

A Space Frontier Foundation

Policy White Paper on

“Re-Structuring the Bantam Low-Cost Boost Technology Program”



Executive Summary:

In re-structuring the Bantam Low-Cost Boost Technology program, the U.S. government has an opportunity to spark a significant increase in private investment and innovation in the small payload space transportation market. This will lead towards much lower cost access to Low Earth Orbit for payloads in the 100 - 250 kilogram class.

To accomplish this, the United States should use its purchasing power in a commercial, market-oriented manner to jump-start the market, as it did with the Air-Mail contracts during the 1920s, and consistent with the 1984 Commercial Launch Act, the 1990 Launch Services Purchase Act and the President's 1994 National Space Transportation Policy.

At the same time, the United States should avoid any mechanism that involves any government direct government funding of the development of operational vehicles. Direct investment in selected companies would reduce private investment in companies not picked by the government. The resulting reduction in private investment, and the reduction in innovation that is driven by free market forces, would be contrary to the goals of the Bantam program.

If appropriate changes were made to the Bantam program, the Space Frontier Foundation would become a major advocate for additional funding for Bantam.

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Re-Structuring the Bantam Low-Cost Boost Technology Program

Introduction

A significant reduction in the cost of access to orbit for small payloads is within the grasp of the newly emerging commercial space industry. With the rapidly growing commercial demand for small satellites in Low Earth Orbit (LEO), at least a half-dozen U.S. companies with many innovative concepts, are investing significant amounts of private capital to supply launch services, including the market segment of 100 - 250 kilograms to LEO. The federal government has demonstrated its intent to support the development of affordable small launchers through the establishment of the Bantam Low-Cost Boost Technology program, with the goal of delivering small payloads (150 kilograms) to Low Earth Orbit (200 nautical-miles, sun-synchronous) for a recurring price of \$1.5M beginning in Calendar Year 2001.

Why is Bantam Important?

Bantam is important for three reasons:

- 1) The United States (in government, in industry, and particularly at the university level) has a significant need for payloads in this size and price class. For example, if a university had quick and reliable access to space for the price of \$1.5 million, there would be a major increase in the number of graduate and post-graduate students who could participate in space research as part of their studies. Today, because of the cost and waiting time, it is almost impossible for graduate students to fully participate in a space research project.
- 2) Innovation starts at the lower-end of the market with new entry-level companies. History demonstrates that it is almost always the new companies which cause rapid innovation and the creation of new industries or revolutionary change in established industries — almost never do the established companies cause or lead the revolution that creates a new industry. This was true for railroads, automobiles, airplanes, the telephone, motion pictures, xerography, quartz watches, personal computers, cellular phones, semi-conductors, software, biotechnology, and a host of other technologies and industries.

The goal of “Cheap Access to Space” will require radical changes in the way space transportation services are delivered, in some cases much greater changes than in the industry revolutions listed above. Today, the federal government focuses almost all its attention on encouraging the traditionally risk-averse aerospace companies to refine technologies and systems developed 30 to 40 years ago. It is time for the United States government to focus on helping, and not hurting, new companies which are developing creative technical concepts and employ commercial-oriented business philosophies.

- 3) Bantam could provide a model for a new government-industry partnership in space. Many of the mechanisms described in this White Paper have applications to other segments of space transportation, and to broader national space policy. Bantam provides a low-risk approach to testing one or more of these models before application to a larger segment of our national space policy.

An Opportunity for Positive Change

Recent changes in the Bantam program open the door for the government to express its need for launch services in this market segment in a commercial, market-oriented manner. Specifically,

the U.S. government could jump-start the market for small-payload launch services, as it did with Air-Mail contracts in the 1920s, and provide another existing market to justify an increase in private investment in small innovative launch concepts. Since the government has a legitimate need for such services, primarily in research conducted by universities around the nation, taking such action is warranted. The Space Frontier Foundation would enthusiastically support government action to increase the market-oriented demand for small launch services.

Consistent with the policies stated above, there are a number of appropriate mechanisms the government can use to encourage Cheap Access to Space by use of its purchasing power. These include “pay-on-delivery” launch service purchase contracts, “pre-paid” launch service purchase contracts, and prizes.

At the same time, certain types of government action could be extremely damaging to the nascent small launcher industry. Specifically, it would be inappropriate for the U.S. government to choose a “winner” or “winners” in launch services, instead of letting private capital markets decide which companies and concepts to invest in, and letting the customers of launch services decide which launch service best meets their individual needs.

Historically, one manner in which the government has worked against the positive effects of commercial market-driven innovation is by directly funding the development of operational launch vehicles. Such action creates government competition for all other concepts not funded by the government, and drives away private investment from those concepts. Moreover, government funding of new launchers violates the spirit, if not the letter, of the 1984 Commercial Launch Act and the 1990 Launch Services Purchase Act. Funding ‘commercial’ launchers directly is counter-productive and, in the long term, results in substantially-higher launch costs as private investment and innovation is reduced.

We have been informed by number of companies which are not currently part of Bantam that they would support the Foundation position if it became national policy. This includes companies which have actively opposed the current Bantam structure because the government was directly funding their competitors, and other companies which sat out the process as a matter of corporate philosophy. Thus, the Foundation believes that adoption of policies described in this White Paper will significantly decrease the controversy created by the Bantam program.

Leading-Edge Research vs. Operational Development

Although the government does have a legitimate role in funding experimental research — such as X-planes — and the development and demonstration of pre-competitive technologies — such as new materials and structures in NASA’s “Future-X” program — national space policy clearly differentiates between the funding of operational and experimental technologies. The private sector is expected to bear the cost of bringing new operational technologies to market.

Since many of the hurdles to the development of truly cheap launchers are operational issues — not technology development — it is not clear that the small launcher market requires advanced technologies to reduce launch costs. Awarding cash grants only to companies that require new technologies, as a mechanism to support the development of operational vehicles, would distort the market in favor of companies that have not solved all their technical problems, or companies which intentionally choose leading-edge technologies to create a justification for government funding. In such cases, the government actually works *against* the forces of the free market — everything else being equal, capital markets will invest first in those companies which are using proven technologies.

Therefore, the Space Frontier Foundation is opposed to any mechanism which would involve direct government funding for the development of operational launch vehicles.

Models of Market-Creation for the U.S. Government

The following are several **examples** of market-oriented means by which the Bantam program can be re-structured to increase private investment in low-cost launch services and to support the small launcher industry. These are only examples — the best choice be a variant on one of these ideas, or something completely different.

1) “Pay-on-Delivery” Launch Service Contracts:

Launch service contracts are used by most commercial users of launch services, even when purchasing undeveloped systems, and on occasion, by NASA. For example, when Hughes wanted to encourage the development of new launchers, it signed 10 launch contracts to both Boeing for SeaLaunch and to McDonnell Douglas (now Boeing Huntington Beach) for Delta III. Each of these companies (now the same company) in turn invested hundreds of millions of private capital in the development of SeaLaunch and Delta III. Motorola and Loral are currently using their payload manifests to support the creation of new reusable space launchers. It would be unfortunate if NASA could not likewise use its payload manifest to support development of new launchers.

Under this approach, NASA would use the Bantam program's budget to fund multiple launch contracts for Bantam-class micro-launchers. Participating companies would bid for these launch contracts, and winning companies (selected largely on the basis of price) would receive payment when launches were accomplished. In addition, following the model of commercial contract procedures, it is fundamentally important to the success of any launch service contract program, that the government be prohibited from requiring any submission of cost data as a part of their bids for launch service contracts. Under the commercial contract model, the government would only care about the concepts of “value” and “price”.

2) “Pre-Paid” Launch Service Contracts:

A variation of the “pay-on-delivery” launch services contracts approach would have the contracts include an advance payment for delivery of services. Commercial launch contracts sometimes provide for partial advance payments on completion of certain milestones by the launch provider — with full payment upon completion of a successful launch — and the federal government could do the same. The advantage of this approach would be that participating companies would receive capital up front that would be useful in developing their launch systems.

Instead of a bidding competition based on price, this structure would require a more traditional government selection phase in which only those companies judged as “qualified” could receive pre-paid launch service contracts. To maximize innovation and private investment, it would be useful to open up the process and utilize the Bantam appropriation to extend pre-paid launch service contracts to **all** “qualified” companies willing to bid at the stated Bantam price (\$1.5 million to launch 150 kilograms to a 200-nautical-mile sun-synchronous orbit).

Launch contracts include a legal obligation to launch by a future date, and the contracted company would maintain a financial liability on its books until successful delivery of launch services. This is an important distinction — “grants” with a launch as a deliverable of the

grant would look a pre-paid launch contract. But they might allow a company to say “We tried” and walk away without any legal obligation. Without a legal obligation to launch, or a legal obligation to repay the grant with interest upon failure to supply a launch, this type of “grant” would constitute a direct federal subsidy of an operational launch vehicle.

Some variants of pre-paid launch service contracts may be difficult under the Federal Acquisition Regulations, or illegal under current U.S. law. In such a case, an amendment or waiver of the current regulations, or legislative action to create new law, may be needed.

3) Launch Vouchers:

Vouchers are used through-out the U.S. government to purchase a variety of services in a cost-effective, timely and non-bureaucratic manner. Customers of launch services (for example, university researchers) would apply for and receive a launch voucher from the government at a fixed price (i.e. \$1.5 million), and use this to negotiate launch services with the provider of their choice. The government would focus on the process of distributing vouchers to universities or other qualified not-for-profit entities. To encourage negotiations for the best price, universities would get to keep part or all of the savings they can negotiate from the launch services provider, or they may simply negotiate a larger payload or higher orbit. Upon delivery of launch services, the voucher could be redeemed at the negotiated price by the provider.

As can be seen, launch vouchers have an additional benefit over and above launch service contracts — they put the purchasing power into the hands of the real customer of launch services. Such a voucher program could be implemented as a Phase III of the Bantam program — after initial Phase II deliveries to orbit are accomplished (financed by launch services contracts), participating companies would be qualified to launch payloads financed by vouchers. In the long run, the Space Frontier Foundation believes that a voucher system is the mechanism the U.S. government should use to deliver space transportation services to Bantam-class government customers.

4) Prizes:

Prizes have a long and illustrious history in encouraging radical breakthrough thinking, and in pressing forward the frontiers of human activity and accomplishment. Prizes have some unique advantages: 1) all approaches to accomplishing the goal have equal footing — there is no “right” approach, 2) rapid development and speed (traits conducive to success in a free and open market) are heavily rewarded, and 3) the government only pays for success. The Space Frontier Foundation is a strong supporter of prizes — we are currently offering the “Cheap Access to Space Prize” of \$250,000 to the first privately-developed and produced launch of a 2-kilogram payload to 200 kilometers altitude (for more details, contact David Anderman, CATS Prize Chairman, at DavidA@cwo.com).

Prizes work best for those things that have specific and easily measurable goals, i.e. objectives that can be easily answered with a “Yes” or “No” answer to the question “Did they do it?” Examples are crossing the Atlantic Ocean in an airplane (Lindbergh in the “Spirit of St. Louis”), flying around the world without landing (Rutan in the “Voyager”), or producing a working electric motor that would fit within a cube of 1/64 of an inch on a side (a challenge with prize by Dr. Richard Feynman).

Under the prize approach, it has been proposed that the U.S. government should provide a significant cash award to a company or companies who achieve the established Bantam program goals — 150 kilograms, 200-nautical-mile sun-synchronous orbit for \$1.5 million in

recurring marginal costs per launch. This approach has the difficult problem of determining the "recurring marginal cost" of a single launch.

This determination would require an intensive government auditing process, and the creation or adoption of a substantial set of auditing rules and accounting procedures. The audit process could cost more than the launch itself, and therefore would be contrary to the goal of significant reductions in cost. For that reason, the Space Frontier Foundation would probably support a prize that did not include a goal based on "cost."

But, if the cost-driven goal is removed from the list of goals for a prize, how can the government ensure that the winning companies have indeed met the Bantam cost goal without extensive auditing of all competitors? There is no easy answer to this question.

The Space Frontier Foundation believes that prizes are most appropriate for easily definable technical achievements. For example, *"be the first company to take-off, fly a vehicle to mach 10, and land, using only a rocket-based, combined cycle engine"* or *"be the first or second company to fly at least 1,000 kilograms to a 100-nautical-mile orbit, land, and repeat within a single week using a totally reusable launch vehicle."* The prize concept can be applied successfully to Bantam, but the key to success is the definition of the prize.

Expansion of the Bantam Model

The current re-structuring of the Bantam represents a historic opportunity for the U.S. government to promote the development of innovative answers in launch services at the entry-level of the market. If the U.S. government can demonstrate new mechanisms, via Bantam, for purchasing launch services in a commercial manner, these tools can be duplicated in other launch segments. The Space Frontier Foundation believes this kind of innovation is critical to the goal of "Cheap Access to Space" and is consistent with the declared policies and intent of the White House and Congress.

Conclusion

The Space Frontier Foundation supports a re-structuring of the Bantam program based on the principles outlined in this paper. If appropriate changes were made, the Space Frontier Foundation would become a major supporter of Bantam and would urge Congress and the Administration to increase its funding. Moreover, if Bantam were to be structured so that all serious launch-service companies would have access to Bantam prizes, vouchers or contracts, support for this program would be exceptionally broad. Additional Bantam appropriations could be added every year, to go to all participating companies and to new entrants with new ideas for this critical 21st Century industry.