

# A Framework for Government-Commercial Economics in the New Space Industry

Mary Lynne Dittmar, Ph.D.\*  
*Dittmar Associates, Inc. Houston, TX*

Since the culmination of the X-Prize contest with the flight of SpaceShip One, a growing range of activities are developing around the “new” (i.e., non-government) space industry. Exploration of commercial potentials associated with space is generating interest in interrelated issues of law, regulation, and economics. Some examples include a review and revision of FAA regulations affecting space tourism, and debate regarding the Departments of Commerce and State regulation of transactions in space-based “territories” quite reasonably recognized as being beyond reasonable borders. Much discussion has taken place regarding the implications of various federal or state policies for economic activities. These might be considered “top down” models, wherein economics are developed within and guided by the framework of existing regulation and policy. By contrast, “bottom up” models are scarce. Such models are constructs of appropriate economic relations between government and commercial interests in space which might, in turn, drive policy and regulation rather than the other way around. This paper concerns itself with the latter and presents ideas on how to develop appropriate economic relationships between government and commercial space efforts.

## I. Introduction

A great deal of discussion in press about how best to enable the “New Space” industry, defined here as private industry initiatives supporting human spaceflight and the eventual human habitation of locations outside of Low Earth Orbit. The industry includes not only the capability for achieving space flight and habitation but the supporting infrastructure (communication, power, and transportation) that are necessary enablers of an expanding human presence in space. Much of this discussion has focused upon two related topics: (1) the role of government vis-à-vis funding for new space endeavors<sup>1</sup>, and (2) the role of government as a regulatory and policy-making entity<sup>2</sup>. These topics are related since agencies and other government entities which provide funding for commercial space (or any other) endeavor typically levy the regulatory and policy framework from within which a candidate company may operate in the pursuit and expenditure of those funds. In addition, the regulatory environment can have direct impact upon the economic viability and growth potential of private space companies by constraining or enabling their ability to carry out trade, create international partnerships (especially those involving technology transfer), and regulate their own safety environments, whether or not they receive government funding.

In the case of the National Aeronautics and Space Administration (NASA), agency execution of federal regulations and agency policies has sometimes had the unfortunate result of limiting or at least failing to enable commercial enterprise associated with the nascent non-government human spaceflight industry in the United States<sup>3</sup>. Historically, this has been a problem not only for NASA, but for the Federal Aviation Administration, which is responsible for development of regulations and policies governing spaceports<sup>4</sup>. Conversely, both agencies have also been praised for their efforts in support of commercial space - NASA in particular with regard to the Space Product Division which partnered industry and government funding for the development of science and technology applications<sup>†</sup>, and the FAA for its recent finalization of standards governing commercial space flight safety<sup>5</sup>.

These differences in opinion underscore an ongoing debate - and that is, what should be the nature of government-industry relationships in the development of New Space? Predictably, the answers frequently depend on who is presenting them. With regard to the topic of government investment in commercial space efforts, there are two general models. The first is one in which the government provides investment of some type, either as “seed” funds or through like-kind, joint investment with industry. This model may also include incentives - for

---

\* President & CEO, Dittmar Associates, Inc., 18333 Egret Bay Blvd., Ste. 270, Houston, TX 77058-6400, AIAA Member

† The SPD program has been effectively cancelled effective October 1, 2006.

example, tax breaks - or business models in which the government serves as an anchor tenant or primary customer, gradually transitioning out of this role as alternate markets develop. Several New Space advocates, most notably the Space Frontier Foundation (SFF), have recently argued that government investment in new commercial space flight capabilities is a necessity to successfully achieve the goals laid out in the Vision for Space Exploration announced in 2004<sup>6</sup>. While the SFF acknowledges that government investment is not a guarantee of success, it basically argues that the role of government should be to encourage commercial enterprise in human spaceflight through the investment of public money, pointing to historical examples as cases in point.

## II. Government Investment

An oft-cited example of government playing a strategic role in the development of an industrial sector may be found in the funding of applied research and construction of aircraft prototypes prior to World War II. NASA's precursor, the National Advisory Committee for Aeronautics (NACA) was from its founding in 1915 the predominant government agency supporting civil aircraft R&D through a series of aeronautical innovations that helped establish a U.S. aircraft industry. Beginning with work on wind tunnels at Langley, Virginia, NACA supported research in aerodynamic efficiency and brought about design of a new family of airfoils, among other breakthroughs. Later, through the Kelly Act, the Postmaster General of the United States was empowered to award contracts for carrying airmail to private airlines. The Post Office expanded the domestic route system by avoiding competition on individual routes and by awarding contracts to fly specific routes in a successful effort to streamline and rationalize the industry. By 1933, the "Big Four"—United, American, TWA, and Eastern—collected nearly 94 percent of the \$19.4 million paid to airmail contractors. Passenger transport eventually took hold, and by 1935 the Big Four were carrying people, cargo, and the mail along established routes.<sup>7</sup>

Another example of government involvement at the early stages of what evolved into a healthy market sector may be found in the most successful example in the commercial space industry, albeit not in human space flight. On October 1, 1958, President Eisenhower signed into law the formation of a new agency, the National Aeronautics and Space Administration, which was made up largely of NACA and a few other assets. The first missions of the new agency pertained to the development and launch of satellites as a direct response to Soviet achievements beginning with Sputnik in 1957. The potential for satellites in civil as well as military applications quickly became clear, and in 1962 NASA spun off commercial satellites into a new, government-formed corporation named COMSAT. This act in turn led to the explosion of satellite capabilities - and in turn drove the emerging launch industry - culminating in a wide array of commercial services which today include GPS and related technologies, satellite television, and satellite voice and internet communications links. These services combined now generate global revenues of more than \$88B yearly.<sup>8</sup>

These two cases are often cited as examples of government investment in space-based capabilities and then transferring those capabilities to the market, and are used as part of a more general argument advocating a reconstruction of NASA's approach to human space flight.<sup>9</sup> However, it is worth noting that other government investment in space initiatives has failed, particularly as pertains to human space flight. The Delta Clipper Experiment, known as the DC-X, was developed as a reusable spacecraft with funding from the DoD but was eventually abandoned by NASA<sup>10</sup> despite its technical promise.<sup>‡</sup> Another program known as the X-33 ("Venture Star"), touted as a next-generation space shuttle and envisioned as a commercial vehicle, was similarly abandoned when technical problems, cost overruns and a change in policy conjoined in 2001, but not until over \$1B had been spent by NASA, which put up approximately 2/3 of the funding.<sup>11</sup>

Other well-known examples of failed attempts by the government to spur commercial development of a new technology may be found outside the space arena, in the related fields of energy and power generation.<sup>§</sup> One of these was concerned with the production of synthetic fuels. In the 1970's and 1980's the government expended considerable resources in the forms of federal loans, loan guarantees, price guarantees, tax breaks, and other incentives totaling approximately \$20B for the purpose of developing a synthetic fuel industry<sup>12</sup>. In 1980, Congress established the Synthetic Fuels Corporation (SFC), a quasi-independent corporation structured much like COMSAT. SFC's charter was to develop large-scale projects in coal and shale liquefaction and gasification. The corporation closed in 1986, after the collapse in energy prices. The National Academy of Sciences noted that the program was established without sufficient flexibility to meet changes in market conditions, and also that an emphasis on early

---

<sup>‡</sup> The DC-X has been resurrected in part by the commercial space transportation company Blue Origin, which is building a reusable launch vehicle loosely based upon the Clipper's design.

<sup>§</sup> These examples were selected for this paper because they may be instructive in regard to recent calls for increased government investment in space power capabilities.

production targets (i.e., bringing fuels to market prematurely) also reduced research and program flexibility.<sup>13</sup> In this case, government investment and incentives exceeded by more than one order of magnitude the investment in either the X-33 program or in the current Commercial Orbital Transportation System (COTS) program<sup>14</sup>, and still failed.

In total, government attempts to commercialize technologies or capabilities are more likely than not to be unsuccessful. Many other factors, including market demand and pricing, market volatility, schedules, and production costs also play a major role in the outcome of commercialization efforts. This is by no means an argument against government investment in technology; basic and applied research and development is undertaken with the understanding that the majority of effort has indirect payoff, if any; however the value of successful development and commercialization of breakthrough technology makes it worth the risk. It does, however, underscore the reality that government investment in human spaceflight is not necessarily the best means-to-an-end, if that end is the development of a viable commercial space industry.

### III. Regulatory Environment

Regardless of the robustness of a technology, the strength of a business plan or the demand characteristics of a target audience, emerging markets can be made or broken solely on the basis of the regulatory environment into which they are born. Similarly, changes in an existing regulatory framework can increase or retard technology adoption and diffusion.<sup>15</sup> Thus, not only the structure but the stability of the framework is important when developing a market. For example, in the case of the Synthetic Fuels Corporation, while rapid market changes contributed to its collapse, so too did the regulatory environment. A primary market for synthetic fuels and for the fuel cell technologies under development by the SFC was anticipated to be as a replacement for heating oil and other fossil fuels used for thermal regulation of buildings, particularly in the northern climes of the United States. However, implementation of energy performance standards for buildings, which would have provided a basis for evaluation of new technologies intended for introduction into that market, were held back by a complex network of regulations imposed by federal and state agencies. Failure to implement those standards resulted in extended delays in introduction of the technology, thereby preventing its adoption<sup>16</sup>.

On the other hand, a case where regulation successfully spurred private investment and growth of an industry may be found in the aforementioned Kelly Act. Government investment in the form of becoming an “anchor tenant” for airmail service has already been described; however the Post Office also used its regulatory power to establish flight routes and develop airports with navigation beacons from coast to coast. The use of regulation to guide infrastructure development and then to determine which airlines could compete for which routes was as much responsible for the controlled growth of the private airline industry as was government investment and incentive.<sup>17</sup> With regard to New Space, recent discussions about the regulatory and legal framework extend from rules governing spaceports on Earth to extensive analysis and interpretation of the “Outer Space Treaty”<sup>18</sup>, with emphasis upon its implications for governance of private activities on the Moon. White has pointed out the need for legislation and regulation governing space commerce, for the following reasons:

- “To implement multilateral space treaties
- To govern private space activities
- To provide legal certainty for companies and their investors
- To minimize litigation
- To provide incentives for private space activities”<sup>19</sup>

“Providing legal certainty...” evokes the need for regulatory/legal stability, and “to provide incentives...” refers to one role that regulations can play, that is to incentivize industry. However, regulations can play many roles, and it is often a challenge to determine *a priori* which regulatory approach may be most useful in enabling new markets. The specific choices of what regulations to put into place, and how to implement them once they are written into law, are complex and are too often the subject of regulatory “post mortems” - that is, analyses of why they have failed.

In testimony before the House Subcommittee on Science, Subcommittee on Space and Aeronautics on April 20, 2005, Burt Rutan described the obstacles placed in the path of the development of SpaceShip One, which he said were based upon the misapplication of regulations developed for expendable booster rockets.<sup>20</sup> Although one consequence of the Commercial Space Launch Amendments Act of 2004 was to place commercial launches under the FAA Office of Commercial Space Transportation<sup>21</sup>, Rutan’s position was that vehicles such as SpaceShip One should be regulated by the FAA aviation safety office (AVS). Not to do so, he believes, will place inappropriate and expensive burdens upon the spacecraft developer.

Rutan's comments evoked considerable controversy, but do point to the difficulty with regulation and the struggle to formulate approaches that will enable, rather than burden, emerging business, particularly when those businesses are not well understood. An additional regulatory burden subsequently facing Rutan's company about which there is far less dispute is the export control difficulties which have faced his company, Scaled Composites, in their development with Virgin Galactic of a commercial suborbital spaceflight service. Virgin is a British company, and U.S. export control laws collectively known as "ITAR" (International Traffic in Arms Regulations) have caused delays in the program, including delays in placing orders for two "SpaceShip Two" spacecraft, resulting in the postponement by one year of the inception of the commercial spaceflight service<sup>22</sup>. These concerns were echoed by Elon Musk, founder of SpaceX, who noted difficulties in conducting business transactions with entities in New Zealand, the United Kingdom, and Canada.<sup>23</sup>

This is not the first time that the negative effects of ITAR on commercial space businesses have been pointed out. In particular, the Satellite Industry Associates (SIA) has been very effective in identifying the impacts of ITAR, estimating that ITAR was largely responsible for a tremendous decrease in U.S. market share of the global satellite industry from 62% in 1998 to 36% in 2002.<sup>24</sup> Accepting for the moment that ITAR is representative of the legislative tightrope that must be walked when developing regulations that balance technology and economic growth with the interests of national security, with regard to space commerce it is also a dramatic example of the "law of unintended consequences" in its effects upon international conduct of business.

#### **IV. Building a Regulatory Model for Commercial Space**

##### **A. The Importance of Impact Assessment**

Neither government investment nor government regulation will necessarily enable New Space ventures. Cases with both successful and unsuccessful outcomes have been presented here. Noting that the United States did not have a regulatory system for defining government/public sector relations that was "effective, consistent, sensible, and understandable", in 1993 President Clinton signed into law Executive Order 12866, which mandated impact assessments prior to formal introduction of regulation. Beginning in 2000, the Bush Administration has essentially followed the approach defined Executive Order 12866, which requires Federal agencies to submit certain regulatory actions to the Office of Management and Budget (OMB) for review. The agency must provide OMB the text of the regulatory action, together with an assessment of the impacts of the regulatory action. The assessment must describe the need for the regulatory action and how it will meet that need. It must also explain how the proposed regulatory action is consistent with statutory mandates, promotes the President's priorities, and avoids undue interference with State, local, and tribal governments in the exercise of their governmental functions, among other criteria.<sup>25</sup> Although Executive Order 12866 and the OMB's implementation seeks to impose greater rigor on the formulation of economic and regulatory policy, the method by which it is implemented varies as a consequence of the history of a given regulatory framework or business/government sector, the perceived urgency of the regulatory change, and the individual training and perspectives of the personnel carrying out the assessment. With regard to the Economic Impact Assessment component of the Order, an analysis of the assessment approach reveals that considerable information regarding the market is necessary in order to make a rigorous determination. With regard to regulations involving government investment, the OMB notes:

"In particular, regulations establishing terms or conditions of Federal grants, contracts, or financial assistance may call for a different form of regulatory analysis, although a full-blown benefit-cost analysis of the entire program may be appropriate to inform Congress and the President more fully about its desirability."<sup>26</sup>

In the case of the New Space industry, a "full-blown cost-benefit analysis" cannot be undertaken without knowledgeable input from industry representatives. No market yet exists from which to extrapolate impacts as a result of introduction or change in the regulatory landscape. As noted, New Space advocates frequently point to historical examples such as the Kelly Act or relaxation of ITAR regulations as necessary to enable success and growth; however, in the absence of supportive data such as can be generated in market analysis or in the development of business plans, these calls are based on an appeal to "what worked before", are therefore highly selective, and disregard the very real possibility of unintended consequences or failure.

##### **B. A Suggested Approach**

Determination of the appropriate relationship between government and New Space will be best defined by the New Space industry itself, but on the basis of formal assessment methodologies, rather than an appeal to the past. These methodologies must be well-grounded in quantitative, qualitative, and participatory approaches that are methodologically sound and will stand up to scrutiny of the government agencies ultimately responsible for

formulating policy. Taken together, the following architectures are recommended when considering the development of effective educational and outreach campaigns pertaining to the Vision, to space, and to related fields such as science, math, and engineering:

In the case of an emerging market, when sustainable growth is the desired outcome, the social, economic and environmental impacts of a regulatory intervention are linked. In order to guide future regulation, New Space and its investors should consider developing industry positions and data that provide a basis for assessing these impacts. The announcement in 2004 of the formation of the Personal Spaceflight Foundation, which has as member companies most of the entities identified with the New Space industry, might serve as appropriate forum for this undertaking. In that role, the Foundation could attract the resources necessary to generate some of the following information:

- Baseline studies (i.e., definition of industry baseline conditions)
- Definition of industry objectives
- Target setting for the industry
- Guidelines for performance evaluation
- Bases for outcome measurement (in the case of regulatory intervention)
- Identification of potential social impacts

Whatever studies are undertaken, consideration should be given to transparency (and public accountability), stakeholder involvement (i.e., all facets of the industry), reliability of the information obtained, reliability of inferences drawn for policy formation, and cost and skill requirements. These studies are often costly and take years to initiate and complete; however at the dawn of an emerging industry such as New Space they represent the best opportunity to influence industry development and - more importantly - to define the industry through the input of its members and business partners.

## V. Summary

Congressional testimony, public announcements and commentary, white papers, and books have focused on the need to establish an appropriate government-commercial business relationship for the New Space industry. To date, these efforts remain limited by their “stovepiped” origins - representing largely the opinion of individuals or organizations. In addition, many of them rely heavily on historical models to define their framework-of-choice for defining the relationship, either through investment of public funds, or the implementation of enabling regulations, or both. This paper reviewed several historical cases built upon economic incentives or regulation and proposes that the industry adopt a proactive, consensual approach to guiding future regulation that is based on data and information generated from within the industry itself.

## References

- <sup>1</sup> Dittmar, M. L. “Commercial Avenues for Space Utilization.” *AIAA Space 2003 Conference*, Vol 1, AIAA, Washington, DC, 2003.
- <sup>2</sup> MacCauley, M. K. “Space Commerce in the 21<sup>st</sup> Century”. Testimony given before the House Committee on Science, Subcommittee on Space and Aeronautics, April 20, 2005.
- <sup>3</sup> Klerkx, G. *Lost in Space: The Fall of NASA and the Dream of a New Space Age*. Pantheon Books, New York, 2004.
- <sup>4</sup> Rutan, B. Testimony given before the House Committee on Science, Subcommittee on Space and Aeronautics, April 20, 2005.
- <sup>5</sup> U. S. Department of Transportation, Federal Aviation Administration. “Licensing and Safety Requirements for Launch: Final Rule”. 14 CFR Parts 401, 406, 413, 415, and 417. Federal Register, Vol. 71, 165. August 25, 2006.
- <sup>6</sup> Space Frontier Foundation. “Unaffordable and Unsustainable? Signs of Failure in NASA’s Earth-to-orbit Transportation Strategy.” Space Frontier Foundation, New York.. Accessed on July 25, 2006 at <http://www.space-frontier.org/Presentations/UnaffordableUnsustainable.pdf>
- <sup>7</sup> National Academy of Sciences, *The Government Role in Civilian Technology: Building a New Alliance*. National Academies Press, Washington, DC, 1992, Chapter 2.
- <sup>8</sup> Satellite Industry Association. “State of the Satellite Industry Report, 2005.” Satellite Industry Association, San Diego, CA, 2005.
- <sup>9</sup> Lepore, D. F. Commercial Acquisition Strategies for Space Exploration. *AIAA Space 2005 Conference*, AIAA, Washington, DC, 2005

<sup>10</sup> Klerkx, op.cit., p.101-110.

<sup>11</sup> ibid

<sup>12</sup> National Academy of Sciences, op.cit.

<sup>13</sup> ibid

<sup>14</sup> National Aeronautics and Space Administration. Commercial Orbital Transportation Services Demonstrations. Announcement Number COTS-01-05. Houston, TX: Lyndon B. Johnson Space Center. 2006.

<sup>15</sup> Hall, B. H., and Khan, B. "Adoption of New Technology," Institute of Business and Economic Research Paper E03,330, Department of Economics, University of California, 2003.

<sup>16</sup> John Deutch, *Commercializing Technology: What Should DD Learn from DoE?*, Center for International Security and Arms Control, Stanford University, 1990, 6.

<sup>17</sup> National Academy of Sciences, op. cit.

<sup>18</sup> United Nations. "Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, include the Moon and Other Celestial Bodies," *United Nations Treaties and Principles on Outer Space*, New York, 2002.

<sup>19</sup> White, W., "Commercial Space Activities and the Law" Presentation given at Exploring the Potential for Lunar Commerce: Roundtable 1, Cox School of Business, Southern Methodist University, Dallas, Texas, June 2005.

<sup>20</sup> Rutan, op. cit.

<sup>21</sup> Harvard University, "Commercialization of Space: Commercial Space Launch Amendments of 2004," *Harvard Journal of Law and Technology*, 17, No. 2, Spring 2004.

<sup>22</sup> Whitehorn, W, Testimony given before the House Committee on Science, Subcommittee on Space and Aeronautics, April 20, 2005.

<sup>23</sup> Musk, E. Testimony given before the House Committee on Science, Subcommittee on Space and Aeronautics, April 20, 2005.

<sup>24</sup> Satellite Industry Association, *Satellite Industry Statistics 2002*. Satellite Industry Association, Washington, DC, 2002.

<sup>25</sup> Office of the President of the United States, "Executive Order 12866 - Regulatory Planning and Review." *Federal Register*, Vol. 58, No. 190. Washington, D.C. 1993.

<sup>26</sup> Office of Management and Budget. Circular on Economic Analysis of Federal Regulations Under Executive Order 12866, January 11, 1996. Accessed at <http://www.whitehouse.gov/omb/inforeg/riaguide.html>