclone, one Molniya, a Proton, and two Soyuz launches. Of these, the only failure was that of the heavy-lift Proton resulting in the loss of the Mars 96 planetary probe.
- Europe launched one Ariane 4 successfully putting two communication satellites into GEO.
- China also successfully launched one Long March 2D vehicle.

First and Second Quarter 1997 Scheduled Launch Events

- The United States will conduct 20 launches, 10 commercial and 10 non-commercial. This includes four Atlas launches (three commercial), and three Delta launches (two commercial), as well as four Pegasus launches (of which two are commercial). The United States is also scheduled to conduct launches of two LMLVs and one Taurus, all commercial, as well as four shuttles, one Titan 2, and one Titan 4, all non-commercial.
- 17 launches are expected from the Russian Republic/CIS. Of these, five will be commercial, four Protons and one Start. The remaining non-commercial launches will be one Cyclone, one Proton, four Soyuz, and six undetermined.
- Europe will launch six Ariane 4s all of which will be commercial.
- China plans five launches of various Long March variants. Two of these will be commercial launches.
- Japan expects to make one non-commercial launch of its M5 launch vehicle.
- Brazil will debut its VLS small launch vehicle with the non-commercial launch of a communication payload, SCD 3.

SUMMARY

Commercial Products and Services

First and Second Quarter 1997

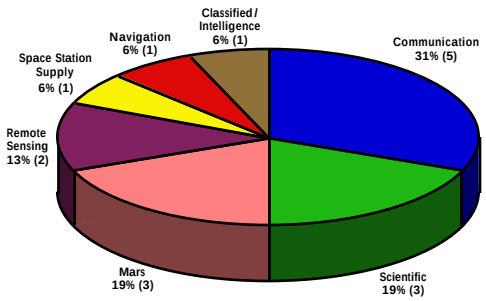
Iridium

Even though it has been delayed by the January 17 Delta/GPS launch failure, the Iridium system should begin to be deployed in the next six months. This initial launch of the Iridium LEO constellation will carry three satellites, as will later Delta launches. These initial satellites will be launched without communications software and will be used to test tracking, telemetry, and steering mechanisms. Communications software will be uploaded later in the year. A Russian Proton launch is already scheduled within the next two quarters and, if Delta recovery is not fast enough, this Proton launch could inaugurate the Iridium constellation.

Meanwhile, Iridium also recently announced that it had changed its business strategy. Iridium now intends to serve as a link between common cellular systems allowing cellular customers to avoid multiple service arrangements with different cellular companies. The change in plan will allow Iridium to serve three million customers instead of the originally projected one million and will allow Iridium subscribers to use the Iridium system without buying a $3,000 Iridium satellite phone.

Payload Use Analysis

Fourth Quarter 1996



In the fourth quarter of 1996, 16 payloads were launched into orbit. By percentage, these payloads were 31% communication, 19% scientific, 19% Mars, 13% remote sensing, 6% space station/supply, 6% navigation, and 6% classified/intelligence.

Of the six commercially launched payloads, 67% were communication related and 33% scientific.

LAUNCH SCHEDULE

Scheduled Launch Events

Vehicle	Payload	Site
JANUARY 1997		
Ariane 44LP	GE 2 Nahuel 1A	Kourou
Delta 2 7925	Navstar GPS 2R- 1	CCAS
Molniya SL-6	Kosmos 97-01	TBA
MSLS*		VAFB
Shuttle Atlantis	STS 81	KSC
FEBRUARY 1997		
Atlas 2AS	JCSAT 4	CCAS
Ariane 44LP	Intelsat 8 F1	Kourou
Cyclone SL-14	Gonets D1-D Gonets D1-E Gonets D1-F Gonets D1-G Gonets D1-H Gonets D1-I	Plesetsk
Long March 3B	Mabuhay 1	Xichang
M 5	Muses B	Kagoshima
Titan 4B/IUS	DSP 19	CCAS
Shuttle Discovery	STS 82	KSC
Soyuz SL-4	Soyuz TM-25	Tyuratam
TBA	Kosmos 97-02	TBA
MARCH 1997		
Ariane 44 LP	BSAT 1A Thaicom 3	Kourou
Atlas	Tempo 2	CCAS
Long March 4	FY 2-B	Xichang
Pegasus XL	Minisat 01	Spain
Soyuz SL-4	Progress M-34	Tyuratam
START 1	EarlyBird 1	Svobodny
TBA	Kosmos 97-03	TBA

* Denotes a suborbital launch

LAUNCH SCHEDULE

Scheduled Launch Events

Continued

Vehicle	Payload	Site
APRIL 1997		
Ariane 44P	PAS 6	Kourou
Atlas 2	GOES K	CCAS
Long March 3B	APStar 2R	Xichang
LMLV 1	Lewis	VAFB
Pegasus XL	SWAS	VAFB
Proton SL-12	Tempo 1	Tyuratam
Shuttle Columbia	STS 83	KSC
TBA	Kosmos 97-04	TBA
Titan 2	DMSP	VAFB
MAY 1997		
Ariane 44L	Inmarsat 3 F4	Kourou
	Insat 2D	
Delta 2 7925	Iridium 1	VAFB
	Iridium 2	
	Iridium 3	
LMLV 1	Clark	VAFB
Long March	Sinosat 1	TBA
Pegasus XL	SNOE	TBA
Proton SL-12	PAS 5	Tyuratam
Shuttle Atlantis	STS 84	KSC
Soyuz SL-4	Progress M-35	Tyuratam
Taurus 1	Geosat Follow-On 1	VAFB
TBA	Kosmos 97-05	TBA
JUNE 1997		
Ariane 44LP	Intelsat 8 F2	Kourou
Atlas 2	UFO 8	CCAS
Delta 2 7925	Thor 2A	CCAS
Pegasus XL	Seastar	VAFB
Proton SL-12	Astra 1G	Tyuratam
Proton SL-12	Iridium 14	Tyuratam
	Iridium 15	
	Iridium 16	
	Iridium 17	
	Iridium 18	
	Iridium 19	
	Iridium 20	
Soyuz SL-4	Soyuz TM-26	Tyuratam
TBA	Kosmos 97-06	TBA

LAUNCH SCHEDULE

Additional Launch Events to be Announced †

For the First and Second Quarter 1997

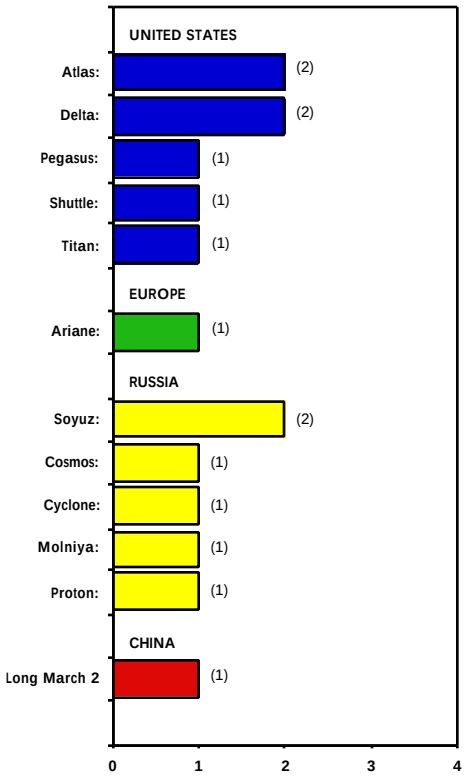
Vehicle	Payload	Site
FIRST QUARTER OF 1997		
Long March 3A	DFH 3-2	Xichang
VLS	SCD 3	Alcantara
SECOND QUARTER OF 1997		
Proton SL-12	Ekspress 4	Tyuratam
TBA	Faisat 2	TBA

† This section summarizes launches and payloads that are expected to occur during the next two quarters. Exact launch dates were not available prior to publication of this report

LAUNCH REPORT

Launch Events

Fourth Quarter
1996



Number of Launches
October - December1996

The United States launched nearly half of the last quarter's launches, seven of 15 total. Three of these launches were commercial (two communication satellites on Atlas launchers and two scientific satellites on a Pegasus). This Pegasus launch was the sole US failure in the fourth quarter. Non-commercial launches included two Delta-launched Mars missions (the Mars Global Surveyor and the Mars Pathfinder) as well as a military Titan 4 launch. One shuttle launch carried the third Wake Shield Facility payload along with the ORFEUS SPAS astronomy platform.

Six launches were made by the Russian Republic/CIS, all of them non-commercial. These consisted of two military satellites (Kosmos 2335 and 2336) as well as a government communication satellite and a Progress Mir re-supply flight. Two scientific payloads were also launched but only one was successful with the Proton-launched Mars 96 spacecraft returning to Earth when its upper stage failed to re-ignite.

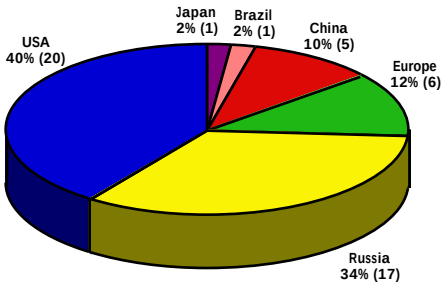
Europe made a single Ariane 44L launch, putting the Arabsat 2B and the Measat 2 communications satellites in orbit.

China launched a single recoverable Earth Resources satellite, the FSW 2-3 which was successfully launched on a Long March 2D and then recovered as planned.

LAUNCH REPORT

Scheduled Launch Events

First and Second Quarter 1997



Scheduled Launch Events, by Region
January - June 1997

(includes small launch vehicles, excludes sub-orbital launch events)

In the first and second quarter of 1997 there are a total of 50 launches planned worldwide. Twenty of these launches will be conducted by the United States. Of the remaining 30 launches, 17 will be Russian, six European, five Chinese, and one each from Brazil and Japan.

Of the 20 United States launches, five will loft communication payloads, four will be remote sensing, two meteorological, two scientific, and one intelligence. There will also be four crewed shuttle flights, one experimental satellite, and one navigational satellite launch. One of these communication launches will carry multiple payloads, launching three Iridium satellites on a Delta launch vehicle.

The Russian Republic/CIS will launch 17 times, of which seven launches will carry communication payloads (two of these launches will carry multiple payloads: a Cyclone launch of six Gonets satellites and a Proton launch of seven Iridium satellites into LEO orbits). There will be two re-supply and two crewed spacecraft launched in support of the Mir space station. Russia plans to launch one remote sensing satellite during this period as well five Kosmos launches for which the purposes are currently unknown.

Europe will conduct six commercial launches carrying nine communication satellites (three of these launches will carry multiple payloads, launching two communication satellites on each flight).

China will put four communications satellites into GEO. It will also launch a meteorological satellite for a total of five launches.

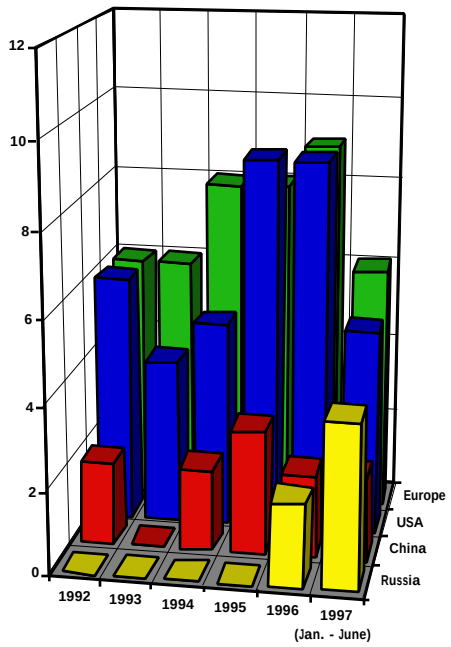
Japan is scheduled to launch one scientific satellite during the next two quarters.

Brazil will launch SCD 3, a data relay satellite, on the first launch of its VLS launch vehicle.

LAUNCH REPORT

Scheduled Commercial Launch Events

First and Second Quarter 1997



Commercial Launch Events
January 1992 - June 1997
(Small Vehicles Excluded)

Twenty-three of the 50 launches (nearly half) projected for the first two quarters of 1997 are commercial launches. These launches are spread between the United States, The Russian Republic/CIS, Europe, and China.

Ten of the 20 launches conducted by the United States will be commercial launches. Three commercial Atlas launches will launch three commercial communications satellites. Two of three projected Delta launches will carry commercial communication satellites. Two NASA technology development satellites, Lewis and Clark, will be commercially launched on Lockheed Martin's LMLV-1s and a US Navy remote sensing satellite will be commercially launched on Orbital Science's Taurus. The remaining two commercial launches will be on Pegasus launch vehicles, consisting of an experimental and a remote sensing payload.

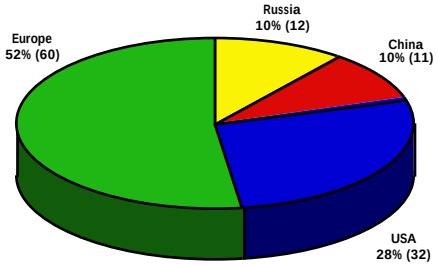
All six European launches in this period will be commercial and will put nine GEO communications satellites in orbit.

The Russian Republic/CIS will make five commercial launches. Four of these will be communication payloads on Proton launch vehicles. The remaining commercial launch will be an Earlybird-1 remote sensing satellite on a START-1 launch vehicle. This satellite was scheduled to go up on a Cosmos vehicle but these plans have now been changed.

China plans two commercial launches, both GEO communication satellites. These are the APStar 2R and the Philippine Mabuhay-1.

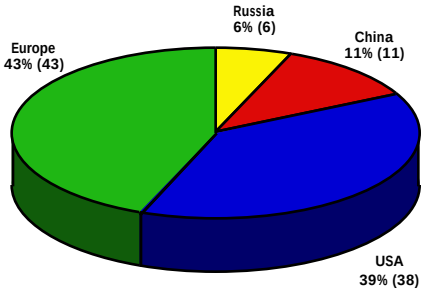
LAUNCH REPORT

Commercial Launch Trends



Internationally Competed Payloads
Market Trend
January 1992 - June 1997

(Small Vehicles Excluded)



Commercial Launch Market Trend
January 1992 - June 1997

(Small Vehicles Excluded)

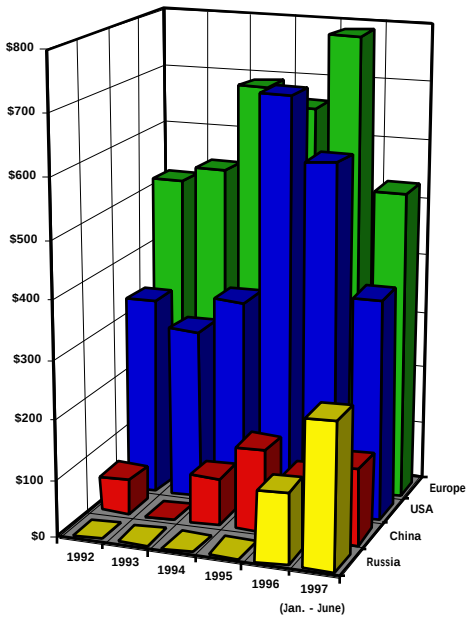
Between January 1992 and the end of June 1997, excluding small launch vehicles, the United States has captured 39 percent of all commercial launches. Over the same period it has launched 28 percent of all internationally competed payloads. This difference reflects the fact that Europe's Arianespace continues to average more payloads per launch vehicle than any other country (with 44 percent of commercial launches and 52 percent of internationally competed payloads in this period).

China and Russia lag far behind in commercial launches and payloads. China holds an 11-percent share of commercial launches and a nine-percent share of internationally competed payloads. Russia has a 6-percent share of commercial launches and an 10-percent share of payloads. The Russian payload share is largely attributable to the planned launch of seven Iridium LEO satellites on one Proton booster. All other Russian commercial launches have, to date, been launches of single payloads on each flight.

In the period covered by this report, October 1, 1996 through June 30, 1997, there were (or will be) 19 commercial launch events (not including small launch vehicles) worldwide carrying a total of 31 internationally competed payloads. The United States has a 32 percent share of these launches, Europe's Arianespace has 37 percent. In terms of internationally competed payloads, Europe has 35 percent of all payloads compared to the United States with 26 percent. Russia has 21 percent of commercial launches and 32 percent of internationally competed payloads (note that the Iridium launches projected for 1997 contribute to these rates). China has ten percent of commercial launches and seven percent of internationally competed payloads in this period.

LAUNCH REPORT

Commercial Launch Revenues



Commercial Launch Revenues by Region (in US $ Millions)*

January 1992 - June 1997

* 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 constant 1994 dollars. Includes small vehicles.

For the first half of 1997, total worldwide launch revenues from commercial launches are expected to total around $1,287 million. This is up from last quarter's six month projection of $1,177. The US percentage of this is $379 million or 29 percent of total launch revenues for this period. Europe has a slightly larger share with $530 million or 41 percent. Russia has slightly more than half of the US portion with an 19-percent share of $248 million. China has just over half of Russia's share with ten percent or $130 million.

Arianespace continues to lead the United States in launch revenue. While the US market share remains fairly stable in the 30 to 40 percent range, however, the European share is declining as Russia's share increases. It should be remembered that Russia's first commercial launches took place in 1996 and is already projected to capture an 19-percent revenue share in the first half of 1997.

The US Evolved Expendable Launch Vehicle (EELV) Programs

The Evolved Expendable Launch Vehicle (EELV) Program is a Department of Defense technology-development program managed by the Air Force. The program is intended to produce an improved launch vehicle family for government use. The EELV will replace the currently used fleet of Atlas, Delta, and Titan launch vehicles and is expected to cut launch vehicle life-cycle costs by 25 to 50 percent. This goal is to be achieved through the use of up-graded (but not "clean slate") technology, improved manufacturing, and decreased launch operations overhead.

The EELV will use existing technology or components in order to reduce cost, time, and development risks. Beyond its immediate goal of reducing the cost and complexity of government launch operations, the EELV program is also intended to increase US commercial market share when EELV manufacturers use the vehicles to compete for international launch contracts. It is hoped that the EELV will increase US market share from the current approximately 35 percent to around 50 percent of the world market.

In 1995, four companies were awarded 15 month, $30 million, concept validation contracts for initial EELV work. These companies were Alliant Techsystems, Boeing, Lockheed Martin, and McDonnell Douglas. On December 20, 1996 the second major selection in the three-part EELV program took place. Lockheed Martin and McDonnell Douglas were selected as the two firms to further develop their EELV designs under two $60 million pre-development engineering and manufacturing contracts. Alliant Techsystems' proposal for a largely solid-fueled launch vehicle and Boeing's proposal for a launch vehicle with a reusable engine pod were passed over for the Lockheed Martin and McDonnell Douglas designs. It is notable that the more unusual technological solutions proposed by Boeing and Alliant Techsystems were turned down in favor of the fine-tuning approach of Lockheed Martin and McDonnell Douglas.

Both the McDonnell Douglas and the Lockheed Martin designs are based on commercial launch vehicles now in development and or in use. The Lockheed Martin design uses technology from both the Atlas and the Titan programs while the McDonnell Douglas entry will build on the current Delta 2 and the Delta 3 (currently in development).

The McDonnell Douglas EELV

Although proven technology is being used in the design of these launch vehicles, new technologies are also being introduced. McDonnell Douglas will use the first new liquid rocket engine developed in the United States since the Space Shuttle Main Engine (SSME), which was designed in the seventies. This engine, the Rockwell-Rocketdyne RS-68, is being developed from the S-II engine used on the second stage of the Saturn 5 moon rocket with the addition of technology from the SSME (also built by Rockwell-Rocketdyne). It will be both larger and simpler than the SSME and is one of the key technologies required to make the McDonnell Douglas EELV a success. The commercial version of McDonnell Douglas' EELV has been referred to as the Delta 4.

Another interesting design feature of the McDonnell Douglas EELV is its use of horizontal integration (Boeing's EELV plans also included horizontal integration). Horizontal integration is when a launch vehicle is assembled, tested, and prepared for launch lying on its side (i.e. horizontally), which is done away from the launch pad. When integration is complete and it is time to launch, the vehicle is moved to the pad, raised, and launched in short order. McDonnell Douglas expects to reduce pad time from the current 24 days to a period of six to eight days. In many ways horizontal integration is easier than the current US standard of vertical integration; horizontal integration has always been the Russian standard.

In addition to making the launch vehicle easier to work on by keeping it closer to the ground, horizontal integration also greatly reduces time spent occupying the launch pad. With the exception of the Saturn family of launch vehicles and the space shuttle (which uses the same pad infrastructure) US vehicles are all assembled or "stacked" on the launch pad in a vertical position. This is done because of historical and technological inertia and has long been recognized as a serious bottleneck in US space operations. This is why the Saturn family's launch infrastructure was designed to allow vehicle assembly and integration to take place in the very tall vehicle assembly building (VAB) with the move to the launch pad delayed to the last minute. Moving vertical rockets is an expensive proposition, however, and the Saturn example has not been imitated. A Titan 4 (for example) may sit on a pad for months while it is prepared for launch. As the availability of launch pads is one of the limiting factors on launch rates, horizontal integration is also a desirable characteristic and contributes to the economic advantages that are a major part of the EELV program's goal.

The Lockheed Martin EELV

Lockheed Martin also plans to use a new rocket engine, the NPO Energomash RD-180, for its EELV. This engine is a derivative of the RD-170 that was used by the Russian Energia heavy lift launch vehicle (no longer in service). The RD-180 is expected to give a five percent performance advantage over current American engines. Because the RD-180 has 70-percent component commonality with the proven RD-170 it should be cheaper and less risky to develop than a totally new design. In order to meet national security requirements this engine will be built by Pratt & Whitney in the United States.

Lockheed Martin is also developing an improved version of its Agena main axial engine for use in a new EELV upper stage. This storable propellant upper stage will be part of Lockheed Martin's EELV entry but it will also be available for other launch vehicles such as Lockheed Martin's Atlas.

Following the second phase of the EELV competition, which is scheduled to end in May 1998, one of the two vehicles will be selected for the final $1.6 billion engineering and manufacturing development phase. This phase will result in a medium-size EELV launch in the year

2000 followed by a heavy-lift version of the vehicle in 2003.

With the announcement that Boeing and McDonnell Douglas intend to merge, Boeing reentered the EELV program. In fact with its acquisition of Rockwell-Rocketdyne, Boeing will control both halves of the McDonnell Douglas EELV proposal.

The intended merger of Boeing and McDonnell Douglas means that the EELV competitors are the two largest US aerospace companies. Boeing is also heavily involved in the space station program and Lockheed Martin is a major satellite builder. The table below shows the strength of the two firms' launch vehicle divisions. Other aspects of these companies are discussed below.

Boeing / McDonnell Douglas

The Boeing Company is headquartered in Seattle, Washington and is organized into three groups. These are the commercial Airplane Group, the Defense and Space Group, and the Information and Support Services Group. Boeing's 1995 sales were $19.5 billion with 1994 sales for the Defense and Space Group at $5.63 billion. Boeing's major space contracts are:

- International Space Station (prime contractor, $6.3 billion)
- Boeing Sea Launch (partnership to launch Zenit launch vehicles at sea)
- Inertial Upper Stage (upper stage used on DoD and planetary probe missions)

In August of 1996 Boeing agreed to purchase Rockwell International's space assets which will be renamed Boeing North American. This sale included the Rockwell Space Systems Division, Rocketdyne, and Rockwell's Autonetics and Missile Systems. Rockwell's space related sales were $2.044 billion in 1994. Current contracts include:

- United Space Alliance (partnership with Lockheed Martin to operate the shuttle)
- Cyclone launch vehicle (marketing partnership)
- SSME (space shuttle main engine)
- RS-68 (new engine for McDonnell Douglas EELV)
- Navstar Block 2F (GPS satellites to follow Block 2R now coming on line)
- Space Shuttle Upgrades.

As of December 1996, it had been agreed that, pending regulatory approval, McDonnell Douglas would merge with Boeing under the Boeing name. McDonnell Douglas is headquartered in St. Louis, Missouri with revenues of $14.332 billion in 1995.

Boeing/McDonnell Douglas Launch Vehicles	Lockheed Martin Launch Vehicles
· Cyclone (international partnership acquired with Rockwell) · Delta 2 · Delta 3 (in development) · EELV Family/Delta 4 (in development) · Zenit/Sea Launch (Boeing international partnership)	· Atlas 2 A, AS · Atlas 2 AR (in development) · Lockheed Martin Launch Vehicle 1 · Lockheed Martin Launch Vehicle 2 (in development) · Proton (ILS international partnership) · Titan 4

Current Major Launch Vehicle Programs

1995 space, missile, and electronics sales were $1.9 billion. Current McDonnell Douglas space related contracts include:

- Space Station (station truss, $2.1 billion)
- Delta 2 Launch Vehicle
- Delta 3 Launch Vehicle
- EELV/Delta 4 Launch Vehicle

Lockheed Martin

The Lockheed Martin Corporation is headquartered in Bethesda, Maryland and is organized into six sectors: Aeronautics, C3I Systems Integration, Electronics, Energy and Environmental, Information and Services, and Space and Strategic Missiles. Lockheed Martin's 1995 sales were $22.397 billion with 1993 (the latest year available) space sales of $6.7 billion. Lockheed Martin's major space contracts are:

- Atlas 2 Launch Vehicle
- Titan 4 Launch Vehicle
- EELV Launch Vehicle
- Lockheed Martin Launch Vehicle
- United Space Alliance (partnership with McDonnell Douglas to operate the shuttle)
- Iridium LEO Communication Constellation
- BMDO/SDI (major contractor)
- Agena Upper Stage
- Milstar (Lockheed has built more military satellites than any other western aerospace company)
- Reusable Launch Vehicle Testbed
- SBIRS

Lockheed Martin is also a major commercial satellite manufacturer.

In April of 1996, Lockheed Martin purchased Loral Corporation's space assets which are initially grouped in the Tactical Systems Sector. This portion of Loral had 1995 sales of $6.2 billion. Current contracts include Space Station systems integration for propulsion, communications, tracking, and information.

Loral is also a major commercial satellite builder and will continue to exist as a separate entity from Lockheed Martin's satellite manufacturing operations for anti-trust reasons.

Lockheed Martin markets both its own Atlas launch vehicle and the Russian made Proton launcher through its subsidiary International Launch Services (ILS). ILS was established in 1995 from Lockheed Martin's Commercial Launch Services Company and Lockheed Khrunichev Energia International (LKEI), a joint venture to market Proton. ILS is working to offer the flexibility and added reliability of two proven launch systems and two launch sites, allowing its customers' payloads to be launched on either vehicle. All commercial Proton launches are arranged through ILS, and the Russian government conducts all Russian national launches on Proton.

GLOSSARY

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

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.

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.

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.

Microgravity: An environment in which gravitational forces are essentially nonexistent. Microgravity is used for materials processing, life-sciences, and other experiments. Suborbital flights generally are conducted to expose experimental payloads to a brief microgravity environment. Microgravity is also utilized for orbiting payloads.

Orbital Insertion: The point of a launch event at which a payload has attained planned orbital velocity and finally separates from its launch vehicle.

Payload: Cargo to be jettisoned or released which may include attached kick motors.

Payload Mass Class: Payloads are categorized in the following mass classes:

Microsat	0 - 200 lbs	Small	201 - 2,000 lbs
Medium	2,001 - 5,000 lbs	Intermediate	5,001 - 10,000 lbs
Large	10,001 - 20,000 lbs	Heavy	over 20,000 lbs

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.

Suborbital: A term used to describe a launch event or payload that does not achieve a full earth orbit.

ACRONYMS

APT	Asia Pacific Telecommunications
ASCO	Arab Satellite Communications Organization
BSAT	Broadcast Satellite System Corp. Satellite
CAST	Chinese Academy of Space Technology
CCAS	Cape Canaveral Air Station
CIS	Commonwealth of Independent States
DASA	Deutsche Aerospace
DFH	Dong Fang Hong
DoD	Department of Defense
DoT	Department of Transportation
DSP	Defense Support Program
EELV	Evolved Expendable Launch Vehicle
ELI	Elliptical
ELINTS	Electronic intelligence satellites
ELV	Expendable Launch Vehicle
ESA	European Space Agency
EXT	Extra-Orbital
FAA	Federal Aviation Administration
Faisat	Final Analysis, Inc. Satellite
FORTE	Fast On-orbit Recording of Transient Events
FSW	Fanhui Shi Weixing
FY	Feng Yun
GE	General Electric
GEO	Geosynchronous Orbit
GOES	Geostationary Operational Environmental Satellite
GTO	Geosynchronous Transfer Orbit
HETE	High Energy Transient Experiment
IKI	Space Research Institute
INMARSAT	International Maritime Satellite Organization
INTA	Instituto Nacional de Tecnica Aeroespacial
INTELSAT	International Telecommunications Satellite Organization
ISAS	Institute of Space and Astronautical Science
IUS	Inertial Upper Stage
JCSAT	Japan Communications Satellite Co. Satellite
JPL	Jet Propulsion Laboratory
JSAT	Japan Satellite Systems, Inc.
KB	Design Bureau
KSC	Kennedy Space Center
LEO	Low Earth Orbit
LMLV	Lockheed Martin Launch Vehicle
Measat	Malaysian East Asia Satellite
MEO	Middle Earth Orbit
MoD	Ministry of Defense
MSAT	Mobile Satellite Communications System
NASA	National Aeronautics and Space Administration
NASDA	National Space Development Agency (Japan)
NEC	Nippon Electric Corp.
nMI	Nautical Mile
NOAA	National Oceanic and Atmospheric Administration
NPO	Scientific Production Organization
OCST	Office of Commercial Space Transportation
ORFEUS-SPAS	Orbiting and Retrievable Far and Extreme UV Spectrometer - Space Pallet Satellite
OSC	Orbital Sciences Corporation
PAS	Pan American Satellite
PTT	Post Telegraph and Telecommunications
RKK Energia	Rocket and Space Company Energia
SAC	Satellite de Aplicaciones Cientificas
SCD	Satellite de Coleta de Dados
SES	Societe Europeene des Satellites
SSTI	Small Spacecraft Technology Initiative
STS	Space Transportation System
SWAS	Submillimeter Wave Astronomy Satellite
TMI	Telesat Mobile, Inc.
UFO	Ultra-high Frequency Follow-On
VAFB	Vandenberg Air Force Base
VLS	Veiculo Lancador de Satellites
XA	Experimental Advanced
XL	Extra Long

Characteristics of Cited Vehicles

Vehicle Designation	(Success + Partials) / Attempts	LEO 28 Degrees	GTO	GEO	Suborbital	Price per Launch (Approximate)	Launch Sites
Heavy							
Long March 3B	0/1|0%	29900 lbs 13600 kg	9900 lbs 4500 kg	4950 lbs 2240 kg	N/A	$50-70 M	Xichang
Proton SL-12	188/209|89%	46297lbs 21000 kg	12100 lbs 5500 kg	4850 lbs 2200 kg	N/A	$50-70 M	Tyuratam
Shuttle Atlantis	16/16|100%	47300 lbs 21455 kg	13007 lbs 5900 kg	5202 lbs 2360 kg	N/A	$161-215 M	KSC
Shuttle Columbia	20/20|100%	47300 lbs 21455 kg	13007 lbs 5900 kg	5202 lbs 2360 kg	N/A	$161-215 M	KSC
Shuttle Discovery	22/22|100%	47300 lbs 21455 kg	13007 lbs 5900 kg	5202 lbs 2360 kg	N/A	$161-215 M	KSC
Titan 4	9/10|90%	39100 lbs 17736 kg	14000 lbs 6350 kg	N/A	N/A	$190-200 M	CCAS,VAFB
Titan 4B/IUS	N/A	47800 lbs 21727 kg	N/A	12700 lbs 5772 kg	N/A	N/A	CCAS,VAFB
Intermediate							
Ariane 44L	20/21|95%	21100 lbs 9600 kg	9965 lbs 4520 kg	N/A	N/A	$90-110 M	Kourou
Ariane 44LP	14/15|93.3%	18300 lbs 8300 kg	8950 lbs 4060 kg	N/A	N/A	$80-95 M	Kourou
Ariane 44P	6/6|100%	15200 lbs 6900 kg	7320 lbs 3320 kg	N/A	N/A	$80-95 M	Kourou
Atlas 2	9/9|100%	14500 lbs 6580 kg	6200 lbs 2810 kg	3086 lbs 1400 kg	N/A	$75-85 M	CCAS
Atlas 2A	8/8|100%	16050 lbs 7280 kg	6700 lbs 3039 kg	3306 lbs 1500 kg	N/A	$80-90 M	CCAS
Atlas 2AS	7/7|100%	19050 lbs 8640 kg	7950 lbs 3606 kg	4604 lbs 2090 kg	N/A	$95-105 M	CCAS, VAFB
Long March 3A	2/2|100%	15800 lbs7200 kg	5500 lbs 2500 kg	2700 lbs 1230 kg	N/A	$40-45 M	Xichang
Soyuz SL-4	930/937|99.3%	15400 lbs 7000 kg	N/A	N/A	N/A	$20-25 M	Plesetsk, Tyuratam
Medium							
Cyclone SL-11	122/124|98.4%	8818 lbs 4000 kg	N/A	N/A	N/A	$15-20 M	Plesetsk, Tyuratam
Cyclone SL-14	112/113|99.1%	8818 lbs 4000 kg	N/A	N/A	N/A	$15-20 M	Plesetsk
Delta 2 7925	32/32|100%	11220 lbs 5089 kg	4060 lbs 1840 kg	2000 lbs 907 kg	N/A	$45-50 M	CCAS,VAFB
Long March 2D	2/2|100%	19400 lbs 8800 kg	2755 lbs 1250 kg	N/A	N/A	N/A	Jiuquan
Long March 4	2/2|100%	8820 lbs 4000 kg	2430 lbs 1100 kg	1220 lbs 550 kg	N/A	$20-30 M	Taiyuan
Titan 2	17/17|100%	7900 lbs 3583 kg	N/A	N/A	N/A	$41-46 M	VAFB
Small							
Cosmos SL-8	405/409|99%	3100 lbs 1400 kg	N/A	N/A	N/A	$10-14 M	Kapustin Yar, Plesetsk, Tyuratam
LMLV 1	0/1|0%	1755 lbs 800kg	N/A	N/A	N/A	$16 M	CCAS,VAFB
M5	N/A	400 lbs 1800 kg	2680 lbs 1215 kg	1080 lbs 490 kg	N/A	$41-46	Kagoshima
Molniya Sl-6	288/303|95%	N/A	N/A	N/A	N/A	$12-25 M	Plesetsk, Tyuratam
Pegasus XL	3/5|60%	943 lbs 428 kg	322 lbs 146 kg	181 lbs 82 kg	N/A	$12-14 M	VAFB, Wallops Island
START 1	1/1|100%	360 lbs 790 kg	N/A	N/A	N/A	$5-10 M	Plesetsk
Taurus 1	1/1|100%	3100 lbs 1400 kg	990 lbs 450 kg	N/A	N/A	$18-20 M	VAFB
VLS	N/A	440 lbs 200 kg	N/A	N/A	N/A	N/A	Alcantara

Characteristics of Cited Vehicles

Suborbital

MSLS A	1/1|100%	300 lbs 136 kg	N/A	N/A	N/A	N/A	VAFB
Texus	27/29|93.1%	N/A	N/A	N/A	661 lbs 300 kg	N/A	Esrange

Characteristics of Cited Payloads

Payload	Use	Price	Orbit	Apogee	Perigee	Launch Mass	Mass in orbit	Freq. Bands & trans.	Stab.	Power
Classified										
USA 129	Classified	N/A	LEO	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Communications										
APStar 2R	Communications	N/A	GEO TBA	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Arabsat 2B	Communications	N/A	GEO TBA	19330 nMi	19305 nMi	7700 lbs 3493 kg	N/A	20 C, 12 Ku, 2 S	3-axis	N/A
Astra 1G	Communications	N/A	GEO	19305 nMi	19305 nMi	6151 lbs 2790 kg	3748 lbs 1700 kg	N/A	3-axis	3300 W
BSAT 1A	Communications	N/A	GEO 110 E	19330 nMi	19305 nMi	2756 lbs 1250 kg	N/A	Ku	Spin	N/A
DFH 3-2	Communications	N/A	GEO TBA	N/A	N/A	4850 lbs 2200 kg	N/A	N/A	3-axis	N/A
Ekspress 4	Communications	N/A	GEO	N/A	N/A	5500 lbs 2495 kg	N/A	10 C, 2 Ku	3-axis	N/A
Faisat 2	Communications	N/A	LEO	N/A	N/A	N/A	N/A	N/A	G-G	N/A
GE 2	Communications	N/A	GEO TBA	19375 nMi	N/A	5500 lbs 2495 kg	N/A	24 C, 24 Ku	3-axis	N/A
Gonets D1-D	Communications	N/A	MEO	756 nMi	756 nMi	529 lbs 240 kg	N/A	N/A	G-G	N/A
Gonets D1-E	Communications	N/A	MEO	756 nMi	756 nMi	529 lbs 240 kg	N/A	N/A	G-G	N/A
Gonets D1-F	Communications	N/A	MEO	756 nMi	756 nMi	529 lbs 240 kg	N/A	N/A	G-G	N/A
Gonets D1-G	Communications	N/A	MEO	756 nMi	756 nMi	529 lbs 240 kg	N/A	N/A	G-G	N/A
Gonets D1-H	Communications	N/A	MEO	756 nMi	756 nMi	529 lbs 240 kg	N/A	N/A	G-G	N/A
Gonets D1-I	Communications	N/A	MEO	10800 nMi	756 nMi	529 lbs 240 kg	N/A	N/A	G-G	N/A
Hot Bird 2	Communications	N/A	GEO 13 E	N/A	N/A	6380 lbs 2894 kg	N/A	N/A	N/A	N/A
Hot Bird 3 Plus	Communications	N/A	GEO 13 E	N/A	N/A	6380 lbs 2894 kg	N/A	20	N/A	N/A
Inmarsat 3 F3	Communications	$80 M	GEO TBA	21600 nMi	19376 nMi	4362 lbs 1979 kg	2423 lbs 1099 kg	2 C,L	3-axis	2400 W
Insat 2D	Communications	N/A	GEO 93.5 E	19433 nMi	19305 nMi	4510 lbs 2050 kg	N/A	19C, 4 Ku, 3S	3-axis	N/A
Intelsat 8 F1	Communications	$68 M	GE0 174 E	19356 nMi	19319 nMi	8140 lbs 3692 kg	N/A	38 C, 6 Ku	3-axis	N/A
Intelsat 8 F2	Communications	$68 M	GEO 64 E	19375 nMi	19319 nMi	8140 lbs 3692 kg	N/A	38 C, 6 Ku	3-axis	N/A
Iridium 1	Communications	$5 M	LEO	419 nMi	419 nMi	1500 lbs 680 kg	N/A	Ka, L	3-axis	N/A
Iridium 14	Communications	$5 M	LEO	419 nMi	419 nMi	1500 lbs 680 kg	N/A	Ka, L	3-axis	N/A
Iridium 15	Communications	$5 M	LEO	419 nMi	419 nMi	1500 lbs 680 kg	N/A	Ka, L	3-axis	N/A
Iridium 16	Communications	$5 M	LEO	419 nMi	419 nMi	1500 lbs 680 kg	N/A	Ka, L	3-axis	N/A
Iridium 17	Communications	$5 M	LEO	419 nMi	419 nMi	1500 lbs 680 kg	N/A	Ka, L	3-axis	N/A
Iridium 18	Communications	$5 M	LEO	419 nMi	419 nMi	1500 lbs 680 kg	N/A	Ka, L	3-axis	N/A
Iridium 19	Communications	$5 M	LEO	419 nMi	419 nMi	1500 lbs 680 kg	N/A	Ka, L	3-axis	N/A
Iridium 2	Communications	$5 M	LEO	419 nMi	419 nMi	1500 lbs 680 kg	N/A	Ka, L	3-axis	N/A

Characteristics of Cited Payloads

Payload	Use	Price	Orbit	Apogee	Perigee	Launch Mass	Mass in orbit	Freq. Bands & trans.	Stab.	Power
Iridium 20	Communications	$5 M	LEO	419 nMi	419 nMi	1500 lbs 680 kg	N/A	Ka, L	3-axis	N/A
Iridium 3	Communications	$5 M	LEO	432 nMi	419 nMi	1500 lbs 680 kg	N/A	Ka, L	3-axis	N/A
JCSAT 4	Communications	N/A	GEO TBA	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Mabuhay 1	Communications	N/A	GEO TBA	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Measat 2	Communications	$110 M	GEO 148 E	N/A	N/A	2646 lbs 1200 kg	1442 lbs 654 kg	10 C 3 Ku	Spin	N/A
Molniya 3-48	Communications	N/A	ELI	21600 nMi	216 nMi	N/A	N/A	N/A	N/A	N/A
Nahuel 1A	Communications	$91 M	GEO 70 W	N/A	N/A	4012 lbs 1820 kg	N/A	18 Ku	N/A	N/A
PAS 5	Communications	$69 M	GEO	19331 nMi	19320 nMi	6437 lbs 2920 kg	N/A	24C, 16 Ku	3-axis	4800 W
PAS 6	Communications	N/A	GEO	19356 nMi	19320 nMi	6437 lbs 2920 kg	N/A	N/A	N/A	4800 W
SCD 3	Communications	N/A	LEO	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Sinosat 1	Communications	N/A	GEO	N/A	N/A	N/A	N/A	C, Ku	3-axis	N/A
Superbird C1	Communications	$392 M	GEO TBA	19305 nMi	19305 nMi	5952 lbs 2700 kg	3748 lbs 1700 kg	24 Ku	3-axis	N/A
Tempo 1	Communications	$183 M	GEO 119 W	N/A	N/A	7700 lbs 3493 kg	4189 lbs 1900 kg	32 Ku	3-axis	N/A
Tempo 2	Communications	$183 M	GEO 166 W	N/A	N/A	7700 lbs 3493 kg	4189 lbs 1900 kg	32 Ku	3-axis	N/A
Thaicom 3	Communications	N/A	GEO 78.5 E	19305 nMi	19305 nMi	N/A	N/A	24C, 14 Ku	N/A	N/A
Thor 2A	Communications	N/A	GEO TBA	N/A	N/A	N/A	N/A	N/A	N/A	N/A
UFO 8	Communications	$181 M	GEO	19321 nMi	19305 nMi	6319 lbs 2866 kg	2304 lbs 1045 kg	EHF, UHF	3-axis	2500 W
Crewed										
Soyuz TM-25	Crewed	N/A	LEO	221 nMi	213 nMi	15587 lbs 7070 kg	14969 lbs 6790 kg	N/A	N/A	N/A
Soyuz TM-26	Crewed	N/A	LEO	226 nMi	213 nMi	15587 lbs 7070 kg	14969 lbs 6790 kg	N/A	N/A	N/A
Experimental										
Minisat 01	Experimental	$11 M	N/A	N/A	N/A	460 lbs 209 kg	N/A	N/A	N/A	N/A
Intelligence										
DSP 19	Intelligence	N/A	GEO	19305 nMi	19305 nMi	5203 lbs 2360 kg	N/A	N/A	N/A	1274 W
Mars										
Mars 96	Mars	N/A	EXT	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Mars Global Surveyor	Mars	$49 M	EXT	N/A	N/A	2200 lbs 998 kg	N/A	N/A	N/A	N/A
Mars Pathfinder	Mars	$160 M	EXT	N/A	N/A	1760 lbs 798 kg	630 lbs 286 kg	N/A	Spin	N/A
Meteorological										
DMSP	Meteorological	N/A	LEO	N/A	N/A	N/A	N/A	N/A	N/A	N/A
FY 2-B	Meteorological	N/A	GEO 105 E	N/A	N/A	2646 lbs 1200 kg	1323 lbs 600 kg	N/A	Spin	N/A

Characteristics of Cited Payloads

Payload	Use	Price	Orbit	Apogee	Perigee	Launch Mass	Mass in orbit	Freq. Bands & trans.	Stab.	Power
GEOS K	Meteorological	$79 M	GEO TBA	19331 nMi	19323 nMi	4000 lbs 1814 kg	N/A	N/A	3-axis	N/A
NOAA K	Meteorological	N/A	LEO	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Microgravity										
Texus 35	Microgravity	N/A	SUB	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Wake Shield Facility	Microgravity	N/A	LEO	N/A	N/A	3748 lbs 1700 kg	N/A	N/A	N/A	N/A
Navigation										
Kosmos 2336	Navigation	N/A	LEO	756 nMi	529 nMi	N/A	N/A	N/A	N/A	N/A
Navstar GPS 2R-1	Navigation	$27 M	MEO	19305 nMi	10899 nMi	4480 lbs 2032 kg	2370 lbs 1075 kg	L	3-axis	1125 W
Remote Sensing										
Clark	Remote Sensing	$45 M	LEO	254 nMi	N/A	612 lbs 278 kg	N/A	N/A	N/A	N/A
Earlybird 1	Remote Sensing	N/A	LEO	270 nMi	254 nMi	992 lbs 450 kg	N/A	N/A	N/A	N/A
FSW 2-3	Remote Sensing	N/A	LEO	219 nMi	92 nMi	N/A	N/A	N/A	N/A	N/A
Geosat Follow-On	Remote Sensing	N/A	LEO	432 nMi	422 nMi	576 lbs 261 kg	N/A	N/A	N/A	N/A
Kosmos 2335	Remote Sensing	N/A	LEO	248 nMi	218 nMi	N/A	N/A	N/A	N/A	N/A
Lewis	Remote Sensing	$51 M	LEO	297 nMi	N/A	804 lbs 365 kg	N/A	N/A	N/A	N/A
Seastar	Remote Sensing	N/A	LEO	546 nMi	N/A	604 lbs 274 kg	N/A	N/A	N/A	N/A
Scientific										
Bion 11	Scientific	N/A	LEO	N/A	N/A	N/A	N/A	N/A	N/A	N/A
HETE	Scientific	N/A	LEO	419 nMi	N/A	265 lbs 120 kg	N/A	N/A	Spin	70 W
Muses B	Scientific	N/A	ELI	10899 nMi	N/A	1760 lbs 798 kg	N/A	N/A	N/A	N/A
ORFEUS SPAS 2	Scientific	N/A	LEO	174 nMi	86 nMi	7900 lbs 3583 kg	N/A	N/A	N/A	N/A
SAC B	Scientific	$6 M	LEO	273 nMi	N/A	770 lbs 349 kg	N/A	N/A	3-axis	N/A
SNOE	Scientific	N/A	LEO	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SWAS	Scientific	N/A	LEO	N/A	N/A	N/A	397 lbs 180 kg	397 lbs 180 kg	3-axis	N/A
Supply										
Progress M-33	Supply	N/A	LEO	219 nMi	211 nMi	1583 lbs 7250 kg	N/A	N/A	N/A	N/A
Progress M-34	Supply	N/A	LEO	219 nMi	211 nMi	1583 lbs 7250 kg	N/A	N/A	N/A	N/A
Progress M-35	Supply	N/A	LEO	221 nMi	211 nMi	1583 lbs 7250 kg	N/A	N/A	N/A	N/A

Launch Events*
October 1996 - December 1996

Launch Date	Vehicle	Payload	Operator	Manufacturer	Int'l Comp	Launch Type	Launch Outcome	Mission Outcome
China								
				Long March				
October 20 1996	Long March 2D	FSW 2-3	Shanghai Bureau of Astronautics	Chinese Academy of Space Technology (CAST)	No	Non-Commercial	Success	Success
Europe (ESA)								
				Araine				
November 13 1996	Ariane 44L	Arabsat 2B Measat 2	ASCO Bina Riang Pte. Ltd.	Aerospatiale Hughes	Yes Yes	Commercial Commercial	Success Success	Success Success
				Texus				
November 24 1996	Texus*	Texus 35	DASA	DASA	No	Non-Commercial	Success	Success
Russia/CIS								
				Cosmos				
December 20 1996	Cosmos SL-8	Kosmos 2336	Russia/CIS MoD	AO Polyot	No	Non-Commercial	Success	Success
				Cyclone				
December 11 1996	Cyclone SL-11	Kosmos 2335	Russia/CIS MoD	Russia/CIS	No	Non-Commercial	Success	Success
				Molniya				
October 24 1996	Molniya SL-6	Molniya 3-48	Russia/CIS PTT	NPO Prikladnoi Mekhaniki	No	Non-Commercial	Success	Success
				Proton				
November 16 1996	Proton SL-12	Mars 96	Space Research Institute (IKI)	NPO Lavotchkin	No	Non-Commercial	Failure	Failure
				Soyuz				
November 19 1996	Soyuz SL-4	Progress M-33	RKK Energia	RKK Energia	No	Non-Commercial	Success	Success
December 24 1996	Soyuz SL-4	Bion 11	Russia/CIS	Russia/CIS	No	Non-Commercial	Success	Success

*High-profile suborbital launch events included

Launch Events*
October 1996 - December 1996

Launch Date	Vehicle	Payload	Operator	Manufacturer	Int'l Comp	Launch Type	Launch Outcome	Mission Outcome
USA								
				Atlas				
November 21 1996	Atlas 2A	Hot Bird 2	Eutelsat	Matra Marconi	Yes	Commercial	Success	Success
December 17 1996	Atlas 2A	Inmarsat 3 F3	Inmarsat	Lockheed Martin Astro Space	Yes	Commercial	Success	Success
				Delta				
November 07 1996	Delta 2 7925	Mars Global Surveyor 1	NASA	Martin Marietta Astro Space	No	Non-Commercial	Success	Success
December 04 1996	Delta 2 7925	Mars Pathfinder	NASA	Jet Propulsion Laboratory	No	Non-Commercial	Success	Success
				Pegasus				
November 04 1996	Pegasus XL	HETE	Massachusetts Institute of Technology	AeroAstro, Corp.	Yes	Commercial	Failure	Failure
		SAC B	Argentina	National Commission on Space Activities (CONAE)	Yes	Commercial	Failure	Failure
				Shuttle				
November 19 1996	Shuttle Columbia	STS 80	NASA	Rockwell International	No	Non-Commercial	Success	Success
		ORFEUS SPAS 2	NASA/DARA	MBB Erno	No	Non-Commercial	Success	Success
		Wake Shield Facility 3	Space Vacuum Epitaxy Center	Space Industries, Inc.	No	Non-Commercial	Success	Success
				Titan				
December 20 1996	Titan 4	USA 129	DoD	N/A	No	Non-Commercial	Success	Success

*High-profile suborbital launch events included

Future Launch Events
January 1997 - June 1997

Launch Date	Vehicle	Payload	Operator	Manufacturer	Int'l Comp	Launch Type	Launch Site
Brazil							
			VLS				
1st Qtr 1997	VLS	SCD 3	IAE	IAE	No	Non-Commercial	Alcantara
China							
			Long March				
February 1997	Long March 3B	Mabuhay 1	Mabuhay Philippine Satellite, Inc.	Space Systems/Loral	Yes	Commercial	Xichang
March 1997	Long March 4	FY 2-B	Chinese Academy of Space Technology	Shanghai Institute of Satellite Engineering	No	Non-Commercial	Xichang
April 1997	Long March 3B	APStar 2R	APT Satellite Co., Ltd.	Space Systems/Loral	Yes	Commercial	Xichang
May 1997	Long March -TBA	Sinosat 1	SINO-Satellite Communications Co. Ltd.	EuraSpace	No	Non-Commercial	TBA
1st Qtr 1997	Long March 3A	DFH 3-2	Chinese Broadcasting Satellite Corp.	Chinese Academy of Space Technology (CAST)	No	Non-Commercial	Xichang
Europe (ESA)							
			Araine				
January 30 1997	Ariane 44L	GE 2 Nahuel 1A	GE Americom Nahuelsat	Lockheed Martin Astro Space Aerospatiale	Yes Yes	Commercial Commercial	Kourou Kourou
February 25 1997	Ariane 44LP	Intelsat 8 F1	Intelsat	Lockheed Martin Astro Space	Yes	Commercial	Kourou
March 1997	Ariane 4	BSAT 1A Thaicom 3	Broadcast Satellite System Corp. (B-Sat) Shinawatra Satellite Public Ltd., Co.	Hughes Aerospatiale	Yes Yes	Commercial Commercial	Kourou Kourou
April 1997	Ariane 4	PAS 6	Alpha Lyracom Pan American Satellite	Space Systems/Loral	Yes	Commercial	Kourou
May 1997	Ariane 44L	Inmarsat 3F4 Insat 2D	Inmarsat IRSO	Lockheed Martin Astro Space IRSO	Yes Yes	Commercial Commercial	Kourou Kourou
June 1997	Ariane 44P	Intelsat 8F2	Intelsat	Lockheed Martin Astro Space	Yes	Commercial	Kourou
Japan							
			M				
February 12 1997	M 5	Muses B	ISAS	NEC	No	Non-Commercial	Kagoshima

*High-profile suborbital launch events included

Future Launch Events
January 1997 - June 1997

Launch Date	Vehicle	Payload	Operator	Manufacturer	Int'l Comp	Launch Type	Launch Site
Russia/CIS							
			Cyclone				
February 14 1997	Cyclone SL-14	Gonets D1-D	Russia/CIS	NPO Prikladnoi Mekhaniki	No	Non-Commercial	Plesetsk
		Gonets D1-E	Russia/CIS	NPO Prikladnoi Mekhaniki	No	Non-Commercial	Plesetsk
		Gonets D1-F	Russia/CIS	NPO Prikladnoi Mekhaniki	No	Non-Commercial	Plesetsk
		Gonets D1-G	Russia/CIS	NPO Prikladnoi Mekhaniki	No	Non-Commercial	Plesetsk
		Gonets D1-H	Russia/CIS	NPO Prikladnoi Mekhaniki	No	Non-Commercial	Plesetsk
		Gonets D1-I	Russia/CIS	NPO Prikladnoi Mekhaniki	No	Non-Commercial	Plesetsk
			Proton				
April 1997	Proton SL-12	Tempo 1	Tempo Satellite, Inc.	Space Systems/Loral	Yes	Commercial	Tyuratam
May 1997	Proton SL-12	PAS 5	Alpha Lyracom Pan American Satellite	Hughes	Yes	Commercial	Tyuratam
June 1997	Proton SL-12	Astra 1G	Societe Europeenne des Satellites (SES)	Hughes	Yes	Commercial	Tyuratam
June 1997	Proton SL-12	Iridium 14	Iridium, Inc.	Lockheed Martin Astro Space	Yes	Commercial	Tyuratam
		Iridium 15	Iridium, Inc.	Lockheed Martin Astro Space	Yes	Commercial	Tyuratam
		Iridium 16	Iridium, Inc.	Lockheed Martin Astro Space	Yes	Commercial	Tyuratam
		Iridium 17	Iridium, Inc.	Lockheed Martin Astro Space	Yes	Commercial	Tyuratam
		Iridium 18	Iridium, Inc.	Lockheed Martin Astro Space	Yes	Commercial	Tyuratam
		Iridium 19	Iridium, Inc.	Lockheed Martin Astro Space	Yes	Commercial	Tyuratam
		Iridium 20	Iridium, Inc.	Lockheed Martin Astro Space	Yes	Commercial	Tyuratam
2nd Qtr 1997	Proton SL-12	Ekspress 4	Informkosmos	NPO Prikladnoi Mekhaniki	No	Non-Commercial	Tyuratam
			Soyuz				
February 10 1997	Soyuz SL-4	Soyuz TM-25	RKK Energia	RKK Energia	No	Non-Commercial	Tyuratam
March 5 1997	Soyuz SL-4	Progress M-34	RKK Energia	RKK Energia	No	Non-Commercial	Tyuratam
			Soyuz				
April 26 1997	Soyuz SL-4	Progress M-35	RKK Energia	RKK Energia	No	Non-Commercial	Tyuratam
June 24 1997	Soyuz SL-4	Soyuz TM-26	RKK Energia	RKK Energia	No	Non-Commercial	Tyuratam
			Start				
March 1997	Start 1	Earlybird 1	Earthwatch, Inc.	Defense Systems, Inc.	Yes	Commercial	Svobodny

*High-profile suborbital launch events included

Future Launch Events
January 1997 - June 1997

Launch Date	Vehicle	Payload	Operator	Manufacturer	Int'l Comp	Launch Type	Launch Site
Russia/CIS							
			TBA				
February 1997	TBA	Kosmos 97-02	Russia/CIS	Russia/CIS	No	Non-Commercial	TBA
March 1997	TBA	Kosmos 97-03	Russia/CIS	Russia/CIS	No	Non-Commercial	TBA
April 1997	TBA	Kosmos 97-04	Russia/CIS	Russia/CIS	No	Non-Commercial	TBA
May 1997	TBA	Kosmos 97-05	Russia/CIS	Russia/CIS	No	Non-Commercial	TBA
June 1997	TBA	Kosmos 97-06	Russia/CIS	Russia/CIS	No	Non-Commercial	TBA
2nd Qtr 1997	TBA	Faisat 2	Final Analysis Inc.	Final Analysis Inc.	No	Non-Commercial	TBA
USA							
			Atlas				
February 15 1997	Atlas 2AS	JCSAT 4	Japan Satellite Systems, Inc. (JSAT)	Hughes	Yes	Commercial	CCAS
March 5 1997	Atlas 2A	Tempo 2	Tempo Satellite, Inc.	Space Systems/Loral	Yes	Commercial	CCAS
April 24 1997	Atlas 2	GOES K	NOAA	Space Systems/Loral	No	Non-Commercial	CCAS
June 1997	Atlas 2	UFO 8	DoD	Hughes	No	Commercial	CCAS
			Delta				
January 17 1997	Delta 2 7925	Navstar GPS 2R- 1	DoD	Lockheed Martin Astro Space	No	Non-Commercial	CCAS
May 1997	Delta 2 7925	Iridium 1	Iridium, Inc.	Lockheed Martin Astro Space	Yes	Commercial	VAFB
		Iridium 2	Iridium, Inc.	Lockheed Martin Astro Space	Yes	Commercial	VAFB
		Iridium 3	Iridium, Inc.	Lockheed Martin Astro Space	Yes	Commercial	VAFB
June 1997	Delta 2 7925	Thor 2A	Tele-TV A/S	Hughes	Yes	Commercial	CCAS
			LMLV				
April 1997	LMLV 1	Lewis	NASA	TRW	No	Commercial	VAFB
May 1997	LMLV 1	Clark	NASA	CTA Space Systems, Inc.	No	Commercial	VAFB
			MSLS				
January 16 1997	MSLS*		BMDO	Unknown	No	Non-Commercial	VAFB

*High-profile suborbital launch events included

Future Launch Events
January 1997 - June 1997

Launch Date	Vehicle	Payload	Operator	Manufacturer	Int'l Comp	Launch Type	Launch Site
2nd Qtr 1997	MSLS*		BMDO	Unknown	No	Non-Commercial	VAFB
USA							
			Pegasus				
March 14 1997	Pegasus XL	Minisat 01	INTA	INTA	Yes	Commercial	Spain
April 1997	Pegasus XL	SWAS	Smithsonian Astrophysical Observatory	NASA	No	Non-Commercial	VAFB
May 1 1997	Pegasus XL	SNOE	University of Colorado/NASA	University of Colorado	No	Non-Commercial	TBA
June 1 1997	Pegasus XL	Seastar	Orbital Sciences Corp. (OSC)	Orbital Sciences Corp. (OSC)	No	Commercial	VAFB
			Shuttle				
January 12 1997	Shuttle Atlantis	STS 81	NASA	Rockwell International	No	Non-Commercial	KSC
February 11 1997	Shuttle Discovery	STS 82	NASA	Rockwell International	No	Non-Commercial	KSC
April 3 1997	Shuttle Columbia	STS 83	NASA	Rockwell International	No	Non-Commercial	KSC
May 15 1997	Shuttle Atlantis	STS 84	NASA	Rockwell International	No	Non-Commercial	KSC
			Taurus				
May 30 1997	Taurus 1	Geosat Follow-On 1	DoD	Ball Aerospace	No	Commercial	VAFB
			Titan				
February 22 1997	Titan 4B/IUS	DSP 19	DoD	TRW	No	Non-Commercial	CCAS
April 2 1997	Titan 2	DMSP 5D-2-F14	DoD	Lockheed Martin Astro Space	No	Non-Commercial	VAFB

*High-profile suborbital launch events included