AIAA-LA Section/SSTC 2003-7002

Los Angeles Section and
Space Systems Technical Committee

Responsive Financing: The Ultimate Oxymoron?

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1st Responsive Space Conference
April 1–3, 2003
Redondo Beach, CA

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ABSTRACT

Despite good intentions, our efforts to develop 'responsive' space systems have largely failed. A fundamental reason for this failure has been the limited attention given to the financial and budget planning required to move new space systems from concept to capability.

Public and private sector financing approaches have distinct strengths and weaknesses, but little attempt has been made to create financial structures that both draw on the strengths and mitigate the shortcomings in an integrated fashion. So-called public-private partnerships in space enterprises have usually avoided this issue entirely, with predictably negative results.

The author suggests that more intelligent public-private combinations can play a key role in creating responsive space systems, but that a new financial architecture is needed to enable them. Closer integration of government space agencies, aerospace industry and the financial community should be explored. The Department of Defense and NASA are committed to transforming their capabilities to meet new challenges and requirements; industry is ready to take on greater responsibilities, but the evolution of the underlying financial structure of space systems development and operations is a requirement that we must address.

INTRODUCTION

Our civil, commercial, and national security space enterprises are increasingly important to the well-being of our country. In ways both visible and hidden, our society depends on a robust capability to utilize the space environment. At the same time, the limits of our current systems are increasingly evident. In simple terms, today's space systems cost too much and take too long to build, are too difficult to operate, and are too prone to failure. If we are to truly expand our reach in space activities, future systems will need to be as different from today's as today's Boeing jetliners are from the DC-3, or today's automobiles from the Model T.

Of course, none of this is 'news'. From the beginning of the space age, government and industry have sought to develop better, more responsive systems. 'Responsive' is one of those fuzzy terms that most would agree is a good characteristic, but that is also difficult to define with precision. Indeed, it can mean several things depending on whether you are a developer, operator, or customer for those systems: shorter development cycles, greater opportunity for 'spiral' technology insertion, shorter mission planning cycles, greater operational flexibility and turnaround times, reduced mission and/or life cycle, improved operating margins and reliability, better alignment of user needs to the development process, etc. As used in this article, 'responsive' refers in some sense to all of these objectives.

Responsive space systems have been an objective of government and industry space program managers since the beginning of the space age. DoD's research laboratories, DARPA, and NASA spend billions of dollars each year to create and demonstrate the technology base necessary. However, while government and industry continue to define and refine future mission needs and the technologies and systems necessary to support them, relatively little, thought has been given to the evolution of 'financial engineering' that is necessary to achieve our objectives.

This is to the detriment of our aspirations, since financial resources are the most basic resource in our program equation. Capital is the basic input that we translate into people, technology and systems. Indeed, if we viewed the 'problem' as developing the most efficient and effective way to transmute cash into capability, we would probably be further towards our national security and space exploration objectives than we are today.

TWO FINANCIAL SYSTEMS

The public and private sectors comprise distinct systems for converting financial resources into responsive space capabilities. In both, the fundamental objective (at least in theory) is to maximize return on investment. In the private markets, investments can be approved, managed and evaluated on tangible metrics - profit and the creation of economic value. In public markets, return on investment is assessed in the less precise terms of national interest (broadly defined political and economic objectives) and mission success (meeting specific mission goals that contribute to the national interest).

Each of these environments has strengths for developing responsive space systems. The public sector process supports investment in long-range technology and systems whose 'business case' cannot be 'closed' in the short-term profit horizon of most private sector financing sources. A detailed legal and administrative structure for rigorous vetting of requirements, and a relatively transparent competitive environment help to ensure that the right systems are purchased, and that the best contractors are selected to build them.

The private sector's multiplicity of financial institutions and instruments, and its overall liquidity enable financing to be closely tuned to the risk profile of any specific venture, to raise capital quickly, to distribute financial risk, and also to terminate or redirect projects that are not meeting their financial objectives. The assumption of direct financial risk, combined with the potential for significant economic returns, creates powerful incentives for success and innovation.

However, each environment also has significant shortcomings, and empirically, these flaws have impeded the development of responsive space systems. The public sector environment is often ponderous in execution, deters system-level innovation, and tends to favor incremental over revolutionary change. It is inherently unpredictable because of the annual budget appropriations cycle, and the 'distortions' caused by political practices such as earmarking and other 'pork barrel' activities.

The private sector environment has problems of its own. Financial institutions are by nature risk-averse, 'skittish', subject to external shocks, and hesitant to consider illiquid investments with long-term payouts (no matter how large). It is also as wrong to speak of one 'financial community' as it is to speak of 'The DoD'. The private sector financial community comprises thousands of institutions with differing objectives, market positions, resources, skills, and knowledge of the aerospace arena. Choosing where to find capital is often as important as knowing how to use it. Further, despite their diversity, financial institutions can also be 'herd-like' in approach – novelty is risky, and few are willing to try something entirely different, especially if there is already a body in the road.

PUBLIC/PRIVATE PARTNERSHIPS

Since the mid-1980s, the United States government has sought to leverage the private sector via various types of public-private partnerships. There are a number of motivations for seeking out novel partnerships. Underlying the interest are two important changes in the aerospace landscape.

First, by the mid-1980s, the 'center of gravity' for space technology had shifted undeniably from the public sector to industry. Into the 1970s, the Air Force and NASA owned the majority of the intellectual and technological capital of the nation's space effort. Today, while government research labs continue to do world class basic and even applied research, few would dispute that industry now has the scientific, engineering and managerial capabilities to design, develop and operate space systems better than the government agencies that they support. A corollary motivation is the assumption that the public sector's space infrastructure could probably be developed more efficiently, at lower cost, if the financial risk/reward discipline of the private sector was encouraged. As a result,

'Commercial Space Policy' evolved through the 1980s and 1990s to (1) create a legal framework enabling private sector enterprise in space activities, (2) reduce or eliminate the potential competition between government-financed systems and privately financed space ventures, and (3) to enable the USG to take advantage of, and use, commercial space systems to pursue public sector space missions.

The results of this policy have been encouraging but modest. The most notable examples of success were the establishment of commercial launch services companies[2], the creation of Spacehab Inc.[3], and the launch and deployment of three commercial remote sensing satellite programs[4]. Unfortunately, the financial community sees none of these activities as a 'home run'; indeed some of have either entered, or are close to, bankruptcy. An even greater number of programs – notably the efforts by a large number of start-up companies to develop low cost small launch vehicles – never passed the concept definition stage because they could not attract private sector financing.

While these programs have all been innovative in terms of private sector participation, they have been relatively traditional in terms of financing structures. Private sector financing was committed by the sponsors, or raised in capital markets, on the basis of each venture's business plan. The revenues in those business plans relied, to varying degrees, on anticipated government usage. Thus, the anticipation of public sector procurements was used to collateralize private sector investments.[5] No real attempt was made to 'fuse' the business plans at the financial level, even though it was clear that such coordination was implicit in the use of the systems.

A second approach to public-private partnership is the use of 'hand-off' structures in which the government underwrites 'risky technology development' and the private sector underwrites 'operational systems' and recurring production for which the government is a principal, if not the primary customer. This was the model pioneered by Arianespace and Spot Image in Europe. The approach has a checkered record in the United States. NASA's X-33 effort was intended to lead to a technology demonstrator of sufficient fidelity to permit private sector development of a reusable, Single Stage to Orbit vehicle. Budget overruns led to a cancellation of the X vehicle demonstrator effort, and it was also questionable whether even a successful X-33 program would have been sufficient to pave the way for an operational Reusable Launch Vehicle (RLV). On a more positive note, the USAF and industry successfully executed a major upgrade to the nation's ELV fleet under the Evolved Expendable Launch Vehicle (EELV) program. However, the significant downturn in the commercial launch market has left the industry contractors financially exposed, and it is unclear whether their considerable investments will capture a reasonable return on investment. The USAF is now reluctantly providing additional funds to ensure that these new systems remain economically viable.

Once again, while these programs contemplated using both public and private sector financing, there was no attempt to integrate these sources of funding. In X-33, NASA funded Lockheed Martin under a traditional R&D effort (although Lockheed invested additional funds of its own); it would have been Lockheed's responsibility to develop a financing plan for an operational RLV. In the context of EELV, a more serious integration of private and public sector funds occurred, as the government's $500M payments covered specific elements of the EELV upgrades, while the contactors funded the balance from their own treasuries and external financing sources. However, the private and public EELV funds were never co-mingled; each was spent on discrete activities, and the contractors had to account for the expenditure of government funds per traditional FAR/DFAR requirements.

A third transition is now occurring that portends a new opportunity to push the envelope. It is, in

[2] These included the privatization/evolution of the Delta and Atlas ELVs, and the introduction of the Pegasus, Taurus, and LLV small ELVs.

[3] Spacehab designed and operates pressurized modules that expand the habitable volume of the Space Shuttle.

[4] These include the Lockheed/Raytheon venture Space Imaging; the Ball-led venture Digital Globe, and Orbital Science Corp.'s spin-off company OrbImage.

[5] This was perhaps most explicit in the case of Spacehab, which had to obtain insurance guarding against the risk of contract termination with NASA for utilization of the company's modules.

large measure, a continuation of the trend cited above – the continuing shift of capability from government to industry with respect to systems acquisition and operations. During the 1990s, as DoD and NASA budgets for RDT&E declined, so too did the NASA and DoD civilian workforce. Traditionally, civil servants have performed many of the tasks associated with system acquisition and management. In DoD, the civilian workforce has declined approximately 30% from its early 1990s levels. Of those that remain, a large and growing percentage are eligible for retirement. Now, with defense budgets on the rise again, there is no plan to rebuild the civilian workforce. Clearly, the growing gap between the size of the workforce and the size and complexity of the investment account budgets raises significant issues for system acquisition and operations management.

There are presently two responses. One is the growing use of Systems Engineering and Technical Assistance (SETA) contractors to provide program/contract management services on behalf of the government customers – in effect service as substitutes for the departed civil servants. Ultimately however, there are limits to the use of SETA contractors for such management functions, as they may not have the size or range of skills necessary to effectively play the role of 'smart buyer' for the services or products NASA and the DoD require. This is especially true as the technical complexity and pace of change accelerates. The second response is the transfer of so-called 'mission management' responsibilities to the prime and integration contractors. DoD has been experimenting with a number of new contractual relationships - Total System Performance Responsibility (TSPR), Prime Integration Contractor (PIC) and Lead System Integrator (LSI) are a few of the more recent. These contract structures are an attempt to assign industry greater responsibilities for such functions as requirements definition, architecture trades, life cycle cost analysis, life cycle support, and acquisition management. Unfortunately, innovative funding and financing structures have not been an element of these efforts.

It is unclear whether this latest wrinkle in USG systems acquisition will lead to greater changes in financing approach. At present, the answer seems to be 'no'. Industry is assuming broader acquisition management and mission definition responsibilities, but these are being funded through traditional contracting methods.

AN ALTERNATIVE FINANCIAL ARCHITECTURE

The preceding section is intended to show that there are several recurrent themes in our nation's attempts to develop responsive space systems:

- There is widespread agreement that responsive space systems are both desirable for current activities, and essential enablers for continued expansion of national security, civilian and commercial space activities;

- The private sector is becoming the dominant player in systems design, development and acquisition – both due to the evident transfer of technical expertise to the private sector, and due to the government's increasing need to rely on those skills;

- Although the public-private interfaces, relationships and responsibilities of these activities have often been extremely creative and nuanced, they have been the equivalent of 'pre-frontal lobotomies' in the financial realm. Public and private sector funds and financing responsibilities have been clearly parsed, creating two sets of (often incompatible) financial expectations, and two separate regimes in which financing barriers can subvert, if not entirely derail, a program.

It is the opinion of the author that the current public-private partnership structure cannot support the significant shifts in investment and operational relationships necessary to achieve truly responsive space systems. As noted above, the 'successes' of such partnerships have been limited to situations in which the new system was evolutionary/incremental in nature, and in which the existing market was considered mature enough to support private sector investment.

A key objective in future systems development should be a strategy to more closely integrate three factors: (1) the government's ability to fund non-profit precursor technology and demonstrations; (2) the government's ability to substantially lessen program risk through usage commitments, and (3) the private capital market's ability to structure more nuanced financing structures that match private capital to

risk profile and encourage a greater focus on system economics and responsiveness to market needs.

In contrast to much of the recent literature emphasizing that the solution lies in greater reliance upon the private sector, the author contends that the government should have the lead role in creating a new financial/investment architecture designed to meet national needs. It is time to acknowledge that as the leading consumer of space products and services, the government shapes not only the technology base, but also how the space industry and financial markets operate in public and private sector space efforts.

What follows are a number of suggested mechanisms to more effectively integrate public and private markets in the development of responsive space systems. None of the ideas presented below are novel; indeed the only thing that may be novel is the explicit recognition that a new financial architecture for space systems development is needed to cut the Gordian knot that is retarding the pace of innovation and system development. Rather, this collection of proposals is founded on an explicit admission that we should not expect the current contracting and financing approaches to yield more spectacular results than those that have (not) been achieved. Indeed, they may inhibit them. It also challenges senior government and industry officials to consider financial strategy as an enabling business process technology that is as important as technology and engineering development and management. Three related ideas are suggested:

- Create Public-Private Companies

Space systems generally take several years to develop and field, and may then be in operation for decades more. It may be that a significant fraction of the project's expenses must be committed before any revenue is received. This long time frame creates significant uncertainty and risk to private sector investors, and Net Present Value nightmares for those forecasting return on investment.

The traditional response to this has been to pay industry to develop those systems under traditional cost plus fee contracts. Such contracts have relatively low profit margins, but the financial risk to the company is low as well, so a low discount rate is applied.

A very different approach would be to commit government payments as paid-in capital to a new enterprise. This 'equity financing' would be used to fund the development of the target system or capability. The private sector partners would likewise take (much smaller) founding stakes. Usage of different classes of equity could yield differing levels of financial return. As the program matured, the new venture could tap additional sources of financing, and the government could, eventually divest its ownership stake, thereby recouping some fraction of its initial investment costs.

- Use Private Sector Capital Structures

In the commercial realm, a business venture will pass through several phases in which its financial requirements, total risk level, and reward profile shift dramatically. A wide range of financial institutions have emerged to support this life cycle: angel investors and venture capitalists for startups; 'mezzanine' and 'second round' equity sources for firms just coming to the market; private equity and debt markets for small, growth companies; and public equity and debt markets for mature businesses.

Within each of these categories there are various types of players, some willing to take higher risks for higher returns, others willing to accept lower returns for greater certainty. Financial instruments have been developed to support this diversity of risk-taking profile. Perhaps the best-known are mortgage securities and derivatives, where a bundled package of securities can be 'repackaged' into investment securities with a wide range of risk:return profiles.

Project financing for space ventures, especially for infrastructure missions, could be readily adapted to such structures, especially if the government actively participated as either an investor, or as a guarantor to financial instruments. For example, if the USG could participate as an equity investor in a project financing, with a separate class of stock designed to yield a lower rate of return (thereby enabling a higher rate of return to private sector investors). Once the project/program was operating, the government could divest or cede its equity position. Similarly, the government could agree to either underwrite or guarantee all or some part

of the project's debt financing (similar to 'Brady Bonds' offered for Latin American investments).

- Create 'Bankable' Usage Commitments

A key factor in securing financing at acceptable terms (whether equity or debt) is the purchaser's expectations regarding revenues of the venture. For the foreseeable future, the USG will be a major customer for many space ventures, and thus, the equity/debt purchaser will want some reasonable assurance that the government will in fact be a user of the system or product in which he or she is investing.

Current contracting practices are exceptionally hostile to 'bankable' government commitments, especially for ventures early in their development cycle. Termination for convenience is a standard clause of most government contracts. This is an acceptable feature of 'cost plus' contracts where the customer is effectively underwriting all risk, but is unacceptable to a private sector venture that would not have recourse to recover the funds they have invested in anticipation of *future* government contracts.

One critical issue here is the difficulty that the USG has in making multiyear commitments. The annual budgeting cycle makes it next to impossible for USG agencies to make bankable commitments (i.e. contracts that are sufficiently strong to be used as 'collateral' for raising equity of debt financing).

The simplest 'answer' to this problem is for the USG to fund a future commitment in the current year. This may prove impractical however, since it exacerbates any budget shortfalls or deficit calculations. Multiyear procurement agreements make sense once established, but creating a consensus for them is always difficult. One potential solution is to create a 'level of effort' account for innovative infrastructure. The operating assumption for this account would be that Congress and the Administration would permit the military services or NASA a greater degree of latitude in allocating funds within this account. The account itself would function as an incubator to mature programs into their EMD phase.

Another possible approach is to establish a government trust fund for high priority activities or missions. Space launch is an obvious candidate for such an effort. A trust fund established the government's legal obligation to pay specified budgetary obligations, but the liability associated with the agreement is 'scored' annually in budget terms. Thus, the expenses do not 'hit' the government until they are incurred, but the recipient can still rest assured that (assuming the terms of payment have been satisfied) they will receive payments.

The hard part in this approach of course, is establishing the trust fund to begin with. Congress and the Administration are understandably reticent to pursue this path, because it creates a non-discretionary obligation, and any attempt to establish a trust fund for, say, space transportation, would lead other industries to obtain similar treatment.

Nevertheless, the USG should consider whether a 'space infrastructure trust fund' is warranted. Given the criticality of space to our economic and military security, and the unacceptably slow pace of new system development over the past three decades, a strong case can be made for establishing such a mechanism.

CONCLUSION

The author believes that public-private partnerships must be viewed as an integral element to the development of responsive space systems. However, in contrast to traditional practice that government and private sector financing should be kept distinct, the author suggests a more radical proposition: that the USG government should consider an overhaul of the way that it finances space systems. Such an approach should acknowledge the growing role of the private sector in the life cycle of space systems development, the benefits that private sector focus on profit and innovation can have for current concepts such as spiral development and upgrade of systems, of the considerable power which the government has to alter the financing approach for space infrastructure and systems, and ultimately, of the limited success and diminishing returns of our current approach

Some of the actions required to implement the financial transformation outlined above would require legislative changes to effect, but other elements might be undertaken within the scope of existing laws, requiring only policy guidance to initiate. Such an approach could bring out the

strengths of both environments while hopefully minimizing their weaknesses.

The ideas presented above are not intended to be either exhaustive or even mutually consistent. Rather, the intent is to stimulate thought on the importance of financial structure as an enabler to more responsive space systems.