

EELV Program — An Acquisition Reform Success Story

Program Provides a Key to Future Military Success

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As technology has advanced, the U.S. military has come to depend on it more and more. This is especially true when launching satellites and using the information they provide for planning and performing operational missions. Whether using the Global Positioning System, hooking up secure satellite communications, or checking weather images, clearly the military's need for information provided by satellites will only increase into the future.

"By fully integrating space capabilities into military operations, combatant commanders are better able to tailor their campaign planning and operations to more effectively employ available forces and achieve objectives at the least risk and cost," stated former Secretary of Defense William Perry in his annual report to the president and Congress in March 1996. Every time the Air Force launches an expendable rocket, a satellite is placed in orbit to augment or improve one of its many functions — at no small expense to the taxpayer. The Evolved Expendable Launch Vehicle (EELV) program was conceived to ensure these satellites reach their target on time, on budget, fully operational, and at 25 to 50 percent less cost than current rocket systems.

An Acquisition Category Level ID program, EELV is being developed using the

latest acquisition reform initiatives to drive down the cost of space launch without losing the capability of today's expendable launchers. Nearly all Department of Defense satellites are launched using Titan, Atlas, and Delta rockets, the cost of which can be close to that of their payloads.

Several programs designed to reduce these costs preceded EELV, including the Advanced Launch System program (1987-1990), the National Launch System program (1991-1992), and the Spacelifter program (1993). Each provided valuable technical data but failed to fully address the nation's space-launch needs for a variety of reasons (Figure 1).

Following the cancellation of Spacelifter, with space-launch costs still rising and no solution to the problem, Congress requested a Space Launch Modernization Plan from DoD. Subsequently, Air Force Lt. Gen. Thomas Moorman, with participants from the military, civil, industry, and intelligence communities, led the Space Launch Modernization Study in 1994. Of the four proposed approaches to lowering the cost of space launch, the Air Force budgeted to support the second option — evolve current expendable launch systems.

"This program [EELV] has tremendous potential benefits for the country. We will secure low-cost, reliable space ac-

cess for the nation and the military, and we can dramatically expand key areas of the aerospace industry as these launchers are made available for international use," said Dr. Sheila Widnall, former Secretary of the Air Force.

Today, Preliminary Design Reviews are complete and Critical Design Reviews are less than three months away. A tremendous acquisition reform success story, the EELV program has been honored with the DoD Value Engineering Award, the U.S. Air Force and Air Force Materiel Command Strategic Acquisition Reform Awards, the U.S. Air Force and Air Force Materiel Command Outstanding Team Contribution To Competition Awards, and the Federal Executive Board Distinguished Public Service Team Award. EELV is also a nominee for the Packard Award, the Welch Award, and the U.S. Air Force Organizational Excellence Award.

Up, Up, and Away

The EELV system includes medium- and heavy-launch vehicle variants and associated launch pads, processing facilities, and control systems. Navigation, intelligence, weather, communications, civil, and commercial satellites will be launched from Cape Canaveral Air Station, Fla., and Vandenberg Air Force Base, Calif., beginning in 2002. The system relies heavily on heritage design from current Titan IV, Titan III, Atlas II,

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and Delta II programs including manufacturing techniques, structures, avionics, and propulsion systems. The system will deliver payloads to geosynchronous, geosynchronous transfer, low earth, semi-synchronous, and polar orbits, as well as provide the capability to deliver exploration satellites to interplanetary orbits. These missions will be launched with a 98-percent design reliability and within 10 days of the scheduled launch date. The system incorporates standard payload interfaces and standard launch pads to reduce costly payload-to-launch vehicle and launch-vehicle-to-ground integration activities. In the event of an urgent military need, an EELV can be "called-up" to launch certain pre-integrated payloads within 45 days of notification by the government.

An Effective Strategy

Using a rolling downselect approach, the development program began in August 1995 with a competitive award of four contracts.

The development program is comprised of three modules: Low Cost Concept Validation (LCCV), completed in November 1996; Pre-Engineering and Manufacturing Development (Pre-EMD), completed in July 1998; and Engineering and Manufacturing Development (EMD), which began in October 1998 and is scheduled to be completed in October 2002. Along with the EMD contracts, Initial Launch Services (ILS) contracts were awarded for launching government payloads from 2002 – 2006 (Figure 2). Because of the burgeoning commercial-launch market, the EELV program office revised the acquisition strategy in November 1997 to allow up to two EMD and ILS contractors, encourage contractor cost sharing, maintain competition for the life of the program, and leverage the rapidly growing commercial launch market.

In May 1995, Alliant Techsystems, Boeing Defense and Space Group, Lockheed Martin Astronautics, and McDonnell Douglas Aerospace were each awarded \$30 million contracts for LCCV and took their designs through Preliminary Design Review. Of the four, Lockheed Martin



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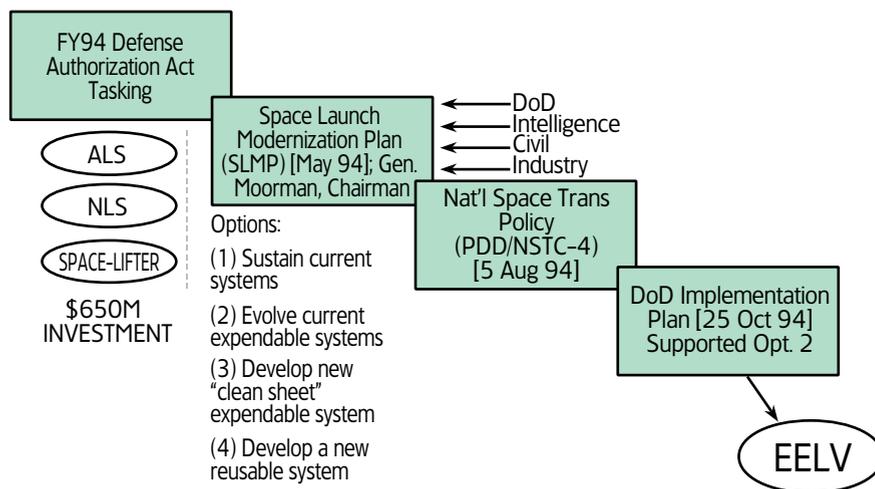
Astronautics and McDonnell Douglas Aerospace (now a wholly owned subsidiary of The Boeing Company) were selected to continue and were each awarded \$60 million Pre-EMD contracts (Figures 3 and 4). Both contractors held a Downselect Design Review in February 1998 followed by release of the Request for Proposal for the EMD and ILS contracts in June 1998 and award of the contracts in October 1998.

In EMD, contractors will complete a Tailored Critical Design Review, establish manufacturing infrastructure, construct and activate launch sites, and complete launch-vehicle development. Concurrently, mission integration activities and analysis will be initiated to support the 2002 – 2006 ILS launches.

Acquisition Reform Initiatives — Cornerstone for Success

Throughout the rolling downselect, acquisition reform initiatives were the cornerstone for success. EELV was initiated with a streamlined chain of command by identifying a single program manager with the responsibility, authority, and accountability to execute the program. Only the system program director, program executive officer, and service acquisition executive are required to execute the program. Also initiated at program conception was a Single Acquisition Management Plan (SAMP) that streamlined routine acquisition documentation by including the Integrated Program Assessment, Acquisition Plan, Acquisition Program Baseline, and Fixed

FIGURE 1. Background



Price Determination in one single document.

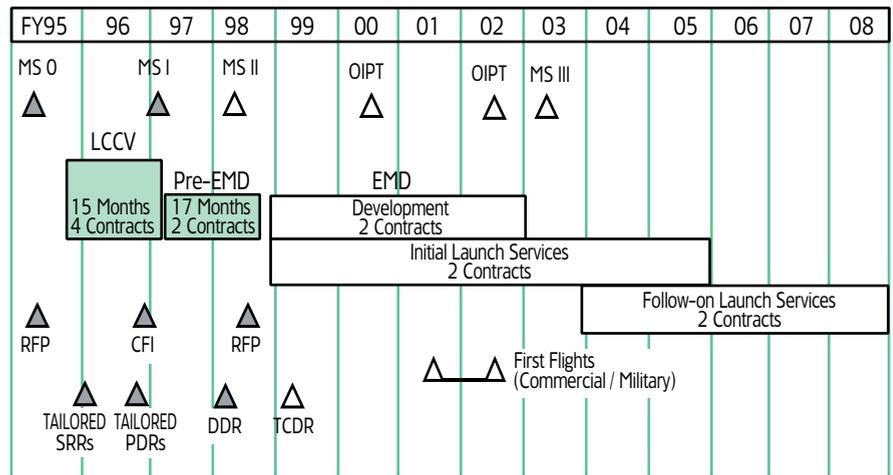
The SAMP was agreed to by acquisition, test, operational, and Pentagon leadership, including the Air Force Operational Test and Evaluation Center (AFOTEC), Air Force Space Command, National Reconnaissance Office, and Under Secretary of Defense (Acquisition and Technology).

To streamline interaction with contractors, the EELV program office is limited to 106 workers composed of service members, DoD civilians, and support contractors. All functions, including engineering, contracting, program control, contract management, administration, and computer support are executed by the 106 people assigned to EELV. This is a significant departure from the large program offices that have traditionally supported military-launch acquisition. This limited manpower – by design – ensures the government technical team members focus on critical, high-value contractor processes and procedures. The limited size also reduces program costs and duplication of effort.

Minimizing contract requirements for deliverable data items further enhances efficient interaction with the contractors. Only 15 deliverables were required during LCCV and eight in Pre-EMD. No deliverables are required on the EMD and ILS contracts. Instead, contractors are required to provide electronic access to key data such as specifications, test plans, vehicle-flight data, technical-performance measures, system security management plans, and payment history. By eliminating deliverables, contractors are free to choose the format that most effectively supports managing the program. Electronic access gives the government real-time insight, improved communication, and reduces overall program costs.

Recognizing that contractors often have more cost-effective solutions to technical issues than the government, compliance with military specifications and standards is not required, giving contractors maximum control and flexibil-

FIGURE 2. EELV Program Schedule



ity for meeting the system’s Key Performance Parameter (KPP) requirements of mass-to-orbit, reliability, and standardization. KPPs are documented in the System Performance Requirements Document and are specified at a high level to allow contractors the freedom to choose the path for meeting those requirements. Program office insight, through participation on contractor IPTs, enables government technical teams to evaluate the standards and specifications chosen for use in design, test, and manufacturing.

Use of evolved and commercial off-the-shelf components is encouraged to incorporate lessons learned from past successes (and failures) while minimizing development costs. To further support the goal of reducing space-launch costs by 25 to 50 percent, contractors are challenged to minimize Material Review Board (MRB) activity that traditionally requires significant government and contractor involvement in accepting reworked and out-of-specification hardware. The ultimate goal is elimination of MRBs, and the associated review teams, after the program has entered production.

Teamwork is a Winning Concept

During each phase of the program, dedicated teams of government personnel are assigned to work with contractors on technical, cost, and contractual issues. These teams are referred to as the Integrated Product Teams (IPT). A typical IPT consists of six military or DoD

civilians and three Federally Funded Research and Development Center members from The Aerospace Corporation. These IPTs are the primary interface to the contractor, ensuring issues are given appropriate attention by government and contractor personnel.

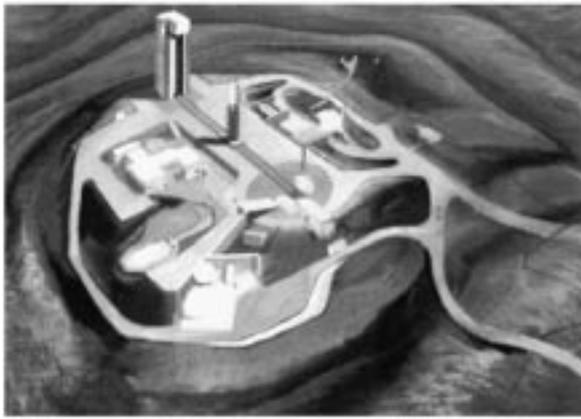
The core of the program office is organized along traditional functional areas of operation. Program control, contracting, vehicle development, and systems engineering teams focus on ensuring requirements are defined, funding is in place, and contracting activities are properly planned and executed. While these core team members interface with all contractors, dedicated IPT members are restricted to interfacing with the contractor to which they are assigned.

The IPTs focus on gaining insight – ensuring government requirements are being met and staying abreast of design and management activities by attending contractor meetings and reviewing plans, reports, and specifications. To accomplish this mission, technical advisors from the core team are employed extensively. IPTs brief the status of the contractor’s performance to the program director every month.

EELV IPTs — Small, But Experienced

Because the System Program Office (SPO) is capped at 106 people, the IPTs are small but staffed with experienced personnel. Planning, use of experienced advisors, and help from other govern-

FIGURE 3. **EELV System Concept (Lockheed Martin)**



VANDENBERG AFB, CALIF. — VAFB SLC-3W



CAPE CANAVERAL AIR STATION, FLA. — CCAS LC-41

ment agencies aid greatly in implementing acquisition reform in EELV.

In general, only senior- and mid-level captains and civilians are employed on the IPTs, most with prior SPO experience, enabling problem resolution at the lowest levels and in a timely manner. Each IPT member is responsible for different technical areas and ensuring adequate coverage of meetings, document reviews, and test events. Dedicated IPT members spend the majority of their time at contractor meetings, listening to contractor discussions of verification events, analysis, trades, and configuration changes. As document deliveries, meetings, and tests are scheduled, IPTs request support from the core team of advisors to gain additional insight in a technical area.

The Aerospace Corporation is the technical backbone of the program, having been involved in the space-launch community for over 37 years. Many of the same Aerospace technical advisors that helped shape today's Atlas, Delta, and

Titan rockets bring that experience to the EELV program. Experts in structures, avionics, software, site activation, facilities, propulsion, reliability, mission performance, guidance and controls, and mission integration are available to assess contractor performance and report issues to the IPTs. Lead engineers in key



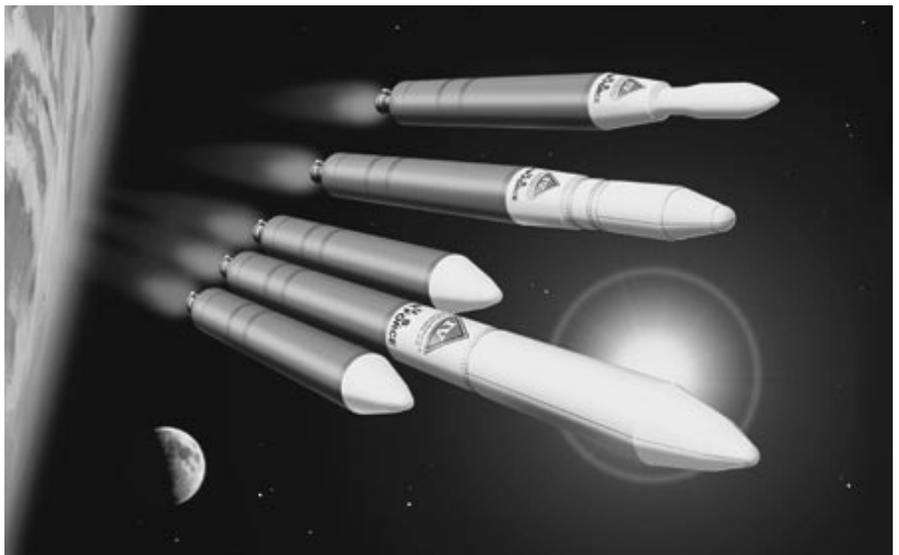
positions are assigned directly to the SPO, with the remainder of the Aerospace Corporation support being drawn from its large, matrixed engineering organization.

While SPO membership is limited to 106 members, there is no limit on the number of people who can help from supporting organizations. Defense Contract Management Command technical personnel supplement the IPTs by providing experts in software, manufacturing, and structures. AFOTEC and specialized Space and Missile System Center Test and Evaluation teams provide additional test support, while Air Force Space Command assigns one officer to each contractor team to clarify requirements and work launch-site issues. These extended team members enable maximum insight without increasing total SPO manpower.

A Working Relationship

The government IPTs are organized to parallel the contractor's organization. Each Air Force counterpart is responsible for forming the government team, clarifying requirements, pulling together technical evaluations, reporting status to the program director, and providing feedback to the contractor. The Aerospace Corporation is responsible for reviewing designs, analysis, and plans and reporting their assessments to the Air Force team leader. The contractor's responsibility includes ensuring the

FIGURE 4. **EELV System Concept (Boeing)**



government has full access to meetings, documents, and events pertinent to the development of the system.

The parallel contractor and government team organizations are part of a larger government focus to make the best use of detailed technical activities in which the contractor regularly engages as the designer of the system — not to create a separate government review process. Because government IPTs are aligned with contractor teams, the process of gathering regular insight into the contractor's system is a natural one. On the surface, this method of government participation may not appear to be different from historical methods; however, on EELV, the contractor determines what meetings are needed, and the government attends rather than organizes or chairs the meetings. This approach supports EELV's acquisition reform initiatives to focus the government on defining requirements, while the contractors focus on meeting requirements.

One of the fundamental rules of engagement of contractor interaction, and probably the most constraining for the technical community, is the restriction on "coaching." As designs evolve and choices are made, often different technical opinions surface between the contractors and the government. As part of EELV's acquisition reform initiatives, the technical community has been restricted from solving the contractors' technical problems. This ensures the responsibility for design remains with the contractors and frees up program office resources to participate in an unbiased evaluation. This ground rule also enables the contractors' creative-design processes to occur. However, the government does make available to all, the results of research and development work done at Air Force laboratories and other sites, which may help the contractors with technical problems. In fact, during LCCV, the SPO sponsored several technical fairs and made visits to all Air Force laboratories and NASA centers to ensure all EELV competitors had access to the latest information and facilities. This EELV acquisition reform approach achieves acceptable technical solutions, but at times the government team

endures frustration while the creative design process runs its course.

Maintaining Influence

Although restricted from suggesting technical solutions, the government retains influence in the design process through continuous risk evaluations and periodic reports to the program director. As contractors make decisions, each government IPT member and Aerospace functional expert stays in touch with the configuration of the system and continuously evaluates the approach. These risks are folded into a monthly briefing by the government IPT to the system program director that gives a "slice-in-time" view of the contractor's performance. Included in the briefing are design changes and contractor-generated system metrics with current predictions for mass-to-orbit, weight, reliability, operability, specification completeness, and software progress. In addition, IPTs brief all pertinent issues associated with the contract, including problems the government needs to solve. The overriding criteria are whether or not the contractors are meeting the government requirements. Only when they are not does the government intervene.

The effectiveness of the monthly briefings is due to the government's close relationship with the contractors. The IPTs work closely with contractor counterparts to build the briefing, ensuring that as the technical evaluation of the system is updated and reported on, the contractor is fully aware of government concerns. Frequently, government concerns are addressed before it becomes necessary to report to the program director. Occasionally, a risk is not sufficiently addressed, and the program director elects to step in and discuss the situation with the contractors. At this time, a mutually agreed-upon Risk Reduction Plan is developed and tracked by both the government and contractors. This close coordination on technical evaluations is key to the successful relationships enjoyed by EELV program members.

Future Challenges

One challenge EELV faces in the coming years is maintaining an adequate ex-

perience level with reduced manpower. Most of the experts involved have been working with current launch systems for many years and are comfortable in a more detailed information environment than EELV's small program office is able to manage. Without time to review and analyze the details, experts may lose the technical depth which DoD depends on.

Current Air Force launch programs depend heavily on technical depth to help identify system flaws that could result in loss of a vehicle. Unfortunately, failures are a reality of the launch business, and though EELV contractors produce world-class vehicles, some will fail over the course of the program. These failures and other developmental setbacks that occur will challenge the program to maintain the focus on *insight* rather than reverting back to traditional *oversight*.

EELV — Cost-Effective Way to Help Improve the Military

Space assets provide navigation, communications, reconnaissance, and weather data critical to modern military operations; now, with EELV, the ride to orbit will cost 25 to 50 percent less than current systems. Because EELV borrows from significant technical advances made on previous programs and employs an aggressive acquisition reform approach, the system is within three months of Tailored Critical Design Review and within two years of first launch. Along the way, acquisition reform has been the cornerstone of success, lighting the way for trusting partnerships with launch-vehicle contractors. In the words of Air Force Gen. Howell M. Estes III, former commander in chief, U.S. Space Command, "The time has come to address, among warfighters and national policy makers, the emergence of space as a center of gravity for DoD and the nation. We must commit enough planning and resources to protect and enhance our access to, and use of, space." EELV is one significant step forward in addressing the nation's space-launch needs.

Editor's Note: To learn more about the program, please visit the EELV Web site at www.laafb.af.mil/SMC/MV/eelvhome.htm.