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# U.S. Commercial Space Launch Policy Implementation: Lessons Learned from 1986-1992

by Craig R. Reed, Ph.D.

There were nearly 2000 launches of all types conducted worldwide between 1982 and 1994, including nearly 250 launched by the United States.<sup>1</sup> Of the total number of launches between 1982 and 1994, 134 were commercial launches, defined as launch opportunities which were available in principle to competitors in the international launch services market.<sup>2</sup> Most recently, during fiscal year 1996, there were eighty-five launches of all types conducted worldwide; the United States launched thirty-five of these.<sup>3</sup> Of the total launches in 1996, twenty-eight (or thirty-three percent) were commercial launch events, including eight launched by the United States. Approximately eighty-five percent of all commercial launches in 1996 were used to launch commercial communications satellites.<sup>4</sup>

Commercial launches have become an increasingly important source of revenue for their industry providers, with total annual revenues generated estimated to have grown from around \$1 billion in 1991 to \$1.8 billion in 1996. U.S. launch firms received only approximately thirty-five percent (\$619 million) of these total revenues in 1996, with roughly fifty-three percent going to European firms (\$951 million) and the remainder split in roughly equal shares between Russian and Chinese launch service providers.<sup>5</sup> While this performance reflects some recent competitive improvement by the U.S. commercial launch industry, it falls short of the expectations for global commercial launch market dominance envisioned by both U.S. launch firm executives and U.S. Government policy makers at the time of the policy change. This paper addresses the early years of the U.S. commercial launch industry and lessons learned from U.S. space launch policy implementation efforts aimed at helping the industry to “get off the ground.”

Commercial launches have increased and accounted for a steadily increasing share of total launches since the first commercial launches were conducted in 1982; prior to that time all launches were conducted by governments.<sup>6</sup> Prior to 1982, the only means into space orbit for a commercial communications satellite was aboard a U.S. expendable launch vehicle, built by a U.S. firm and launched by the U.S. Government. The U.S. Government purchased expendable launch vehicles from U.S. launch vehicle manufacturing firms and provided launch services to both commercial and foreign users, in addition to using them for Government missions. In 1983, commercial launches also became available on both the U.S. Space Shuttle, which had become operational in 1982, and an expendable launch vehicle developed and operated by a European government-backed consortium, Arianespace. With the introduction of the Space Shuttle into the U.S. Government launch fleet, U.S. expendable launch vehicles were deemed obsolete and were destined to be phased out of production. However, entrepreneurs recognized the potential advantages of privatizing or commercializing expendable launch vehicles as an adjunct to (or competitor with) the Space Shuttle and the European launch system. Early policy initiatives were promulgated that endorsed the commercialization of U.S. expendable launch vehicles and the first seeds for the industry were sown. Yet U.S. launch firms found it difficult to compete with the U.S. Government's subsidized Space Shuttle and virtually no successful inroads into the commercial market were made. In 1986, after the Space Shuttle Challenger accident, U.S. policy was changed and the Space Shuttle was taken out of the competition with U.S. launch firms using expendable launch vehicles for the commercial market. After

this juncture, U.S. launch firms stepped up their efforts to pursue international commercial launch market opportunities, in competition with Europe's Ariespace and other potential international launch service providers.

Between 1986 and 1992, the international commercial launch industry comprised three U.S. commercial firms (i.e., General Dynamics, Martin Marietta and McDonnell Douglas); a French company, backed in part by the European Space Agency and member country governments (i.e., Ariespace); and a foreign trade company responsible for marketing and negotiating commercial launch services for the Chinese government (i.e., the China Great Wall Industry Corporation). Other countries—in particular, Russia, Ukraine, and Japan—followed the development of the commercial launch market but did not enter into a contract for a commercial launch during this period.

The political economy of the U.S. commercial launch industry is unique; U.S. launch firms both owe their existence to and have been constrained by their historical reliance on the U.S. Government as a developer and financier.<sup>7</sup> The capabilities of U.S. launch systems initially were developed to support U.S. Government mission requirements; the space launch systems offered by U.S. firms evolved from U.S. Government intercontinental ballistic missile programs dating back to the 1950s. These capabilities were not optimized to fulfill the requirements of commercial customers to the same degree that emerging foreign competitors, such as Europe's Ariane, have been. Throughout the development of this industry, the U.S. Government controlled every aspect of U.S. launch capabilities: what tooling and infrastructure would exist; what the rates of production and launch would be; what processes and procedures would be used to build and launch them; what their technical capabilities would be and when and how these would be upgraded; as well as what appropriate rates of profit could be charged for their development and operation. Even as commercial market opportunities grew, the U.S. Government retained significant control over numerous factors influencing U.S. firms' ability to compete in that market.

Through 1996, procurement of launch services or launch vehicles by U.S. Government agencies still comprised a substantial majority of the business base for U.S. launch firms and influences the requirements and processes used to build them. Between 1986 and 1992, commercial spacecraft launches accounted for only twenty-four percent of General Dynamics' launch business (payloads launched); thirty percent of McDonnell Douglas' launch business, and seventeen percent of Martin Marietta's launch business. On the other hand, commercial launches accounted for seventy-seven percent of Ariespace's launch business and forty-three percent of Long March's launch business.<sup>8</sup> The U.S. Government still controls the launch infrastructure (e.g., the launch pads, mission control centers, and tracking stations) as well as the terms (e.g., cost, schedule, processes, and access) under which it can be used. While some competitive factors have become liberalized as the market has developed (e.g., production rates, ownership of tooling and equipment, profit rates, and developments to enhance technical performance), the degree of U.S. Government involvement in nearly all aspects of the launch process continues to have a dominant affect on the behavior of U.S. commercial launch firms. The dependency of U.S. launch firms on the U.S. Government for launch business, as well as for infrastructure and support functions, continues to be both an enhancing and a constraining condition.

In the wake of the Challenger accident, National Security Decision Directive 254,<sup>9</sup> took NASA and the Space Shuttle out of competition with U.S. commercial launch providers for

commercial and foreign spacecraft payloads. This change received strong support from a diverse collection of national policy makers, whose motivations included: broadening the market for U.S. commercial launch firms to reduce launch costs for the U.S. Government; preserving U.S. industrial base capabilities for national security purposes; improving the U.S. international balance of trade; directly benefiting constituent U.S. launch vehicle manufacturers; and general promotion of free enterprise practices. It set in motion an array of implementing actions by U.S. Government agencies and spawned a series of other directives aimed at refining these policy objectives and establishing implementing guidelines for U.S. Government agencies. In the first few years following the Challenger accident, new policy directives dealing with space or space launch were released nearly every year. Executive Branch agencies created new offices, Congressional oversight committees conducted myriad hearings, and the domestic launch industry invested hundreds of millions of dollars in pursuit of commercial launch market opportunities.

With each successive policy directive and implementation guideline that was promulgated, additional emphasis was placed on “return[ing] the U.S. launch industry to the dominant world position it occupied in the 1960s and 1970s.”<sup>10</sup> By 1986, due to the Challenger accident and the absence of a U.S. commercial expendable launch vehicle alternative, the number of commercial satellites launched by the United States had fallen to zero. The policy change raised expectations in industry, within Congress, and within some U.S. Government agencies that the Government was undertaking a course of action aimed at helping U.S. launch firms to establish the capabilities necessary to compete successfully in the burgeoning international commercial launch services market.

Despite a panoply of policy statements and initiatives aimed at improving the abilities of the U.S. commercial launch industry to compete, U.S. commercial launch providers failed to secure a leadership position in the market through 1996. Even eleven years after the Challenger accident, Europe’s Arianespace held a decisive lead. In fact, Arianespace’s market share today is greater than it was prior to 1986 when NASA was competing against it, launching foreign and commercial spacecraft from the Space Shuttle. Between January 1991 and December 1996, U.S. firms were responsible for forty-one percent of total commercial launches, and only thirty-four percent of total commercial payloads launched, compared with the Europeans, who captured forty-eight percent of the total commercial launches and fifty-six percent of the total commercial payloads launched.<sup>11</sup>

The implementation of the U.S. Government’s commercial space launch policy has affected the U.S. industry’s abilities to compete in a variety of ways, some positive and others negative. Efforts by the Office of Commercial Space Transportation to regulate and license the commercial launch industry took an enormous amount of time to get underway; it took more than four years from the time that the initial tasking was given to the Department of Transportation (via Executive Order 12465) until its final ruling was published and another year still before the first license was issued. Launch firms were required to go through an arduous licensing process for every launch. The mere definition of a commercial launch, for example, took substantial U.S. Government agency time and energy. The Office of Commercial Space Transportation’s efforts to maintain licensing jurisdiction over NASA launches actually would have cost commercial launch firms more in insurance costs than letting the launches proceed under NASA oversight. The Office of Commercial Space Transportation’s desire to accommodate the wishes of Congress on user fees resulted in an increased financial cost to commercial launch firms; while this charge was modest, the action was inconsistent with the U.S. Government’s stated commitment to enhancing the abilities of the firms to compete.

Scheduling problems, the lack of a commercial business environment, security restrictions, and costs associated with the U.S. Government launch infrastructure were all cited by U.S. commercial launch firms as having adversely impacted their abilities to compete. Significant energy was spent both by the U.S. Government and industry during the period under review to redress aspects of these infrastructure problems, but many could not be alleviated, either because of overall physical limitations of the existing Government facilities or the perceived high cost barriers associated with creating new infrastructure with private financing. These intractable infrastructure problems tended to adversely affect the costs, schedule and other factors facing the U.S. launch firms in their efforts to secure commercial launch business. On issues such as frequency reassignment, and allocations of ammonium perchlorate and AVTEX rayon, the decisions made by the U.S. Government had mixed implications for the abilities of U.S. commercial launch firms to compete. For example, the frequency reassignment decision resulted in a modest increase in costs being passed onto commercial launch firms. The ammonium perchlorate decision, on the other hand, resulted in the U.S. launch firms receiving a national security priority rating that would ensure that they would receive allocations of a scarce commodity that would enable them to keep flying, resulting in a positive impact.

The strategies used by U.S. Government agencies for procurement of commercial launch vehicles and services were largely responsible for the re-establishment of U.S. expendable launch vehicle production lines. Without the earliest Air Force procurements, specifically the Complementary Expendable Launch Vehicle, the Medium Launch Vehicle 1, and Medium Launch Vehicle 2 procurements, none of the major launch vehicle manufacturers would likely have entered the commercial launch market. Every launch vehicle or commercial launch service purchased by the U.S. Government increased the production base for commercial launch firms and lowered the indirect costs (overhead, and general and administrative expenses) that had to be spread against the price of launch vehicles for commercial customers.

The structure of the Air Force's Medium Launch Vehicle procurements, however, resulted in their being viewed as "lowest cost" competitions that led the competitors, in turn, to believe that they must reduce the cost of their launch vehicles to be purchased by the Air Force by spreading the non-recurring engineering charges associated with the purchases against projected follow-on commercial sales. While the Air Force benefited from this practice through lower launch costs, this "buy-in" by the launch firms on the Government sales raised the cost of these launch vehicles in the commercial market.

The approach taken by U.S. Government agencies towards the support of research and technology programs to improve the capabilities of commercial launch systems was a continuing source of frustration for U.S. commercial launch firms. There were numerous recommendations made by COMSTAC, the Congressional authorizing committees, and external review boards to initiate vigorous research and development and component technology research programs that would benefit the commercial launch industry. While several programs related to these objectives were begun (e.g., Advanced Launch System, National Launch System, and Spacelifter), they typically were terminated with little tangible progress to show for the effort and were not aimed from the outset at developing the capabilities needed by U.S. launch firms to compete more successfully.<sup>12</sup> NASA resisted the adoption or application of what was frequently referred to as the "NACA model," under which NASA and the commercial aeronautics industry had successfully developed technology that benefited commercial firms for years. Neither the Air Force nor NASA initiated relevant launch technology programs on their own; the studies and programs that were externally generated and forced on these agencies generally either were

ultimately diverted to support the higher priority mission requirements of those agencies or focused on such far-term technology developments that they had little practical payoff to commercial launch firms during the period under review. The U.S. Government chose not to work with the commercial launch industry in the same manner it had with the aeronautics industry. As a result, U.S. commercial launch firms were selling launch systems based on older ballistic missile technology in competition with the newer technology launch system of Ariane that had been optimized for use as commercial launch vehicles.

The issue of international launch trade agreements was intertwined with that of commercial satellite technology exports, as U.S. Government agency officials struggled to juggle national security and foreign policy considerations, the interests of U.S. commercial launch firms, and the interests of U.S. commercial satellite firms. In each case, the launch trade discussions with Europe, China, and the Soviet Union offered opportunities to use the issue of commercial launch trade as a tool to advance the nation's foreign policy agenda. Discussions with Europe never led to a formal agreement but did establish some basis for a discussion of what were appropriate levels of Government supports for the commercial launch industry. Commercial launch firms encouraged the U.S. Government to conclude a restrictive trade agreement with the Europeans, but a breakdown in agreement over who had the authority to negotiate on behalf of the Europeans sidelined the discussions. The aspect of the decision by the U.S. Government that allowed the export of satellites to China for launch clearly had an adverse impact on the competitive interests of U.S. commercial launch firms. The other aspect of the decision, the Memorandum of Agreement between the United States and China that limited the total number of commercial launches and the rate and conditions of their market entry, partially mitigated the potential competitive damage posed by the export approval. The Cape York decision would have permitted another entrant to the commercial launch market, but under controlled terms, as did the ultimate decision to allow Russia to launch an INMARSAT spacecraft.

Taken together, the U.S. Government actions which comprised the implementation of U.S. commercial launch policy both helped and hindered the abilities of U.S. commercial launch firms to compete. This is not to imply that the policy and its implementation actions were not at all beneficial to the U.S. launch firms; on balance, many of the outputs from the policy's implementation contributed greatly to what competitive success U.S. commercial launch firms have enjoyed. However, the implementation actions summarized herein portray an experience marked by mixed results. The output of the implementation did not lead to the expected outcome for the policy. This is a reflection both of the effectiveness of the policy's implementation and the limitations of the policy's design.

The competitiveness of U.S. commercial launch firms depended not only on the policy implementation actions of U.S. Government agencies, but also on decisions made and actions taken by U.S. commercial launch firms, international competitors and commercial customers, for reasons sometimes largely independent of U.S. commercial launch policy. These factors included: business decisions made by U.S. launch firms; purchasing decisions made by commercial satellite firms; the foreign policy priorities of other countries; and a number of other factors such as the timing of the policy, launch vehicle technical capabilities and reliability, spacecraft technology trends, and the fluctuation in the value of the U.S. dollar relative to the French franc.

There are several implications of these conclusions for the future of commercial launch policy and the future competitiveness of the U.S. launch industry. First, policy makers must take into account the degree to which they can control the behaviors of the actors and the events

which will ultimately shape the outcome of the policies they are designing. In commercial launch policy, U.S. Government policy makers could affect the behavior of the U.S. Government agencies, the behavior of U.S. launch firms through procurements, research and technology programs, and the behavior of international competitors through the negotiation of launch trade agreements. But it could not guarantee that the behaviors of those making private decisions would be consistent with its objectives and it could not assure a specific outcome in a market that it does not and can not control. Second, policy makers also must understand the relationship between the historical ties U.S. launch firms have enjoyed with the U.S. Government and its goal of competitiveness without subsidization. The U.S. launch services industry is limited in its abilities to change its ties with the U.S. Government. U.S. launch firms have depended in the past and continue to depend for their livelihood on sales of launch vehicles and services to the U.S. Government, use of U.S. Government launch facilities and support services, and U.S. Government investments in research and technology. While this trend is changing, U.S. launch firms will not behave like true commercial firms as long as this is the case, because they are not true commercial firms any more than are their government-subsidized European, Chinese, Russian, Ukrainian, and Japanese competitors. There may be little practical benefit, especially to U.S. launch firms that must bear the investment cost and risk, in moving the United States towards freer trade when the remainder of the launch industry continues its ties to its government sponsors. A more appropriate posture may be an open acknowledgment of the importance of a healthy launch industry to a range of U.S. Government interests and a renewed effort to engage all competitors in a trade negotiation process to establish "rules of the road" for fair trade. Finally, while U.S. commercial launch policy was an important priority of the United States, it was not as important as many other national priorities that appeared on the policy making agenda on any given day, and probably has not been as important in recent years as it was in 1986 after the Challenger accident. The national security and foreign policy objectives served by allowing the entrance of China and the Soviet Union into the commercial launch market has, in the long run, had a greater potential impact on the U.S. commercial launch industry than any other implementation action.

What does this suggest about the future ability of U.S. launch firms to compete? When a clear implementation strategy for U.S. commercial launch policy was finally defined and articulated, it comprised two interrelated elements: holding foreign competitors at bay through launch trade agreements to establish a level playing field in the near-term, while investing and enabling the U.S. commercial launch industry to develop more competitive technologies and get better organized for the long-term. While much has changed in the commercial launch industry since 1992, these two elements continue to comprise the current implementation strategy for U.S. commercial launch policy. New launch trade agreements have been signed or extended with China, Russia and the Ukraine, although the current U.S. national space policy "lays the groundwork for moving away from international launch quotas toward an international commercial environment characterized by free and fair trade in commercial launch services."<sup>13</sup> The most recent National Space Policy directive, promulgated by President Clinton's National Science and Technology Council, states that,

Free and fair trade in commercial space launch services is a goal of the United States. In support of this goal, the United States will implement, at the expiration of the current space launch agreements, a strategy for transitioning from negotiated trade in launch services towards a trade environment characterized by the free and open interaction of market economies. The U.S. Trade Representative, in coordination with the Office of Science and Technology Policy and the National Economic Council, will develop a strategy to guide this implementation.<sup>14</sup>

In one media account of the new policy, a reporter quoted a U.S. Government official as saying that, "Such a change 'would have been shocking a few years ago, but not now' . . . 'The world has changed so rapidly,' . . . that 'we're just trying to match policy with reality.'"<sup>15</sup>

Since 1992, the U.S. Government has initiated two major new launch vehicle development efforts. The Air Force has begun an Evolved Expendable Launch Vehicle program aimed at reducing future launch costs through a low-risk evolution and upgrading of existing launch vehicle technologies. The cost of these launchers to the Air Force is expected to be lowered by U.S. launch firms spreading the non-recurring expenses over anticipated commercial launch opportunities as well as expected Government launches. NASA, on the other hand, has initiated a cooperative development of Reusable Launch Vehicle technologies with the U.S. industry aimed at significantly reducing future launch costs for both Government and commercial launches. For the Reusable Launch Vehicle currently envisioned to be viable on a commercial basis, some commitment of future Government launches is also likely to be necessary. These programs represent a significant step forward in developing the technologies necessary for lower cost access to space. However, if the goals for both of these programs are to be fulfilled, both a significant commitment of future U.S. Government launches and the capture of a significant share of the potential commercial launch market will likely be necessary. All of this is taking place at a time when the U.S. Government is considering extending the life of the Space Shuttle by nearly twenty years and reconsidering its policy of flying commercial payloads on the Shuttle. These developments will likely result in the establishment of liens on the majority of the U.S. Government's launch market for years to come, continuing the dependence of U.S. launch firms on the Government market for their viability, and perpetuating the influence of this political economy on the abilities of these firms to compete in the commercial market.

Based on the experience between 1986 and 1992, one might predict that the future success of the U.S. launch industry will also continue to depend on the balance struck between negotiated launch trade agreements and the development of new launch vehicle technologies and capabilities that enhance U.S. competitiveness. The U.S. Government will continue to get pressured by the U.S. commercial satellite industry, which will continue to push for more liberal trade in launch services in search of lower launch costs. If the United States ever does transition away from negotiated trade in launch services to a free and open market, the competitiveness of U.S. launch firms will depend on the degree to which new launch technology has been developed that will give the United States a competitive edge. If, for whatever reason, that technology is not present when the transition to free markets is supposed to occur, one could predict that pressure will mount from the commercial launch industry within the United States to extend the trade agreements. What is clear is that there are valuable lessons to be learned from the early years of commercial launch industry that are readily applicable to the issues facing the country and U.S. launch firms today. It remains to be seen whether or not those lessons will be applied or whether they will have to be re-learned.

<sup>1</sup> Steven J. Isakowitz, *International Reference Guide to Space Launch Systems*, 2d ed. (Washington, D.C.: American Institute of Aeronautics and Astronautics, 1995), *passim*.

<sup>2</sup> The definition includes “any launches licensed by the Office of the Associate Administrator for Commercial Space Transportation of the Federal Aviation Administration under . . . the Commercial Space Launch Act . . . and certain European launches of post, telegraph and telecommunications payloads on Ariane vehicles.” Department of Transportation, Office of Commercial Transportation, “Quarterly Launch Report, 4th Quarter 1996,” November 1996, 1, A-1.

<sup>3</sup> Compiled from data in Department of Transportation, Office of Commercial Space Transportation, “Quarterly Launch Report, 1st Quarter 1996,” and subsequent reports.

<sup>4</sup> *Ibid.*

<sup>5</sup> Department of Transportation, “Quarterly Launch Report, 3rd Quarter 1996,” 12. Amounts are in constant 1994 dollars.

<sup>6</sup> *Ibid.*, “Quarterly Launch Report, 4th Quarter 1996,” SR-3.

<sup>7</sup> While the U.S. Government was the primary user of U.S.-produced launch vehicles, it also provided launch services to the INTELSAT consortium from 1965 on.

<sup>8</sup> Department of Transportation, COMSTAC Technology & Innovation Working Group, “Commercial Spacecraft Mission Model Update,” report, May 18, 1995, Appendix 1: COMSTAC 1995 Mission Model—History, 12-13.

<sup>9</sup> White House, Office of the Press Secretary, “United States Space Launch Strategy,” fact sheet, December 27, 1986.

<sup>10</sup> See Department of Transportation, “Quarterly Launch Report, 2nd Quarter 1996,” 13, for additional discussion regarding the intent of the National Space Transportation Policy released August 5, 1994.

<sup>11</sup> *Ibid.*, 11. The U.S. commercial launch industry has conducted over fifty commercial launches since the Challenger accident. The number of payloads and launches may differ because more than one payload can be launched on some launchers.

<sup>12</sup> While the Spacelifter program was proposed in the last days of the Bush Administration, the incoming Clinton Administration put a quick end to White House support for the program and it never “got off the ground.”

<sup>13</sup> White House, Office of the White House Press Secretary, “President Clinton Issues New National Space Policy,” September 19, 1996.

<sup>14</sup> White House, National Science and Technology Council, “National Space Policy,” fact sheet, September 19, 1996, 9.

<sup>15</sup> Kathy Sawyer, The Washington Post, September 19, 1996, A-23.