Commercial Space Transportation

QUARTERLY LAUNCH REPORT

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

2nd Quarter 1996

United States Department of Transportation • Federal Aviation Administration

Office of Associate Administrator for Commercial Space Transportation

2nd QUARTER 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.*

Cover Photo credit: McDonnell Douglas Corporation (1996). Image shows the January 14, 1996, Delta II 7925 launch of KoreaSat-2, built by Lockheed Martin Corporation. Commercial license #LL0-91-023.

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This document was prepared by the Futron Corporation and was released on April 22, 1996

SUMMARY

First Quarter 1996 Launch Events

- The U.S. successfully conducted one Pegasus, two Delta, one Atlas, and three Shuttle launches.
- Arianespace performed well with three successful launches.
- Russia conducted six launches using one Cosmos, one Cyclone, two Proton, and two Soyuz rockets. All were successful except for a Proton launch of Raduga 33, which ended in failure.
- China suffered a catastrophic failure of its first launch of the Long March 3B.
- India conducted its second successful PSLV flight in three attempts.

Second and Third Quarter 1996 Scheduled Launch Events

- The U.S. expects to conduct 22 launches, 11 of which are commercial, in the next two quarters.
- Arianespace plans to launch nine times in the next 6 months. Eight of these launches will be commercial. The Ariane 5 will begin service in May. Two Ariane 5 flights are scheduled for the next two quarters.
- China intends to launch two Long March vehicles, one of which is commercial. No launches of the Long March 3B config-uration— the first of which failed in February— are planned.
- Russia/CIS has 21 scheduled launches for the next two quarters, including its first dedicated commercial launch.
- India will launch its fourth Polar Satellite Launch Vehicle (PSLV).

SUMMARY

Commercial Products and Services

The following satellites are being deployed by space launch vehicles licensed by the FAA Office of the Associate Administrator for Commercial Space Transportation. These satellites will provide a range of commercial communication services to the general public.

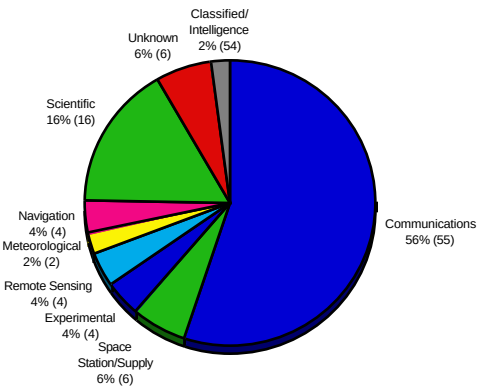
Galaxy 9 (Delta 2 7925), GE 1 (Atlas 2A),
and TEMPO 1 (Atlas 2AS)

Video services provided by these systems represent the greatest overall use of transponder capacity. Satellite use by the video sector has been increasing steadily as specialized video services such as direct-to-home and pay-per-view have developed. More substantial growth in demand for satellite capacity is likely to come from corporations, schools, and other large institutions establishing private networks for video, voice, and data communications.

Inmarsat 3 F2 (Atlas 2A) and Hot Bird Plus 1 (Atlas 2A)

These satellites will ensure continuity of maritime services, while maintaining reliability, redundancy, and connectivity. The increased capacity will be sufficient for both existing maritime services and for new and innovative maritime services that will include critical distress and safety communications.

Payload Use Analysis



For the period January through March 1996, communications (55%), scientific (16%), and space station/supply (6%) satellites make up the vast majority of all payloads delivered to orbit.

When only commercial launches are considered, communications satellites make up 90% of payloads. The remaining satellites perform scientific or experimental functions.

LAUNCH SCHEDULE

Scheduled Launch Events

Vehicle	Payload	Site
APRIL 1996		
Ariane 42P	MSAT 1	Kourou
Proton SL-12	Astra 1F	Tyuratam
Soyuz SL-4	Progress M-31	Tyuratam
TBD	Kosmos 2332	TBD
Atlas 2A	Inmarsat 3 F1	CCAS
Atlas 1	SAX	CCAS
Delta 2 7920	MSX	VAFB
MAY 1996		
Long March 3B	Intelsat 7A F8	Xichang
Ariane 44P	N-Star B	Kourou
Ariane 44LP	Intelsat 7A F7	Kourou
Texus *	(not available)	Esrange
PSLV	IRS P3	Sriharikota
J-1 *	Hyflex	Tanegashima
Proton SL-12	Raduga 33	Tyuratam
Soyuz SL-4	Soyuz TM-23	Tyuratam
Delta 2 7925	NEAR	CCAS
Delta 2 7925	Polar	VAFB
Pegasus XL	Rex 2	VAFB
Columbia STS 75	TSS 1R/USMP	KSC
JUNE 1996		
Ariane 4	Arabsat 2A and Turksat 1C	Kourou
Soyuz SL-4	Progress M-32	Tyuratam
TBD	Kosmos	TBD
Delta 2 7925	Navstar GPS 2-26	CCAS
Shuttle Columbia	STS 78	KSC
Titan 4/TBA	Classified	VAFB

** Denotes a suborbital launch.*

LAUNCH SCHEDULE

Scheduled Launch Events

Continued

Vehicle	Payload	Site
JULY 1996		
Ariane 44LP	Intelsat 8 F1	Kourou
Soyuz SL-4	Soyuz TM-24	Tyuratam
Soyuz SL-4	Progress M-33	Tyuratam
TBD	Kosmos	TBD
Atlas 2	UFO 7	CCAS
Pegasus XL	TOMS 1	VAFB
AUGUST 1996		
H 2	ADEOS 1	Tanegashima
TR 1A*	(not available)	Tanegashima
TBD	Kosmos	TBD
Atlas 2A	Hot Bird Plus 1	CCAS
Delta 2 7925	Navstar GPS 2-26	CCAS
Delta 2 7925	Iridium 1-8	VAFB
Delta 2 7925	Navstar GPS 2R-1	CCAS
LMLV 1	Clark	VAFB
Shuttle Atlantis	STS 79	KSC
SEPTEMBER 1996		
Ariane 44LP	Intelsat 8 F2	Kourou
PSLV	IRS P4	Sriharikota
M 5	Muses B	Kagoshima
TBD	Kosmos	TBD
Atlas 2AS	Tempo 1	CCAS
Pegasus XL	FAST	VAFB
Titan 2	NOAA K	VAFB

** Denotes a suborbital launch.*

LAUNCH SCHEDULE

Additional Launch Events†

For the Second and Third Quarter of 1996

Vehicle	Payload	Site
SECOND QUARTER OF 1996		
Cosmos SL-8	Faisat 2	Plesetsk
Cyclone SL-14	GEO-IK 2	Plesetsk
Cyclone SL-14	Coronas F	Plesetsk
Molniya SL-6	Molniya 3-48	Plesetsk
Proton SL-12	Express 2	Tyuratam
Titan 2	DMSP 5D-2-F14	VAFB
THIRD QUARTER OF 1996		
Long March 3A	DFH 3-2	Xichang
Ariane 4	Inmarsat 3 F3	Kourou
Ariane 5	ARED	Kourou
	Intelsat 7A F9	
	Oscar 16	
Cyclone SL-14	Gonets D1-D -	Plesetsk
	Gonets D1-I	
Proton SL-13	Priroda	Tyuratam
Proton SL-12	Ekran 21	Tyuratam
Soyuz SL-4	Foton 11/Mirka	Plesetsk
Zenit SL-16	Okean 5	Tyuratam

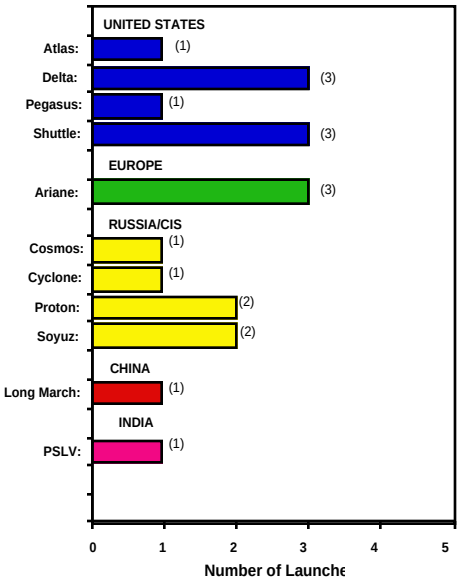
* Denotes a suborbital launch.

† 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

First Quarter 1996



The majority of launch events for the first quarter of 1996 were U.S. and Russian government payloads such as NEAR, REX-2, IRS-P3, and Gorizont 31. The United States and Russia/CIS remain world leaders in the number of payloads delivered to orbit.

During the past 3 months, the U.S. had a total of eight launches, which supported two commercial communications satellites, one military experimentation payload, and five scientific missions.

In this period, the first successful flight of the Pegasus XL, conducted by Orbital Sciences Corporation, resulted in the deployment of REX-2, a radiation experiment for the U.S. Department of Defense (DoD). This flight followed two previous launch attempts in 1994 and 1995. The U.S. delivered two foreign telecommunications satellites, Koreasat 2 and Palapa C1, aboard the Delta 2 and Atlas 2AS vehicles, respectively. Two Delta vehicle launches were employed by NASA for the Near Earth Asteroid Rendezvous and Polar scientific spacecraft. In addition, NASA conducted three shuttle missions, including one involving a second attempt to launch the Tethered Satellite System (TSS-1R). During its deployment phase, the TSS-1R system inadvertently separated from the shuttle and later reentered the Earth's atmosphere. The cause of the accident is currently under investigation. The shuttle also housed two large microgravity payloads, retrieved Japan's Space-Flyer Unit, and rendezvoused with Russia's Mir Space Station.

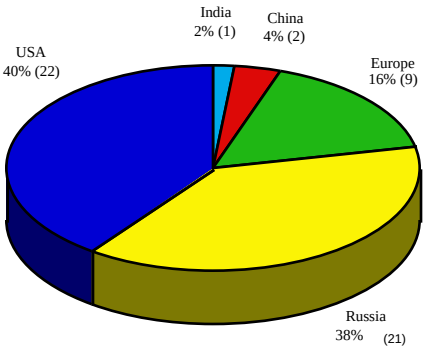
The European space launch company, Arianespace, deployed four telecommunications payloads for commercial launch service customers from the U.S., Japan, Malaysia, and Intelsat. In China, the first Long March 3B vehicle veered from its intended trajectory and exploded shortly after clearing its launch tower at China's Xichang launch complex, causing fatalities and extensive damage and resulted in the destruction of the Intelsat 708 payload.

Major foreign launch events supporting missions other than commercial also occurred in this quarter. Specifically, Russia/CIS conducted six missions, including one for crew rotation of the MIR Space Station. Russia also deployed six small communications satellites including three military Strela-class (Kosmos 2328-2330) and three Gonets. (Gonets is a precursor to a commercial telecommunications system.) Japan successfully launched its first J-1 vehicle in a suborbital trajectory. However, the recoverable payload was lost at sea due to a malfunction in its floatation device. The first J-1 orbital flight is planned for 1998. India also launched its sixth Indian Remote Sensing satellite.

LAUNCH REPORT

Scheduled Launch Events

Second and Third Quarter 1996



Scheduled Launch Events

In the next 6 months, the Russian Republic/CIS and the United States will lead all space-faring nations in the number of launches scheduled in this period.

Among the 22 U.S. launches scheduled for the second and third quarters of 1996 are three NASA shuttle launches. NASA also plans to deploy three scientific satellites, including a Total Ozone Mapping Spectrometer (TOMS) and the Fast Auroral Snapshot Explorer (FAST). The DoD will orbit and operate eight satellites with a wide range of missions, e.g., navigation, scientific, meteorological, and intelligence.

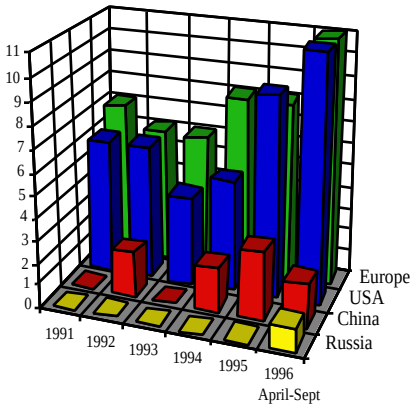
Only one of the 21 scheduled Russian launches for the same period is commercial. The remaining launches are primarily civil and military communications satellites and space station supply missions. The Priroda module for the Mir space station, for example, is planned to be deployed aboard a Proton rocket in late April.

Japan intends to deploy remote sensing and radio astronomy satellites with its H-2 and M-5 vehicles, respectively, and India has scheduled the launch of its next PSLV vehicles for September.

LAUNCH REPORT

Scheduled Commercial Launch Events

Second and Third Quarter 1996



Commercial Launch Events
(Small Vehicles Excluded)

International Launch Services, a joint U.S. - Russian commercial venture consisting of Lockheed Martin, Krunichev State Research and Production Space Center, and RSC Energia, intends to conduct Russia's first dedicated commercial launch using its Proton rocket to deploy SES's Astra 1F telecommunication satellite in early April.

China's Great Wall Industry Corporation also plans to conduct a commercial launch of Hong Kong's APStar 1A satellite after completion of an investigation into the February 1996 failure of the first Long March 3B, the heaviest capacity vehicle in China's inventory. APStar 2 was destroyed in a Long March failure in January of last year. Due to the recent problems facing the Long March program, a number of previously booked commercial customers, including Intelsat and Echostar Corporation, have opted to contract other launch providers for upcoming deployments.

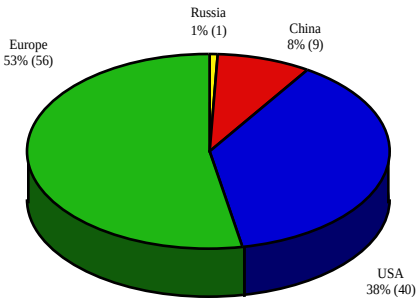
Arianespace plans to introduce the heavy-capacity Ariane 5 vehicle in April, with the non-commercial launch of four scientific satellites. The Ariane 5 will be capable of delivering about 12,000 kg to low Earth orbit at a total price of approximately $140 M. Future Ariane 5 payloads are planned to accommodate commercial customers. Nine Arianespace launches, including seven Ariane 4s, and two Ariane 5s, are slated to launch 16 satellites, ten of which were internationally competed contracts. Ariane customers include organizations from the following countries: United States, Canada, Israel, Italy, Turkey, and Indonesia. Arianespace will also launch three Intelsat payloads, one for the Arab Satellite Communications Organization (ASCO), and five for the European Space Agency (ESA).

McDonnell Douglas plans to conduct three commercial Delta 2 launches in the next two quarters, including the first multiple payload deployment for the 66-satellite Iridium constellation. Six Lockheed Martin commercial Atlas vehicles are planned to deploy satellites for customers from Italy and the United States. Lockheed Martin will also deploy an Inmarsat and an Eutelsat satellite from Atlas 2A vehicles.

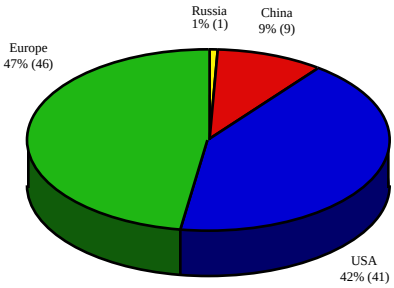
Following the success of its March Pegasus XL flight for the U.S. Air Force, Orbital Sciences plans to conduct a commercial launch (one of a total of three launches in the next two quarters). After the failure of the first LMLV flight, Lockheed Martin plans to resume flight activity in late August 1996 with the deployment of the Clark satellite as part of NASA's small spacecraft technology initiative program.

LAUNCH REPORT

Commercial Launch Events



Commercially Launched Payloads
Market Trend
January 1991 - September 1996
(Small Vehicles Excluded)



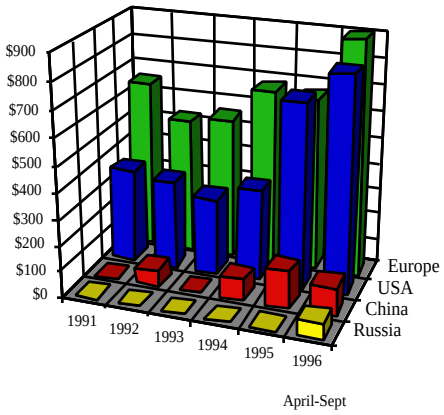
Commercial Launch Market Trend
January 1991 - September 1996
(Small Vehicles Excluded)

Arianespace's share of the commercial space launch market is largest when the market is defined by number of payloads delivered to orbit, because Ariane launches frequently carry more than one satellite. Payloads that correspond to internationally competed launches over the last five years, including those payloads associated with actual and scheduled launches cited in this report, reflect an average market share of 53% for Arianespace.

The historical trend of orbital commercial space launches among market competitors indicates that the competition between the traditional market leaders, the United States and Europe, has fluctuated. Over the same period, however, U.S. competitors have roughly matched Arianespace with an average market share of 42%. The trend appears to continue through the third quarter of 1996 when scheduled launches are considered. (This trend covers large vehicles - defined as those ELVs with lift capacity greater than 5,000 lbs. to low Earth orbit.)

LAUNCH REPORT

Commercial Launch Revenues



*Approximate revenues based on actual price quotes and historical price averages. Figures shown in 1994 dollars.

The expected launch service revenue from the U.S., European, Russian, and Chinese scheduled launches for the next two quarters will total approximately $1800 million, of which 47% will be realized as commercial launch revenue for American companies. Leading communications satellite manufacturers, notably Hughes Communications and Lockheed Martin Astro Space, have received the majority of contract awards for payloads in this period.

Since 1991, Arianespace commercial launch revenue has averaged $690 million per year for an average annual launch rate of 8. By comparison, the United States has averaged $500 million in annual revenues, with approximately 7 launches per year. Since the years following the Challenger disaster, Arianespace has maintained a relatively robust launch revenue base despite growth in the U.S. industry. Arianespace's dual manifesting practice and its focus on the geostationary market segment account for its relatively large ratio of revenues to launches.

U.S. Advanced Launch Vehicle Technology Programs

U.S. firms and U.S. government agencies are jointly investing in advanced launch vehicle technology. This Special Report summarizes U.S. launch vehicle technology programs and highlights the changing roles of government and industry players in picking technologies and providing funding. It also reports on the role of the FAA Office of Commercial Space Transportation (OCST) in advanced launch vehicle programs and on the joint National Space Transportation Policy Implementation Plan recently released by the Department of Transportation (DOT) and the Department of Commerce (DOC).

The U.S. National Space Transportation Policy

U.S. investment in advanced launch vehicle technology is guided by the National Space Transportation Policy (NSTP). The policy, released on August 5, 1994, is intended to return the U.S. launch industry to the dominant world position it occupied in the 1960's and 1970's. This is to be accomplished through a partnership between government and industry in two separate launch vehicle development efforts: the high-risk NASA Reusable Launch Vehicle (RLV) program and the lower-risk Department of Defense (DoD) Evolved Expendable Launch Vehicle (EELV) program.

Beyond creating development programs the NSTP has more general commercial implications, directing the Departments of Transportation and Commerce to foster government-industry cooperation in both the RLV and EELV programs. The Implementation Plan described below is a response to this directive. The NSTP also addresses other commercial issues, clarifying the conditions under which military missiles may be used as launch vehicles and providing guidelines for

the use of foreign launch systems and components in government-sponsored launch vehicles.

DOT/DOC Joint NSTP Implementation Plan

The Departments of Transportation and Commerce have released a joint National Space Transportation Policy Implementation Plan with their vision and implementing actions. The vision of the Departments of Transportation and Commerce is for the U.S. space transportation industry to capture a dominant share of the global launch market by encouraging the development of a more internationally competitive launch vehicle fleet and supporting infrastructure.

The Implementation Plan notes that achieving this goal will require a coherent effort by the private and public sectors to foster a significantly more internationally competitive launch vehicle fleet by the turn of the century. DOT and DOC, in cooperation with Federal agencies, state and local governments, and industry, will develop and implement innovative partnership arrangements.

The Plan emphasizes the need for market-driven solutions that address commercial as well as government needs for launch vehicle development and infrastructure improvements. It identifies industry preferences for anchor tenancy, termination liability, and public-private partnerships (especially R&D limited partnerships) as the most effective measures to attract private capital. The Plan also discusses loan guarantees, tax deferments, exemptions, and credits, and a range of innovative partnership options such as consortia, space service brokerages, leveraged foreign investments, contracted partnerships, and government prizes.

The Plan notes the government's intention to continue the interagency process involving DOT, DOC, DoD, and NASA that was initiated under the NSTP. DOT and DOC will continue to support the U.S. Trade Representative in negotiating, analyzing, and monitoring commercial space launch trade agreements with countries with economies in

transition, and to participate in the Working Groups on Information. The Working Groups are chaired by DOT and include representatives of DOC, the Department of State, and other agencies. They assess launch markets (supply, demand, bids, contracts, prices, terms, and conditions) and monitor compliance with the space launch trade agreements.

The Implementation Plan concludes by noting that achieving its goal of a dominant market share for the U.S. space launch industry will require a significantly more internationally competitive U.S. launch industry, and that it will also require cooperation between the private and public sectors to develop new or improved launch vehicles and infrastructure.

The Reusable Launch Vehicle Program

The Reusable Launch Vehicle (RLV) Program is the high-risk portion of the National Space Transportation Policy's launch vehicle development plan. Its goal is the demonstration of technologies for a vehicle that will provide "routine and affordable" access to space. This vehicle should achieve launch costs that are about one tenth of current prices or about $1000 per pound to low Earth orbit. It should also provide "airplane-like operations" that allow flexibility of the sort expected in aircraft operations but not yet seen in launch vehicles and spacecraft.

The RLV program includes three different flight vehicles as well as a series of ground-based technological demonstrations. These three vehicles are the DC-XA, the X-33, and the X-34. Each of these attempts to explore a different aspect of the technology and operations envelope in which an RLV would function. It is through these practical demonstrations that the government and its industry partners hope to enable the private commercial development of an RLV to serve as a next generation launch vehicle and possible shuttle replacement.

The RLV program has a strong commitment to the goal of commercial development and operation of reusable launch vehicles. OCST is participating in the RLV program to aid in achieving this goal. Frank Weaver, the Associate Administrator for Commercial Space Transportation will serve on the Source Selection Board that convenes in May for the X-33. OCST is also represented on the non-advocate review board that is meeting through the procurement process to ensure that program deadlines, performance standards, and budgets are effectively addressing the long-term goals of the program and that the program continues to attract the appropriate level of private sector involvement. In addition, the OCST staff is working with NASA, DoD, the Department of Commerce on other aspects of the program to help ensure that commercialization goals are met.

DC-XA

The McDonnell Douglas Delta Clipper Experimental (DC-X) was a non-orbital technology demonstrator for initial aspects of a single-stage-to-orbit launch vehicle. It first flew in August of 1993 as a Ballistic Missile Defense Organization project. Following a series of eight test flights it was turned over to NASA on July 7, 1995 for use in the RLV program. The DC-XA was produced by replacing a number of the original DC-X components with new components testing various X-33/RLV technologies. Chief among these replacements were an aluminum-lithium oxygen tank, a graphite composite hydrogen tank, and a graphite composite intertank between them. Such lightweight structures are required if the RLV is to succeed and they will be proven on the DC-XA in time to incorporate them in the X-33 technology demonstrator.

X-33

The X-33 is the linchpin of NASA's RLV program. It will demonstrate the technology necessary to produce an operational RLV. It is intended to reduce the risk of developing that RLV to the point where it can be done commercially without further government aid.

The X-33 Program is unique in that it is jointly funded by government and industry. NASA is

requiring substantial financial expenditures by its industry partners. NASA is also acting as a contractor to industry and is including in the X-33 program government agencies that are responsible for commercial aspects of space, such as OCST. The X-33 program is an organizational, as well as a technological, demonstration. If it succeeds it will have strong implications for the future of government/industry relationships in aerospace.

Proposals for X-33 are due on May 13, 1996. The Source Selection Board for X-33 proposals will convene to begin evaluation, and will include experts who can assess the commercial and competitive aspects of the proposals as well as their technical quality. Frank Weaver, Associate Administrator for Commercial Space Transportation of the Federal Aviation Administration, will serve on the board, as will Keith Calhoun-Senghor, Director of the Office of Air and Space Commercialization of the Department of Commerce, and other government and industry experts.

The X-33 program consists of three phases. Phase I (the initial design work) is nearly complete. Phase II proposals are due on May 13, although firms may submit additional technical information through June 3, 1996. Phase II will involve the selection of one team's design for construction and flight testing; this decision is expected by July, 1996. Once the X-33 vehicle is completed NASA plans a series of up to 15 flights between March and December of 1999 to prove the RLV concept. The program objective is to sufficiently demonstrate RLV technologies and capabilities with these flights so that industry will continue with Phase III and develop an operational RLV without further government support.

The three current participants in the X-33 program are:

- Lockheed Martin with a vertical takeoff/horizontal landing wingless lifting body design. This design also makes use of innovative aerospike engines (currently involved in an SR-71 based test program).
- McDonnell Douglas/Boeing with a larger version of the DC-X's basic configuration that will takeoff vertically and land vertically.. In mid-March of 1996 Boeing reduced its involvement in this design partnership and may not take part in the X-33 construction phase at all.
- Rockwell International with a winged vertical takeoff/horizontal landing vehicle vaguely resembling the shuttle orbiter (also a Rockwell design) but of considerably more advanced design.

X-34

The X-34 program is currently aimed at providing a relatively near-term testbed technology demonstration vehicle for X-33 technology, with a NASA investment in the range of $60 million. The program is using a very flexible procurement mechanism, a NASA Research Announcement (NRA), to enable proposing firms to specify the project structure, the relative investments of NASA and industry, development milestones, and incentives. The first round of X-34 proposals is due by May 10, 1996.

The NRA replaces an earlier arrangement that was intended to produce an operational commercial launch vehicle, rather than the technology testbed currently planned. The vehicle was to have been a reusable suborbital stage with an additional stage to propel a payload into orbit. Use of the X-34 was to have provided experience in the operation of a reusable launch vehicle that could be used in the development of the X-33. (Orbital Sciences Corporation (OSC) and Rockwell International were chosen in March 1995 from three bidders to develop the X-34. In February of 1996, however, Rockwell withdrew from its partnership with OSC and OSC subsequently withdrew its X-34 bid as being unprofitable to operate as a commercial launch vehicle.)

The Evolved Expendable Launch Vehicle Program

The Evolved Expendable Launch Vehicle (EELV) Program is the lower-risk development program

coming out of the NSTP. It is run for the Department of Defense by the Air Force and is intended to produce an improved launch vehicle family. EELV is expected to cut launch vehicle life cycle costs by 25 to 50 percent through increased production rates and decreased launch overhead. EELV will use existing technology or components in order to reduce cost, time, and development risks.

Unlike the RLV program (in which the ultimate vehicle size and design is left up to industry) the EELV program is intended to fill current design slots. The Atlas, Delta, and Titian IV ELVs currently used by the Air Force will be replaced by the results of the EELV program.

While launcher classes to be filled are not subject to contractor choice, almost everything else is. The four contractors, Boeing, McDonnell Douglas, Alliant Techsystems, and Lockheed Martin all have very different approaches to the design of a EELV:

- Boeing is developing a design in which space shuttle main engines are used in a reusable propulsion module and are recovered after launch.
- McDonnell Douglas is studying a Delta 4 configuration as a candidate; Delta 4 would combine the planned Delta 3 cryogenic upper stage with a new booster.
- Alliant Techsystems is planning to use a modified Ariane V core vehicle that will be built in the U.S.
- Lockheed Martin has selected the RD-180 Russian derivative as the baseline engine for its EELV design.

The teams are currently involved in a 15 month, $30 million concept validation phase of the EELV program. This will be followed by a 17-month pre-engineering and manufacturing development phase in which two contractors will compete and two will be dropped. Finally, the winning contractor will receive an estimated $1.5 billion contract to provide launch services over an eight year period. The contractor will be expected to make an initial launch of the light lift vehicle around the year 2000 with the first medium lift vehicle around 2003 and the first heavy lift vehicle around 2005.

Highly Reusable Space Transportation Study

Finally, NASA's Office of Space Access and Technology is looking toward launch vehicle evolution beyond EELV and RLV. The Highly Reusable Space Transportation (HRST) project addresses the long-term challenge of reducing space launch costs to approximately $100 to $200 per pound payload to low Earth orbit. The HRST program consists of industry-identified technology research and development projects with relevance to

identification and definition of new concepts for civil space activities across the full spectrum of NASA transportation interests. The program is intended to support efforts to identify, define, and analyze innovative new concepts and to perform necessary laboratory scale experiment studies to validate physical performance characteristics for these concepts. NASA plans to issue a Cooperative Agreement Notice on or about April 5, 1996. Receipt of proposals is planned for on or about May 6, 1996.

APPENDIX