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Paper Session I-A - Subsidization: Fact of Life, Necessary Evil or Appropriate Policy?

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Subsidization
Fact of Life, Necessary Evil, or Appropriate Policy?

Subsidization Defined

In October of 2000, Andrew Beal, Chairman and Founder of Beal Aerospace Technologies, Inc., announced that his fledgling space launch company was ceasing all operations before it built its first rocket. He gave the reason as “There will never be a private launch industry as long as NASA and the U.S. government choose and subsidize launch systems.” This is a harsh, and perhaps unrealistic indictment of current government policies, but it raises the question “What is a subsidy?”

In terms of the dictionary, a subsidy is defined as “....money granted by the state to a commercial undertaking (such as a transportation service) considered to be of public benefit...” (Webster’s Dictionary New Edition, Banner Press). Today, subsidization is a highly controversial topic in the space launch industry, both in the U.S. and internationally. It has been alleged by various different space industry representatives that that subsidies are absolutely necessary, and by others they have the effect of destroying innovative new concepts. But what is subsidization? How is it practiced, if at all? And what are its effects?

In terms of the dictionary definition of subsidization, U.S. Government subsidies are not given to commercial space launch firms. In fact, they are forbidden by law. The same situation does not exist in the rest of the world. However, subsidies come in many forms, especially in the highly complex business of launching payloads into space.

History

Direct subsidies have been very limited for U.S. commercial launches, but government support has been essential for virtually all of them. Prior to the Commercial Space Launch Act (CSLA) of 19XX, all launches of commercial satellites occurred on government procured boosters. Firms wishing to place commercial satellites into orbit would contract with NASA to purchase a McDonnell Douglas Delta or General Dynamics Atlas Centaur booster. This subsidy situation was complex from the start. For its own, non-commercial objectives, the Federal Government paid for all of the development of the boosters, funded the cost of maintaining the launch crew and launch pads, and provided most of the workload that made the program viable from the business standpoint. In addition, the government provided overall management and oversight of the system and provided the launch ranges and launch support services at the launch bases. While this all could be viewed as a significant subsidy, the government charged commercial customers an extra fee. For a Delta 2914 procured in the late 1970’s a government user paid about $20M and a commercial customer about $25M.

The most important form of government support in the U.S. has been related to industrial base and economic production issues. The extensive use by the U.S. Government of space for military, civil, and scientific purposes resulted in the creation of a large space launch industrial base, including the development and production of boosters, rocket engines/motors, and guidance systems as well the creation of a variety of launch pads and launch ranges at three different bases and the expertise required to ensure successful missions. Commercial missions generally have been in the minority – albeit by narrow margins of late – and simply could not have afforded the
cost to develop and maintain the industry on its own. Commercial launch companies with
government contracts have been assured of a certain number of launches that can provide the
margin required to make commercial ventures successful.

The advent of the Space Shuttle program introduced another kind of subsidization.
NASA allowed commercial satellites to be carried into low Earth orbit on the Shuttle but charged
the private firms only a small percentage of the cost of the mission, typically less than one third
the actual cost. In addition, the Air Force paid all launch range costs for the Shuttle missions.
NASA justified the subsidization under the excuse that shuttle launches were needed anyway in
order to support experiments and manned spaceflight activities, and the commercial payloads
were just an add-on. Private firms attempting to compete with the Shuttle using expendable
rockets found this situation difficult to handle, and U.S. commercial ELV production almost
stopped completely. The government largesse came to an end following the loss of the Shuttle
Challenger in January 1986 and the removal of all commercial payloads from Shuttle missions.
At the same time, the new CSLA rules prevented the government from buying boosters for
commercial missions. For the first time, the cost of launching commercial payloads was going to
have to be done without government aid, ... or was it?

The approach taken for support of commercial payloads became known as “Excess
Capacity”. The essence of Excess Capacity was that the Air Force and NASA required the
capability to launch payloads to meet national needs, which translated into booster production
lines, launch pads, launch ranges, and the associated government and private contractor
manpower. Since the capability was going to be there anyway, private firms were allowed to use
it for only the additive cost associated with their use. For launches, Excess Capacity meant that
when the Federal Government was not using the launch pads, processing facilities, and ranges the
private firms could use them to launch commercial missions and pay the government only what it
actually cost the government for the use. Rent or depreciation for the launch facilities and
instrumentation was not charged, nor were the private firms required to contribute to the future
replacement or upgrade of the facilities.

Government enabling of commercial use did not just happen at the launch bases. Most
boosters were built in government-owned plants or used government-owned production
equipment. Here a bewildering variety of agreements went into effect, each tailored to the
circumstance, but totally inconsistent overall. Some firms paid rent on use of government plants
and production equipment; others paid nothing. Some hardware was built in privately owned
plants using privately owned equipment but which was maintained under a government contract.
Government owned and privately owned test facilities sat side by side, used interchangeably and
with no rent paid by any user. It was confusing, and it all reflected government support for a
private enterprise. And it wasn't technically subsidization but the arrangements were vital to
allowing commercial space launch firms to do business.

Things started getting complicated at the launch bases, too. At Cape Canaveral,
General Dynamics required the use of two Atlas launch pads to meet its commercial ambitions
but the Air Force only paid to refurbish and operate one pad, SLC-36A. GD paid to refurbish the
adjacent pad, SLC-36B, and also paid rent to the Air Force for the use of nearby land on which to
build support facilities, becoming the first commercial renter. Even this was not straightforward,
since the amount of the rent was decreased by the percentage of work done to support
government missions.

Most of the advantages of available government-owned capabilities went to the large,
established firms, but some of the smaller companies benefited as well. The Orbital Sciences
Pegasus air launched ELV began as a purely private venture, but benefited enormously from a Defense Advanced Research Administration (DARPA) contract that bought the first launch contracts and also enabled the company to secure the use of a NASA-owned B-52B to serve as the drop aircraft. Although often touted in its early days as the first true commercially developed launch vehicle, most Pegasus missions were to carry government payloads and to launch from government-operated launch ranges.

In 1993 a new factor was introduced, that of state involvement. Largely through the efforts of the State of Florida, Congress set aside $20M of Air Force space research funding and directed that it be used for “joint-use” projects, i.e., projects that would benefit both military and commercial space launch efforts. A variety of efforts were funded with the DoD money, and the funding as also provided in 1994. One of the most significant uses of the funding occurred when approximately $3M of it was combined with lesser amounts of State and corporate funds to build a launch vehicle pad at SLC-46, a U.S. Navy missile test site at Cape Canaveral. Ironically, the first user of this pad was a NASA lunar survey mission. The SLC-46 effort pointed up one of the industry’s concerns about government support; it wasn’t always there. Major programs such as Delta II, Atlas, and Titan IV received enormous support in that they could use launch facilities built by and often maintained by the government to launch boosters originally developed at government expense. Smaller programs, usually flying small and experimental payloads received far less support, having no ready-to-use launch pads, and having to bear the cost of flight hardware development as well. The reason for this was based not only on the heritage of launch vehicle development but also on the importance and associated funding attached to small payloads. Such R&D payloads were typically seen as “nice to have” efforts at best in Washington.

By the mid-90’s commercial missions had grown in number to the extent that they equaled or surpassed government missions. This led to calls for reduced government support by the cash-strapped Feds. In the DoD, in particular, the hundreds of millions of dollars of required to operate and maintain the facilities at Cape Canaveral and Vandenberg were seen as hard to justify when the majority of use appeared to be commercial. The fact that most of those costs would have to be borne anyway in the absence of commercial launches was largely overlooked in the budget-stretching that occurred annually in the Pentagon. A typical American commercial launch made use of hundreds of millions of dollars worth of government equipment and real estate, but under the CSLA, the companies could only be charged the direct and unambiguously attributable costs associated with their missions. For typical commercial missions, this came to between a half million and a million dollars per launch.

By the late 90’s, commercial missions had equaled or even surpassed government missions in number, and the attitude within DoD increasingly became focused on what was viewed as subsidization of an apparently thriving commercial industry. The order came down “Charge them more!” although how this could be done within the framework of the law was never explained. In terms of future planning the Air Force began to figure out ways to buy tickets to ride the commercial train to space rather than to operate its own railroad and allow others to use the track for free.

Also in the 90’s the arms control treaties that accompanied the end of the Cold War had brought a new kind of subsidization to the fore: surplus military missiles. While the Air Force had been using converted Atlas and Thor missiles for space launch since the early 60’s, in those days there existed no commercial marketplace to be impacted by the use of such surplus military asses, and there were too few of them at any one time to enable the rockets to be offered to commercial users in any case. But with the advent of the Strategic Arms Reduction Treaty
(START), up to 53 Titan II ICBM’s, up to two hundred or so Minuteman ICBM’s and a number of Poseidon SLBM’s would become available for space launch use. START even allowed launching the missiles as a means of destruction. And most of the U.S. commercial launch industry looked on this peaceful bounty with horror.

It was feared that the surplus missiles would enable companies using them to far undercut the prices of companies building new hardware. Suitably modified, the Titan II’s could replace the Delta II and vehicles based on the surplus Minuteman solid motors could handle all conceivable small launch vehicle requirements for at least a decade. The very companies that depended heavily on government support for their commercial and government contract operations lobbied heavily in Washington in opposition to any use of surplus missiles for either private or government space launch use. The Department of Transportation’s Office of Commercial Space Transportation even opposed such use. In the end, the U.S. use of surplus missiles was limited to DoD launch contracts only, and only in cases when the cost advantage clearly justified it. For the first time, the industry itself had fought a form of subsidization, and succeeded in all but stopping it.

The support the Air Force provided to the commercial industry was not technically subsidization, but to many it looked suspiciously like it. And some of those that viewed things that way were foreigners; they had good reason to be nervous about the subject

The Foreign Factor

By the mid-1980’s the U.S. launch industry was facing serious competition from foreign sources, the most significant of which was the French Ariane launch vehicle. The Ariane was developed specifically as a commercially viable launch and was launched from a new facility at Kourou, French Guiana. Although the French government and the European Space Agency planned the launch of military and civil payloads, unlike the U.S., most of their launches were planned to be commercial right from the start. Rather than the U.S. situation, where companies with government contracts could either take advantage of the government investment and industrial base or chose not to do so, with Ariane, the Government subsidization was built right into the program.

The European Space Agency (ESA), a consortium of 15 nations, paid for the development of the Ariane 4 launch vehicle and the later and much larger Ariane 5, although only 12 of the ESA member nations chose to participate. The Ariane 5 development effort alone cost ESA $6.3 billion Eurodollars. The motivation for this massive support was ensuring that Europe was not left out of the commercial space race and, especially, ensuring that high tech, high paying jobs stayed in Europe. One indication of the sharing of the wealth aspect of Ariane is given by the fact that Arianespace is owned by 53 shareholders, including aerospace firms, banks, and the French national space agency, CNES, the largest shareholder, with 32% of the company. In other words, by American standards Arianespace looks to be only slightly more commercial than NASA.

Under current circumstances, Arianespace could not make it as a private company. It costs about $200M to launch an Ariane V, but the commercial going price ads up to only about $129M. And the $200M actual cost does not even include the cost of paying off the development of the boosters. The other $71M shortfall for each launch as well as the original development costs are paid by the Arianespace shareholders, the governments of Western Europe.

As for launch bases costs, technically, the launch base at Kourou is owned by CNES, the French Space Agency, who rents it to the private company, Arianespace. In reality, Arianespace
was the only user of the installation and the only justification for its existence. The launch base costs an estimated $275 million a year to operate, but Arianespas currently only pays around $129M to use it, a cost the company passes along to its launch customers. The significance of this is that unlike the U.S. launch bases, if there were no commercial launches, Kourou would not be operating.

The Ariane effort began to pick up speed in the mid-80’s and really became a factor in 1986, when the loss of the Space Shuttle Challenger put an end to the heavily subsidized commercial use of the Space Shuttle. Arianespas was able to move into a market vacuum caused by the ending of not only the subsidized Shuttle rides but also the virtual abandonment of the expendable launch vehicle industrial base by the U.S. Government. The new direct subsidization approach – that of using the Shuttle for all missions – had destroyed the most important subsidy – that of the maintenance of a viable industrial base – and suddenly in 1986 the U.S. had neither it nor the subsidized Shuttle to offer commercial users. Overcoming a series of initial failures, Arianespas grabbed the opportunity offered by the shutdown of the U.S. effort, secured over 50% of the world commercial launch market, and has not relinquished it since.

In the early 90’s the U.S. and ESA entered into negotiations regarding support to commercial launches. No doubt the intent of each was to agree on an equitable amount of support to their private industries rather than eliminate such subsidies entirely. The initial focus was on the highly visible operations at the U.S. launch bases, with the French closely scrutinizing details they could term as subsidies, such as the no-cost military manpower provided. The U.S. did raise the delicate issue of the massive support provided for Ariane manufacturing, but the French responded quite negatively to such expansion of the talks and left more or less in a huff (or was it a Renault?).

U.S./French negotiations were overshadowed and eventually made irrelevant by the entrance of new international players. These were especially worrisome due to the fact they were the products of the non-market economies of the People’s Republic of China and the Former Soviet Union.

Rather surprisingly, the Chinese were the first into the market, with the Asiasat launch of 199X. The U.S. satellite manufactured by Hughes was launched on a Chinese Long March booster. The low prices charged by the Chinese caused alarm in the West. In fact, the Chinese had to be implored to raise their prices from about $20M per launch for a Delta II equivalent to around $30M a launch. Even at that, their prices were over 30% lower than a comparable U.S. or French vehicle, and this was not entirely due to the low pay workers or the fact that the rockets shared the same production line as military ICBM’s. Like most non-market economies, the Chinese simply had no way to figure out what a given product was worth. In reality, the opportunity to gain Western business and technical expertise was priceless to the Chinese; they would probably have launched the first missions for free.

The poor reliability of Chinese rockets eventually made them less attractive to buyers, but by that time the Russians had come along. The Proton and Zenit launches were regarded as highly desirable launch vehicles, with plenty of performance and a high degree of reliability at a relatively low cost. In fact, by the mid-90’s a Hughes official described the Proton as the most desirable commercial launch vehicle. The Russian launch services became even better competitors when U.S. firms joined the team and assisted in marketing.

The Russian subsidization situation was rather more like the American one than it resembled the European. The USSR had paid to develop the Proton and Zenit and the associated
launch facilities for military purposes only. Commercial sellers and customers reaped the benefits of the Soviet government’s investment. At the same time, the Russian situation resembled the Chinese in that their low wage rates enabled low costs.

The Proton and Zenit were not the only ways in which the states of the Former Soviet Union entered the commercial market. The U.S. Government was squeamish about releasing surplus missiles for commercial space launch use but the Russians and Ukrainians had even more decommissioned missiles to offer than the U.S. did, and START enabled them to use them commercially. As it has turned out, the swarm of small satellites that were prophesied has not come forth, and the ex-Soviet missiles have not found many buyers as yet.

Later Developments

By the late 90’s with commercial launch companies up and running and placing about as many payload into orbit as were the governments, support and/or subsidization began to change. In the U.S., a new Air Force launch vehicle program, the Evolved Expendable Launch Vehicle was substantially restructured from a classic military competitive development program to one based on a partnership with private industry. Both Boeing and Lockheed Martin received half of the program budget, and a roughly equal share of available facilities. The companies would fund about half the cost of developing the new boosters and building the launch pads, and would pay all of the cost to develop commercial versions of their designs and to operate and maintain the launch facilities. Launches were to be procured competitively and as launch service packages. This was seen as highly innovative but was more a less a logical extension of the policy that had been developed over the years for Delta, Atlas, and Titan. Unlike the earlier programs, rather than the government funding the entire cost of developing the flight and ground hardware, the cost was shared with industry. Like the older programs, the companies paid for uniquely commercial costs, such as for design mods and additional launch pads required to meet commercial mission models. Originally, having helped to build the new space transportation systems, the Air Force planned to become simply another user and only pay for the cost of individual missions. However, as the real mission model has developed the Air Force has had to plan to fund some O&M costs to ensure the EELV capability would remain viable.

In the area of more exotic developments, NASA proposed an even more hands-off approach for the follow-on Reusable Launch Vehicle (RLV) to replace the Space Shuttle. The NASA-funded X-33 would be a sub-scale test vehicle that would prove or disprove the technical feasibility of a single stage to orbit fully reusable RLV. The actual construction of the full scale vehicle would be a privately funded affair, using the same approach as used for the design, development and production of airliners; i.e., if it can make enough money, do it. NASA has also followed the same cost-sharing approach with its Space Launch Initiative, the effort that caused Mr. Beal so much consternation.

The cost of operating the launch bases became a concern for both the U.S. and the Europeans. A National Security Agency and White House Office of Science and Technology Policy study released in mid-2000 recommended having commercial users of the U.S. launch ranges pay a larger share of the costs. Meanwhile, ESA balked at the cost of running Kourou. The commercial users of the facilities were concerned, since large increases in their costs would be required to offset any significant government payments. At less than a million dollars a launch for U.S. launches, even a doubling of launch support costs would yield little more than 1% of the cost of running the U.S. ranges. As for Arianespas, at over $10M per launch for launch services, the company sees itself as paying over 20 times what its U.S competitors do for ground support. In fact, Arianespas even argued that it was having to charge its customers for too large a share of
the cost of operating its launch base, citing the much smaller amounts American firms pay as a justification. However, ESA refused to provide more funds and even indicated some desire to reduce the support.

Summary: The Forms of Subsidization and Government Support

Based on the history of commercial space launch, we can summarize the forms of subsidization as follows:

1. Government-funded development, no cost to commercial user
2. Government-funded O&M of launch facilities, no cost to commercial users
3. Government support of the industrial base and economic order quantities
4. Government subsidization of production and launch
5. Commercial pays only added costs of use of government-owned facilities
6. Free or reduced cost support services
7. Use of surplus missiles at reduced cost to commercial firm
8. Cost sharing
9. Access to expertise

The United States government has employed methods “1.”, “3.”, “4.”, “5.”, “8”, and “9” in the past, and of late is tending to modifying these with an increasing use of method “8.” Method 4 was a chief feature of the original Space Shuttle program, but now in the U.S. this method is limited largely to use of government-owned production facilities and factories. There has been some limited use of method “7.” in the U.S., but not for commercial payloads; examples include the use of surplus Atlas E/F and Titan II missiles and use of Peacekeeper missile first stages for Orbital Sciences Taurus boosters.

The French, ESA, Arianespas, consortium has used all of these except for method 6, and that probably only because they lacked the surplus missiles to use. ESA has increased interest in method 7, cost sharing, but only very cautiously.

The Chinese appear to have used all of the methods except possibly methods “7.” and “8.”

The Russians appear to have used all of the methods, and for the most part still are.

Big Deal or So What?

Subsidization occurs, and in many forms. But what is its impact? Is Andrew Beal right?

In analyzing the impact of subsidization, the first and most obvious conclusion is that everyone does it, although everyone does it differently. Given that fact, it is a fact. If the U.S. does not provide at least some form of subsidization, that will not stop the other countries from doing so.

However, while subsidization is fact and more a less a requirement on the international scene it is somewhat anti-competitive in terms of a country’s internal marketplace. Companies with government launch contracts have enormous advantages over those who do not. Such firms are assured a place at the launch ranges, frequently have free or at least reduced cost for O&M of facilities, are allowed greater access to government expertise, and have cover from the impacts of some government regulations. Most importantly of all, they have an assured base of orders to establish their place in the commercial market. Against these advantages, they must put up with
Perhaps the biggest problem with the government support is that it is unequal. Not only do firms that don’t get the Air Force and NASA contracts not receive the attendant advantages, but the even those that do win bids may not get all of the benefits. For example, small launch vehicle firms have to suffer from a greater variability and reliability of funding than do companies making the larger products. Small payloads don’t receive much support in Washington. Their schedule is highly variable, and their funds are often siphoned off by various special interest groups action in order to study the Aurora Borealis or build museums on unrelated topics. Thus, the small ELV companies have a somewhat unreliable customer in the government and therefore cannot count on the base of orders needed on which to build commercial business.

Aside from that, small R&D payloads are usually one-time events in program terms and lack the continuous programmatic support needed to make sure facilities will be available. The State of Florida built a launch pad for small ELV’s because the Federal Government was unwilling to do so, despite the fact that the first launch from the pad was for a NASA mission.

But what about government supported R&D, the single largest issue that Mr Beal has with the current system? Ironically, R&D assistance probably has been the least controversial form of government support. Every nation does it; it is tradition going back to when the first step in building a new airliner was developing a new bomber. R&D was not even an issue in the U.S./French talks on subsidization. But Mr Beal’s problem was less the existence of R&D support than the fact that it was doled out inequitably, based upon a government’s agency’s own needs. NASA is not going to provide R&D support for a major launch system not capable of handling manned exploration missions. The DoD is not going to develop systems that do not meet national defense needs. It would take a very major change in not only national policy but also national attitudes for anything else to happen.

Subsidization is fact of life in today’s world. It has many forms and every nation does it differently, but all that are capable of it do so. And as long as any one of them does, the others will be forced to.

In answer to the question we posed in the title, is subsidization a fact of life, necessary evil, or appropriate policy?” The answer is “Yes, all of the above, sometimes.”