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Paper Session I-A - Changes and Challenges in Air Force Approaches to Space Launch Procurement

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Abstract

Changes and Challenges in Air Force Approaches to Space

Launch Procurement

U.S. Air Force approaches to meeting military space launch needs have undergone significant changes over the past 15 years, evolving definitely, and at times, fitfully. But the future approach remains undefined and recent events have called into question previously accepted basic assumptions.

This paper briefly reviews the Air Force's past approach to space launch procurement, how and why it changed. The paper describes the current approach planned by the Air Force and new dilemmas associated with it.

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Changes and Challenges in Air Force Approaches to Space

Launch Procurement

By Robert Wayne Eleazer, III

U.S. Air Force approaches to meeting military space launch needs have undergone significant changes over the past 15 years, evolving definitely, and at times, fitfully. But the future approach remains undefined and recent events have called into question previously accepted basic assumptions.

When space launch programs began in the late 1950's the Air Force employed a procurement approach driven both by the R&D nature of the new systems and by traditional aircraft-style contracting methods. The booster airframes were procured under one contract, the engines and rocket motors under other contracts, and avionics under others usually all from separate contractors.

Under this approach, government design control of the hardware was nearly total and close oversight of contractor activities was the norm. Even relatively minor design changes could not be made to flight hardware, software or even Ground Support Equipment (GSE) without the approval of the Air Force System Program Office (SPO). Engineering Change Proposals (ECPs) were used to control the configuration of the hardware, and Independent Verification and Validation (IV&V) reviews confirmed system configurations. The SPOs conducted their own evaluations of contractor actions and recommendations, and the Aerospace Corporation not only supported the SPO activities but did first hand examinations of hardware and even conducted

modeling and simulations in such arcane and esoteric areas as rocket engines and guidance software.

At the launch base, additional Air Force contracts supplied base support and range services and the Air Force launch organizations, acting as the SPOs' field arms, supplied their own oversight and control as well as complete safety oversight of all phases of processing and launch activities. Although occasionally chafing under the Air Force-imposed restrictions and controls, the major space contractors accepted the management approach and adapted their own organizational structures to handle the implications.

This management approach was pretty much the way it was for approximately twenty-five years, until in the mid-80's two new factors forced a change. The first was the down-directed dominance of the Space Shuttle for launch of Air Force systems, the second was the Commercial Space Launch Act of 1984.

In the early 1970's it became official Federal Government policy that the Space Shuttle would be used for all U.S. Government missions and that Shuttle launch services would be offered at discount prices to commercial satellite companies. This policy effectively put expandable boosters on notice that they would be going out of business; it did not appear there were enough commercial missions to support a separate launch industry. Less obvious was the fact that the Air Force would have to devote large amounts of technical manpower to supporting Shuttle operations, in particular at Vandenberg AFB, CA. When the Air Force made the decision in 1984 to procure ten heavy lift expendable launch vehicles to complement the Space Shuttle's capabilities, a new, streamlined contracting and management approach was needed; this effort became the Titan IV program

The Commercial Space Launch Act (CSLA) was another factor the Air Force had to consider. Previously, launch of commercial payloads had been accomplished under existing government contracts with the launch companies. The CSLA put an end to this practice; companies would handle such work directly. The difficulty was that the companies were not set

up to do so. There existed no history of commercial relationships between the booster manufacturers and the suppliers of engines and other components; the companies traditionally had managed their interface with the Air Force rather than every aspect of the entire program. In essence, continuance of the traditional Air Force SPO management techniques were seen as an impediment to U.S. companies' ability to serve the commercial market.

What made competitiveness so urgent was the emergence of Arianspas' Ariane launch vehicle as serious contender in the international commercial marketplace. In the mid-70's experts sneered at the Ariane as hopelessly behind the U.S. capability, even if it worked. But the government-enforced abandonment of future U.S. expendable systems gave Ariane an opportunity, and the French company fully exploited it. The loss of the Space Shuttle Challenger in January 1986 gave Arianspas a foot in the door.

All of these factors drove the Air Force to a new approach for the Complementary Expendable Launch Vehicle (CELV) even before the Titan IV booster was selected to fill the need. A prime contractor approach was chosen, with component and subassembly acting as suppliers to the prime rather than as associate contractors under an Air Force SPO. One contract would be issued, to include not only production of all hardware, but its integration, launch operations, and construction of launch facilities. Furthermore, to help offset the decreased Air Force control and oversight a concept called Total System Performance Responsibility (TSPR) was developed. Essentially, TSPR gave the prime contractor the responsibility for making it all work rather than the government SPO.

In the case of the Titan IV program, the prime contractor approach was seen as essential to posturing U.S. firms for commercial competition, but also had the theoretical advantage of reducing Air Force program office manpower requirements. All of this occurred at a time when the military build-up of the 80's was making increasing demands on Air Force manpower.

However, for Titan IV the Air Force also essentially reinvented an old and largely discredited procurement approach: Total Package Procurement (TPP). TPP was used on the C-

5A and AH-56 programs in the 60's and left everyone involved with a bad taste in his mouth. Nonetheless, by buying Titan IV as a package, rather than in individually evaluated phases, what was essentially TPP was used once more. The reasoning was basically the same as used in the C-5A program; the technical challenges were relatively minor and industry could be trusted to handle things with less government involvement.

Following the loss of the Challenger, the prime contractor concept was applied to procurement of the boosters used to replace the Space Shuttle for Air Force missions. In fact, there was a distinct evolution to the Air Force approach. The Titan II and Delta II used the same prime contractor and TSPR approach as Titan IV did. The Atlas procurement to support launch of Defense Satellite Communications (DSCS) Program satellites went one step further, with no procurement of launch hardware as such; instead launch services were procured - essentially a delivery service to orbit. For the last of the procurements, the small launch vehicle contract which led to the Pegasus, the Air Force took a further step back and was less involved in hardware design and operations than ever before. Despite the pro-active stance taken by the Air Force, this transition was not without controversy. By 1989, elements in the launch industry were voicing their opinion that Air Force contractual control was still too extensive and led to greatly increased costs. In response to congressional interest in the topic, including proposed legislation that would have mandated commercial-style procurement, the Air Force indicated that it envisioned a spectrum of procurement practices. The Air Force stated that high value and nationally critical missions would be subject to a greater degree of control than less critical payloads, with low-cost R&D scientific missions such as those on Pegasus receiving the least degree of oversight. There would be no universal one-size fits-all approach to launch capability procurement.

As for Titan IV, the post-Challenger challenges imposed on the program probably invalidated the program's Total Package Procurement approach. The program had to almost instantaneously meet an enormous increase in number and types of payloads, missions that had

been pulled off of the Space Shuttle. The huge increase in types and numbers of missions (over 400%) enormously complicated the program, but it was too late to return to the more traditional approach.

By the late 1980's a new factor had to be taken into account for launch procurements: "Operationalization" of Air Force space launch capabilities as advocated by Air Force Space Command. Space Command took over the launch bases at Cape Canaveral and Vandenberg in October 1990 and began to advocate procurement, operations, and logistics support approaches which would "normalize" launch operations, using Air Force aircraft operations as a model. Even replacement of contractor launch crews by military launch teams was suggested.

The net result of all of these conditions, factors, and initiatives was a major clash of concepts. Air Force Space Command wanted greater control and involvement in launch operations. Commercial launch firms generally wanted less Air Force control, although their opinions varied as to how urgent a concern this represented. The TSPR concept was integral to the prime contractor approach, but was disliked by Air Force Space Command due to the requirement to vest greater responsibility in the private firms and less in the Air Force launch organization. Congress generally still advocated more "commercial like" procurement and even imposed such an approach on NASA as part of appropriations legislation. And the Air Force SPOs had to figure out how to make everyone more or less happy and obey the law.

While these controversies raged, the U.S. Navy went a step beyond everyone else in the government and adopted a delivery to orbit approach for the Ultra High Frequency Follow-On (UFO) series of communications satellites. Rather than procuring the satellites and then depending on the Air Force to procure the required launch services, the Navy chose to procure the satellites on a "delivery to orbit" basis. The satellite contractor, Hughes, procured the launch services commercially in essentially the same manner as typically is done for commercial comsats. If the launch failed, the Navy would pay nothing, but government oversight designed to help ensure mission success would be greatly reduced as well. As the DoD lead for space launch,

the Air Force opposed the Navy's approach; among other things it would eliminate the bundling of procurements which could reduce procurement costs. The Air Force pointed out that the Navy approach was more costly than using an Air Force SPO, but would be cheaper if at least two launch failures occurred. As it turned out, the first Navy UFO mission did fail during launch. The Navy did not have to pay for the mission failure, but didn't get the services it desired, either. Subsequent UFO missions were successful.

Meanwhile, as all of the theoretical arguments were being tossed about, U.S. commercial launches grew in number, and in the mid-1990's first equaled and then passed government launches in annual rate. This was to have a profound impact on future government procurement approaches.

The Air Force started a new launch vehicle program to replace the cancelled National Launch System and Advanced Launch System; it was entitled Evolved Expendable Launch Vehicle (EELV). EELV started out as a program designed around the concepts of Operationalization and its logistics equivalent, Normalization, including increased involvement by military personnel, and with relatively little consideration given to commercial requirements. After much discussion at various levels in the Pentagon, there appeared to no real way to practically or legally incorporate uniquely commercial requirements into an Air Force program. But as the truth about anticipated commercial versus predicted military launch rates became known, it became obvious that the EELV program would not be successful in meeting Air Force space launch requirements unless it also was commercially successful.

In the fall of 1997 the Air Force suddenly announced some radical changes to the EELV program. There would be no downselect to one bidder; development of both the Lockheed Martin and Boeing designs would be funded. Furthermore, the Air Force would step back from direct involvement in EELV launch activities and allow the private firms much greater control and responsibility. This was a dramatic change in direction, but the attendant impacts were even more significant. The private firms would be given full responsibility for and exclusive rights to

all dedicated facilities. As time proceeded, the concept was further developed, and plans were made to phase out the Air Force launch squadrons, and dramatically reduce the available launch base and range services currently provided either free or at cost by the Air Force launch wings. Details are still being worked out, but it is obvious that the approach being spearheaded by the EELV program will define new ways of doing business for numerous aspects of launch operations and contracting. Even these radical changes potentially are merely the first step in eventually adopting a Delivery to Orbit approach for all missions, both government and commercial. One size fits all was back.

The latest concern that has been raised is reliability. What kind of success rate can be expected under the new commercial-style procurements? From the middle of 1998 to mid-1999, three out of four Titan IV missions launched failed, and these were procured under the original concept which reduced government oversight but which is still far beyond the insight approach of EELV. Over the same period of time, the first two Boeing Delta III missions failed, as did a Lockheed Martin Athena launch. The Delta III and Athena are boosters developed as purely commercial ventures with less government involvement than any other current vehicle; as such they herald the future. Six failures in a year's time is not only disturbing, it is unprecedented since the R&D days of the 1960's. In contrast, during the 1985-86 timeframe a total of only four launch failures caused near-panic in the launch industry. It has been assumed that the demands of the commercial marketplace would drive the launch firms to attain equal or better reliability as achieved under close government oversight. This assumption must now be questioned.

One valid reaction after any such series of failures is to question the procurement methods used. Based on past experience, a typical response would be to increase oversight of the contractors, an approach which flies in the face of plans to reduce government involvement.

It would be easy to conclude that increased government oversight is required, but the recent failures don't necessarily support that conclusion. Government missions, with a degree of oversight in place, failed, as did commercial missions with no such external oversight. Certainly

the decreased government involvement planned for EELV must be called into question. Despite this, the return to the close control of ten years ago is probably not feasible for variety of reasons, the most significant of which is the reduced amount of skilled manpower available to the Air Force. The demands of worldwide deployments are stressing the Service's capabilities. Despite the acknowledged importance of military space capabilities, it would be very difficult for the Air Force to forgo missions in places such as Bosnia, Kosovo, and the Middle East in order to ensure the success of an industry in which it is a minority user. This situation is exacerbated by the congressional direction in the early 1990's to significantly scale back the Aerospace Corporation's manpower.

The Air Force now finds itself in something of a dilemma, partially of its own making and partially a result of a radically changed economic and international environment. What space launch procurement approach is optimum for either low cost or high confidence in mission success may well be irrelevant; the determining factor is what can be accomplished given capabilities, resources, priorities, and expectations.