

THE PROSPECTS FOR SPACE COMMERCE IN THE AFTERMATH OF 9/11

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The first humans landed on the Moon with Apollo 11 on July 20, 1969. Our last lunar landing was with Apollo 17 on December 11, 1972. In the thirty years that have past since men walked on the Moon, we have seen the commercial space industry, consisting mainly of telecommunication satellites and expendable launch vehicles (ELVs), grow into a multibillion dollar industry. Yet, today's commercial space industry is a limited industry. If the commercial space industry is to develop beyond today's level of space commerce, it needs to expand by developing New Space Industries (NSIs) and emerging space business ventures. Is this expansion plausible in the aftermath of 9/11, a near global recession, and our war on terrorism, and if so, over what time period?

This paper discusses some of the more plausible NSIs and what is needed for the overall success of new and emerging commercial space ventures. In addition, an attempt is made to gauge the full impact of the aftermath of 9/11, the recession, and the war on terrorism upon a newly developing and expanding commercial space industry. The effect of current launch costs upon the developing space industry is also considered including whether the payload consists of cargo or humans to orbit, and the payload destination. Business planning, including the financing of space ventures, is also discussed.

Policy considerations play an important role in developing our space economy. As such, some of the conflicts of interest within both the established aerospace industry and NASA that have the potential to adversely impact commercial space development are discussed. Sometimes the commercial space industry can be its own worst enemy through improper planning, damaging rhetoric, and conflicts of interest. By noting these problems we can learn how best to avoid them in the future and move forward in expanding the commercial space industry.

The paper concludes with a discussion of the awesome responsibility we have in seeding the off-Earth environment with our people, culture, business practices, and our economic principles and values. What we do today in space has the potential to impact those of us here on Earth, as well as those who will choose to work, live, and play in space from this time forward through future generations. Therefore, my Code of Ethics for Off-Earth Commerce¹ is cited as one possible tool for ethical behavior and for assuring corporate, business, and personal responsibility for our future in a space-faring world.

Resolving the problems associated with transporting people to and from space in a cost-effective space transportation vehicle—most likely the reusable launch vehicle (RLV)—is crucial to the successful development of the commercial space industry. Suggestions are set forth that have the potential for making a positive impact on the RLV, space tourism, and commercial space industries. Public and private sector cooperation is essential. Financing NSIs and emerging space business ventures is fundamental to developing an expanded commercial space industry.

Today's Commercial Space Industry

Lest anyone doubt the profitability of businesses commercially operating in space today, we need look no further than the commercial satellite industry. This industry has a thirty-eight year track record of commercial space operations dating back to April 1965 when the Early Bird satellite was successfully launched. Since then, commercial space ventures have grown and profited to an impressive degree.

To gauge the growth and profitability of the commercial space business, we need reliable data. Fortunately, such data exist. KPMG Peat Marwick in collaboration with SpaceVest, the Center for Wireless Telecommunications, and Space Publications, has published an informational journal, *1997 Outlook: State of the Space Industry*. This comprehensive report analyzed the commercial space industry of 1996 with industry projections for the year 2000. The report stated that worldwide revenues from space commerce totaled \$77 billion in 1996 and projected annual revenues of \$121 billion by the year 2000.² In 1996, for the first time, revenues received by private launch companies were greater from commercial organizations than from the federal government, with 53 percent of the revenues coming from the commercial side and 47 percent coming from the government side.³ Also in 1996, the space industry as a whole employed an estimated 835,900 employees.⁴

In addition to the KMPG *Outlook* report, two other industry reports are useful in demonstrating the financial success of this industry, although they don't evaluate and analyze the industry in the exactly the same way. Merrill Lynch, in its annual satellite industry review, *Global Satellite Marketplace 99*, projected the industry to increase from an estimated \$36 billion in 1998 to \$171 billion by the year 2008. This represented a 17.5 percent annual growth rate.⁵

C.E. Unterberg, Towbin, a noted financial company with offices in New York and San Francisco, produces *The Satellite Book* with quarterly updates. According to the second quarter 1999 issue, the commercial satellite industry was estimated to grow from a \$54.8 billion industry in 1998 to an estimated \$116.3 billion in the year 2003.⁶

Clearly there is a profitable commercial space industry operating both worldwide and in the United States today. Putting today's commercial space industry in perspective with leading businesses at the time these reports were made, however, gives a sense of the relative size of this newly developing industry and the potential awaiting its continued development. For example, it is interesting to compare the entire launch industry segment of the total commercial space industry with General Motors, the largest revenue-earning corporation in the world in 1999. General Motors reported total international sales of \$176.6 billion for 1999, with a corresponding total net income for the same year of \$6 billion.⁷ In 1997, Arianespace studied the size of the launch market and determined that its growth would be flat over the next ten years, generating gross revenues totaling \$34 billion.⁸ This is slightly more than \$3 billion per year and includes both the commercial launch demand and the demand for government research launches. One corporation alone, General Motors, generated almost 59 times the revenues of the total launch industry!

New Space Industries (NSIs)

NSIs have the potential to increase revenue streams and profits dramatically for the space industry. The most commonly mentioned NSIs include reusable launch vehicles (RLVs), space transportation systems, fast package express, space tourism, space business and theme parks, space manufacturing, microgravity research & development, remote sensing, communication, space solar power, entertainment, space rescue services, space mining/resource development, waste disposal, space servicing and transfer, space utilities, and orbital debris removal. In addition to this known list, I like to include one's imagination as an NSI because once a space-based economic infrastructure exists and NSIs are being developed, new ventures will come into being that are not even in today's consciousness.

From the list of possible NSIs, those with stronger market certainty and needing less in the way of new technology or costly engineering are more likely to be realized. Some of these near-term NSIs are the RLVs, space transportation systems, space tourism, fast package express, orbital debris removal, remote sensing, communications, entertainment, and space rescue. Most if not all of these plausible space businesses are ideal for the private sector to develop and exploit. They can also be built upon common and shared space infrastructure.

It is worth noting that NASA and the White House are considering the development of nuclear power for space travel. Identified as Project Prometheus, this government program would enhance access to space, especially to locations outside low-Earth orbit (LEO). Nuclear powered space transportation vehicles would be able to operate more efficiently, with larger payloads than today's chemical rockets and the travel time to destinations would be greatly reduced. For example, a mission to Mars, which might take six months or more using one of today's chemical rockets, might only take six weeks to make the same trip using nuclear power.⁹ Should Project Prometheus come into being over the coming decade, it has the potential to revolutionize and accelerate the timetable for NSI development, just as Apollo revolutionized the space program thirty years ago.

Cost-Effective Space Access

More than ever, for NSIs to come into existence in the aftermath of 9/11, the recession, and the war on terrorism, there needs to be cost-effective space access, constructive public and private sector policies, comprehensive and strong business planning, risk mitigation, market validation and exploitation, capital acquisition, and proper timing. There must be a focus on fundamentals and essential economic components of the space business venture. Thus, we need to start by taking a look at our ability to both frequently and economically access space.

At the present time, there is no cost-effective space access for either cargo or humans. Today, we access space using expendable launch vehicles (ELVs) or evolved expendable launch vehicles (EELVs) for satellites of all types. We require the Space Shuttle in the United States and the Soyuz in Russia for men and women going to space. Though ELV and EELV costs can be high, ranging upwards of more than \$10,000 per pound to orbit depending on the launch vehicle used (the Space Shuttle) and the orbit objective, most satellite and telecommunication companies

have been able to operate profitably, grow, and expand their markets. However, transporting people to and from space is a completely different matter.

The U.S. Space Shuttle costs upwards of \$500 million per launch, sometimes approaching \$1 billion per launch. While the Soyuz is considerably less costly at a price of about \$100 million per launch, the Soyuz only holds three people and the number of flights it can make per year are limited as are the number of annual flights using the Space Shuttle. For human space flight, there simply is no affordable space transportation system, thus all commercial ventures requiring the presence of people in space are thwarted until the economics of space access dramatically change along with the ability to go to space frequently with large numbers of people.

Many companies are working toward designing and developing RLVs, which will allow for cost-effective human space access. These companies are in various stages of their business development program, attempting to raise capital, working on engineering and technology requirements, and competing to be the first with a passenger-certified RLV. NASA and the large aerospace industry are also working on second-generation launch vehicle designs but at a much slower pace and using a more research- and new-technology-oriented approach. Regardless of how a new launch vehicle comes into being, the fact is that today, there is no cost-effective launch vehicle of any type. Having such a vehicle is absolutely essential to developing and expanding space commerce. In the aftermath of 9/11, many companies, especially the start-up space transportation companies, have been adversely impacted in their ability to attract and secure capital. Still, for businesses with solid planning, market confirmation, and a cost-effective marketing program which allows for market development with a proven management team, the opportunities for success are remain strong. Regardless, it is important to understand that an RLV or new space transportation system remains the key to the future economic success of space development, and that such a vehicle makes possible space tourism and the other plausible near-term NSIs.

The newly emerging space businesses must also show they are capable of mitigating their risks, capitalizing on the right timing, and working within the present policy and regulatory environments. Having an experienced and proven management team is a crucial component of success and is highly valued by investors and financiers. While modifying or changing space policies and regulations to enhance a business opportunity can be a good thing, it will probably be costly and time consuming.

Public and Private Sector Issues of Concern

There are several policy issues that concern commercial space development. These issues include competition with the government, government financial and tax incentives, aerospace industry issues, determining the proper role for NASA, the Space Launch Initiative (SLI),¹⁰ and comprehensive business planning. Examples of this concern stem from the following: the National Transportation Space Policy of 1994, the National Space Policy of 1996, the NASA Strategic Plan, the NASA Administrator's Strategic Outlook, various U.S. laws and regulations, the lack of both private- and public-sector financing, the X-33 failure,¹¹ the Iridium bankruptcy¹² and other constellation satellite system problems, misperceptions and damaging rhetoric from

leading industry and NASA executives, conflicts of interest within the large aerospace industry as well as the government, and the SLI.

Damaging Rhetoric

It is important to highlight the damaging rhetoric, as this may be the most insidious of all space barriers. This is because it directly and adversely impacts people's minds and the result is very difficult to overcome. Changing a law, policy, or regulation has a process to it. Changing a point of view, a deeply entrenched belief system, or altering one's perception based on new information can be quite challenging. The examples of damaging rhetoric that can skew a person's mind, thinking, and ultimately their behavior come from both the leaders of the aerospace industry as well as NASA.

Addressing Congress On May 21, 1999, Peter B. Teets, then-President and CEO Of Lockheed Martin, when referring to their VentureStar RLV, stated that the project was unsuccessful in "attracting Wall Street investors and would need some form of added government funding or loan backing. Wall Street has spoken. They have picked the status quo—they will finance systems with existing technology. They will not finance VentureStar."¹³

Another example comes from a comment made by Daniel Goldin, the former NASA Administrator, on July 12, 1999. Goldin was reported saying that U.S. companies and investors won't finance costly new launch-vehicle programs without further reducing the technical and financial risks. *Space News* quoted Goldin as saying that "NASA will probably have to retire the technical risk. There isn't one corporate executive in their right mind that would take on a multibillion-dollar investment that won't have a payoff until 10 years from now. In the space community, we have space in our heart. When you're in corporate America, you've got to meet the numbers."¹⁴

Yet another example comes from a Boeing study of commercial space tourism showing that the costs of developing a space tourism capability was currently impractical, according to Vice Chairman Harry C. Stonecipher. Boeing found that development of a two-stage commercial vehicle to provide 50 passengers with short orbital flights would cost at least \$16 billion. Tickets would have to cost \$150,000 each, and the vehicle would have to fly at least 800 times per year for the project just to break even. Stonecipher and other Boeing managers said they believe the \$16 billion figure is itself seriously understated because it does not deal with costs associated with regulatory issues or other expenses.¹⁵

What all of these comments failed to mention was important. With VentureStar for example, the engineering was widely considered by experts to be flawed from the beginning with no chance of VentureStar succeeding. Also, its selection in the competition over other companies with already successfully tested technology and a prototype vehicle was an issue. Yet for Wall Street financiers not knowing the history or the specifics of the matter, hearing directly from the Lockheed CEO was enough for them to agree with his analysis. The same for the Goldin comment. Wall Street believed (and still believes) that if NASA or Lockheed can't build it, it simply can't be built. Goldin's comments did not tell the entire story. From the perspective of

those that were knowledgeable about the issue he was discussing, it was easy to see how his comments could be construed as misleading.

As for the Boeing space tourism comments, this too needs to have the light of day shined upon it. While Boeing has this study, it would obviously be from the Boeing perspective. It is important to understand that Boeing is a very large and profitable maker of ELVs and the newer Delta IV, an EELV. Along with Lockheed, Boeing benefits from a multibillion-dollar contract to operate the Space Shuttle and to improve and upgrade it. At the present time, it is not in the financial interest of Boeing or its stockholders to develop a new launch vehicle that would eat into the company's existing launch vehicle and shuttle operating stream of revenues. For someone hearing or reading these comments without have a full understanding the complete picture, however, one might easily think that commercial space tourism is simply not plausible in a reasonable time period. It is easy to see how an understanding like this could result from the very authoritative Boeing report and statement, but the Boeing perspective needs to be considered. Thus, the rhetoric can be damaging and people's minds can easily be adversely influenced by one-sided statements that do not address all sides of an issue. In a perfect world, such statements would be accompanied by an explanation of the legitimate and very real pressures that are exerted on the people or the company making the statement. Were this the case, any statements made would reflect the complete picture regarding a specific issue.

Recommendations For Expanding Space Commerce

It is relatively easy to look at the way the commercial space industry is structured today, including all of the components that have an impact upon on it, and point out weaknesses, problems, barriers, and troublesome policies. The challenge, however, is coming up with practical, viable, and cost-effective remedies to these difficulties and in getting support from those involved in space commerce that can make a difference. With this in mind, I have suggested a series of recommendations that have the potential to move the commercial space industry forward.

A long-term recommendation is for young people to begin to consider, plan, and choose the commercial space industry as a career. Real opportunities await those who can take advantage of the developing commercial space industry. While this particular recommendation will take several years to develop as education and skill building are not achieved overnight, such actions undertaken now by students, teachers, space advocates, policy makers, and space-oriented businessmen and women, will help pave the way for commercial space development during the coming years.

A second recommendation is to realize that political activity on the part of space advocates and commercial space promoters is important. Our nation thrives on political activity and effectively communicating with our elected representatives and policy makers is an important part of our political, social, and economic way of life. Even if the immediate response is tepid, we must push forward with our goals and our focus in the political arena. By doing so we can accomplish much over a shorter time frame than if we did not advocate in the political arena. The key is to make sure that our efforts are productive and that we understand how specific barriers in the form of policies, regulations, and laws actually interfere with space

business opportunities, and how these can be changed. Many of the existing space advocate organizations have very effective political action components in their organizations so learning how to do this does not mean reinventing the wheel.

Third, applying constructive pressure to accomplish positive results is essential in space development. Challenging the contradictory and limiting policies, regulations, laws, and even international treaties is important. It is through these challenges and the creation of an effective strategy for dealing with these challenges that solutions to the problems will be achieved.

Fourth, it is important that space businessmen and women understand that their business plans and concepts must compete with terrestrial businesses. This puts added burdens on the space venture to project and competitively perform, mainly because the associated risks for the space venture may be higher than those for similar terrestrial ventures. It also demonstrates to financiers and investors that the space venture management team understands the financial and risk markets. Thinking that the business is special because it involves space is not sufficient for attracting capital and other business support.

Fifth, when talking about space commerce or related fields, it is extremely important to personalize the benefits for the person or group being addressed. Just to say that the space program is responsible for pace makers or Velcro is not enough unless one has had or is having a valuable experience or relationship with someone using these items.. Finding out what may be important to the person or group being addressed, and seeing how that relates to space can be transforming as it makes a direct and personal connection with those in the audience. When this connection is made and when a firm relationship is established, new advocates for the space program are created and while they may not be very active in promoting space, they no longer are part of the barrier side of the issue.

Misperceptions are common in the space field and are largely a result of damaging rhetoric from agencies and businesses that seem to have authority in space matters, as has already been pointed out. A sixth recommendation, then, is to support quality space educational programs and political action to counter the rhetoric and the misperceptions, something that all of us can readily do. The results from such positive action taken to counter the rhetoric and existing misperceptions can also be realized over a reasonable period of time.

Seventh, it is strongly urged that within the space community itself, infighting and conflicts of interest be eliminated or exposed and dealt with in an open and honest fashion. The infighting among those with competing agendas is damaging and counterproductive. While competition is desirable and can produce positive results and benefits for everyone, it must not be destructive. Conflicts of interest exist widely in the commercial space environment, especially in relationships with NASA, the aerospace industry, and even with some of the smaller, entrepreneurial start-up space companies. It is not possible to avoid conflicts of interest, but they should be stated up front so that people know the perspective and pressures on a particular company, agenda, or course of action. One such example of this latter point is the development of a reusable launch vehicle by private industry. Boeing and Lockheed are logical builders for this type of vehicle, yet they are only involved in long-term research and are working on the problem within the framework of NASA programs. This position is clearly understandable when

one is aware of the contracts to maintain and eventually remodel the Space Shuttle to keep it flying for another 15 years, and their sale of both ELVs and EELVs. It would not be prudent for these companies to expedite an R&D program that would reduce or even replace a company profit center. It may even be counter to their fiduciary responsibility for their investors given that a small number of RLVs can theoretically replace the Space Shuttle and all the ELVs and EELVs launched each year.

Eighth, the commercial space industry needs to ethically and professionally manage its business ventures, space resources, and overall space development. Across the board on a worldwide basis, there is an ethical consciousness about what and how we do things here on Earth as well as in space. As expanded space commerce comes closer to reality, ethical concerns will increase. The space industry, through professional management and a demonstrated concern for ethical issues and principles, can win friends and supporters during this crucial initial stage of commercial space development. This support will prove vital in helping achieve constructive policies and legislation. If people perceive that space businesses and the related space development are following the greed and unethical models of business that seem so prevalent as we move into this new century, then they will make sure their concerns and restrictive goals for space development are heard by those responsible for in the very policies and regulations needing change. By demonstrating ethical and professional management of their plans for space exploitation, much of the policy, regulatory, and legal barriers can be avoided or at least minimized. By working within an ethical framework, or by adopting my Code of Ethics for Off-Earth Development, today's active space entrepreneurs, businessmen, and women can certainly facilitate the commercial space industry.

Concluding Thoughts

Space commerce and all that this field entails will expand not only within the United States, but also throughout the rest of the world. Eventually, we will evolve into a space-faring world. The only real issue is the timing of when this will happen. To a large degree, we can influence the timing by our actions of today. It is also important to understand that it is an awesome responsibility to export our way of life, our culture, our economy, and even our presence off-Earth. To start life on a different world is probably as big a step forward as is cloning humans. It behooves us all to make sure we give our future space brethren the best foundation possible. We the people, not the government, and not a special few, should decide what qualities and characteristics of ourselves, our culture and values we take with us off Earth and use for seeding future space settlements with our future generations. Those of us concerned about space development, advocating an economic infrastructure for space development and an expansion into a commercially driven space program, must come to know that it is we who control and shape space development and our future in space, not events such as 9/11, or the policies and programs flowing forth from this or related events.

ENDNOTES

- ¹ <http://www.davidlivingston.com/presentations.htm>.
- ² KPMG Peat Marwick, *1997 Outlook: State of the Space Industry* (KPMG Peat Marwick, SpaceVest, Space Publications, and Center for Wireless Telecommunications, 1997), 9.
- ³ Ibid.
- ⁴ Ibid.
- ⁵ Thomas W. Watts and William W. Pitkin, Jr., *Global Satellite Marketplace 99*, (New York: Merrill Lynch, Pierce, Fenner & Smith, Inc., 1999), 15.
- ⁶ J. Armand Mussey, William B. F. Kidd and Patrick Fuhrmann, *The Satellite Book*, vol. 1, no. 2, (New York: C.E. Unterberg, Towbin, 1999), 7.
- ⁷ General Motors 1999 Annual Report, "Financial Highlights," <http://www.generalmotors.com/company/investors/ar1999/fh/index.htm>, (21 June 2000), 2.
- ⁸ Patrick Collins and H. Taniguchi, "The Promise of Reusable Launch Vehicles for SPS," presentation for SPS 97, Space Transportation Systems Group, Tokyo, http://www.spacefuture.com/the_promise_of_reusable_launch_vehicles_for_sps.shtml&terms=SST, (19September 1998), 3.
- ⁹ http://www.nuclearspace.com/a_project_prometheus.htm
- ¹⁰ As defined by NASA, the Space Launch Initiative is a program designed to develop a lower cost, safer, privately operated space transportation capability to replace the Space Shuttle early next decade.
- ¹¹ The X-33 was an attempt to develop a prototype for a second-generation reusable launch vehicle, VentureStar, that was fraught with problems and eventually abandoned after the government development funds were exhausted.
- ¹² Iridium was a company created by Motorola to put dozens of satellites into LEO to provide worldwide cell phone-like communications throughout the world. The satellites were expensive to launch and maintain, the phones were heavy, and the cost to users was excessive. Motorola declared Iridium bankrupt and the few satellites launched are now owned and operated by the U.S. government.
- ¹³ SPACEDAILY.com, June 26, 1999.
- ¹⁴ *Space News*, July 12, 1999, p. 1.
- ¹⁵ *Aviation Week and Space Technology*, 'On Orbit' section, February 4, 2002, Edited by Bruce A. Smith.