

U.S. Competitiveness: Where Do We Stand, and What Can We Do?

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Thank you, Janet, and good morning everyone.

With the dedication of the new Virgin Galactic Gateway to Space facility out at Spaceport America on Monday, this has already been quite an exciting week for Commercial Space. But with such an impressive array of attendees from all across our industry gathered together here this morning as ISPCS speakers, panel members, and participants, I'm really looking forward to some thought-provoking discussions over the next couple of days.

My topic today has to do with competitiveness and innovation, especially as they apply to Commercial Space Transportation. But I'd like to start with some reflections about one of America's most innovative and successful entrepreneurs, Steve Jobs, who passed away two weeks ago at the age of 56. As I'm sure you've noticed, there has been quite a bit of media coverage about his life and his many accomplishments. But if you want to get a better sense of who he was as a person, and how he looked at life, I'd encourage you to watch the YouTube video of the commencement address he gave at Stanford University back on June 12, 2005.

His remarks that day consisted of three stories. "Connecting the Dots" explained how dropping out of college and learning calligraphy put him in a position to be able to create the vast array of artistic fonts and typefaces that we all enjoy on our personal computers today. "Love and Loss" described how he ended up getting fired from Apple, after having founded the company, and why that turned out to be one of the best things that ever have happened to him. As he described it, "the heaviness of being successful was replaced by the lightness of being a beginner again, less sure about everything. It freed me to enter one of the most creative periods of my life." His third story, about "Death," recalled how being diagnosed with pancreatic cancer helped him to learn to Stay Hungry, and Stay Foolish. It's a great speech, and I highly recommend it.

Thinking about all of his achievements, it's hard for me to fathom the seemingly boundless creativity that Jobs possessed. All together, he is listed as the primary inventor or co-inventor on 342 patents or patent applications. But much more than say, a Thomas Edison or other well-known inventors, Jobs was a special kind of visionary who had great confidence in his ability to engage the public and to help us to imagine how the world could become a better place. Way back in 1982, after having led the development of the Apple II computer, Jobs was featured on the cover of Time magazine, as a representative of the new entrepreneurial community, under the tag line, "America's Risk Takers." He was actually a strong contender for Time's Man of the Year in 1982, but Time ended up selecting the personal computer as Machine of the Year instead. That was well before the Macintosh, before the iPod, before the iPhone, and before the iPad. Jobs didn't wait for a market survey to tell him that there was a demand for those products. In fact, he seemed to have a knack for creating products that people didn't even know they wanted.

If we compare the aerospace industry today with the computer and telecommunications industries, there are certainly many significant differences: the cost of the hardware for one, the possible consequences involved when things go wrong (we usually talk about loss of life instead of just loss of life savings), and the size and scale of the infrastructure involved in order to carry out the mission at hand (since it's really hard to build big rockets in your garage). But when it comes to market uncertainty; the overall risk aversion of the general public, the business community, and our government institutions; and the potential power of innovation to change the landscape in a positive way, I think there are also some interesting parallels.

Clayton M. Christensen, in his book, "Seeing What's Next: Using the Theories of Innovation to Predict Industry Change," observes that conventional wisdom suggests that

government involvement is bad for innovation. It is often said, especially in today's environment, that more intervention leads to less innovation, and less intervention leads to more innovation. I think it's really more complex than that. Christensen notes that there are two factors that are usually associated with a situation in which innovation can thrive: motivation and ability. He defines motivation as "a pot of gold waiting for the winners." Ability is defined as "the capability to obtain resources, craft them into a business model, and offer products and services to customers." That allows us to create a two-by-two matrix, with continuums of ability and motivation along the two axes.

Factors that affect the ability variable include the amount of resources available, the existence of standards, ease of market access, and the state of industry development. Factors impacting the level of motivation that is present include market size and growth rate, industry attractiveness, and competitive forces. So in the case where ability is high and motivation is high, you have a "Hotbed" that can teem with innovation. If ability is high, but motivation is low, you are basically "Looking for the Money" with firms struggling to find ways to monetize an opportunity. When ability is low, but motivation is high, firms are "Looking for a Target" but are constrained in accessing resources or reaching potential customers. Finally, when both ability and motivation are low, you have a real "Dilemma" with no readily available avenues to create a profitable business.

So how would one characterize the commercial space transportation market today? I believe that we are in a time of significant transition, and in fact are in the process of moving from one very important but fairly stagnant market, to a total of five promising, but more dynamic market segments. From the beginning of the space age, we have been launching satellites into orbit. We'll continue to do that in the future of course, but since this is a rather

mature market segment, it's not likely to experience much growth. There are two emerging market segments, commercial cargo and commercial crew, that are based on transporting cargo, and eventually people, to the International Space Station, and also to commercial space stations once they begin operations. It's not really clear how large the commercial parts of these market segments are, but there are some well-defined government requirements that one can count on for at least the life of the ISS. The final two market segments are really brand new: suborbital science missions and space tourism. I'm rather bullish on these two market segments myself, but there are plenty of skeptics. There have been a number of attempts made to estimate the sizes of these market segments, but it is hard to accurately pin down the number of customers who are willing to pay for a product that isn't yet available. Of course, we have been launching suborbital sounding rockets for a very long time, but the kind of low costs, high flight rates, and rapid turnarounds that are anticipated from the new suborbital reusable launch vehicles that are currently under development really represent a completely different level of capability than we have ever had in the past.

Let's think about how these five market segments would fit in Christensen's Motivation/Ability Framework. It might be a bit of an over-simplification, but I would say that the satellite launch business is an example of a Looking for the Money scenario. The existing launch operators have plenty of ability, but the size of the overall market is limited, and the U.S. share of that market is embarrassingly small, so the motivation is low. The situation for the suborbital science and space tourism market segments is somewhat different, especially since most of the companies involved tend to be newer and more entrepreneurial in nature. In this case, even though the industry attractiveness and the competitive dynamics cause the motivation to be high, the lack of established standards and the relative immaturity of industry development

cause the ability level to be relatively low, putting us in the Looking for a Target quadrant. As for the commercial cargo and commercial crew market segments, it's not clear to me where they would fit on the Motivation/Ability grid. Depending on how the government incentivizes the industry, and how burdensome the insight, oversight, and regulatory requirements turn out to be, we could see a Hotbed of innovation, or we could find ourselves in a Dilemma with no readily available avenues to create profitable businesses.

There are many other ways to look at competitiveness of course, and it will be interesting to see which economic theories are most helpful in characterizing the real world as events unfold. If we look at the data to date, the situation today doesn't look too good, at least for the satellite launch market. Back in the 1980's, the U.S. had almost 100% of the commercial launch market. During the 5-year period from 1996-2000, we had 40% of the global market share. From 2001-2005, the U.S had fallen to 22% of the market. During the most recent 5-year period, from 2006-2010, we were down to 16% of the global market, significantly behind both Russia and Europe. Clearly, we no longer appear to be able to compete internationally, at least with our current launchers. Probably the biggest reason for this is cost, but there are also questions about being able to get a launch slot on the range, and the overall nature of the commercial customer experience, given the temptation for U.S. launch providers to focus on their primary government customers, NASA and the DoD.

When it comes to carrying cargo to the ISS, now that the Space Shuttle has been retired, we are forced to rely on the Russian Progress, the European ATV, and the Japanese HTV to deliver what we need on orbit. Both SpaceX and Orbital are hoping to demonstrate the capability to successfully take on that mission in the next few months. Unfortunately, for the next several years, we will be completely dependent on the Russians to take our astronauts to and

from the Space Station. Although several companies are eager to show that they can do the job as part of the Commercial Crew Development Program, the limited amount of money that has been allocated to the program to date calls into question, at least for me, whether we are really serious about maintaining a robust U.S. human spaceflight capability.

As for the space tourism and suborbital research missions, it appears to me that the U.S. is currently the world leader when it comes to the technology, the business planning, and the regulatory framework. But the rest of the world is watching closely, and they would love to try and get in the game if the American companies should stumble.

Is there anything that the government can do to help? Remember that the FAA's Office of Commercial Space Transportation, which I am privileged to lead, has that two-part statutory mission: to ensure public safety during commercial launch and reentry activities, and to encourage, facilitate, and promote commercial space transportation. Well, I can think of 10 specific actions that I believe could help our industry, and our nation, to be more competitive:

0. Conduct more research, such as through our new Commercial Space Transportation Center of Excellence.
1. Offer prizes to encourage out-of-the-box thinking and new ways of doing business.
2. Upgrade and modernize our nation's launch infrastructure, through FAA Spaceport Grants or other mechanisms.
3. Capture and communicate Lessons Learned and Best Practices.
4. Encourage the development of industry consensus standards.
5. Reform our liability and risk sharing regime to provide more certainty that a launch operator doesn't have to "bet the company" on every launch.

6. Streamline our existing regulations, taking advantage of what we have learned over the years to take out the excessive conservatism and incorporate the benefits of new technologies.

7. Be open to sharing, leasing, or turning over to industry the control of excess or under-utilized government facilities.

8. Provide more certainty on the size and stability of the government market through anchor tenancies or guaranteed launch purchases like the Flight Opportunities Program.

9. Continue to support STEM education to ensure that we will be able to have a qualified aerospace workforce in the future.

Some of these things are already being done, but perhaps they can be done better; the others may be worth a try if we really want to strengthen our industry and our national space capabilities. To truly be successful, those of us in the government are going to have to learn how to let go a little bit more; how to not be in control all of the time; and how to trust other Departments and Agencies, and our colleagues in industry. Some people seem to think that private industry can't possibly build safe and reliable systems, since they will always be tempted to cut corners in order to maximize their profits. Now I know that is not the case. Think about it. If you develop a reputation for killing or maiming your customers, it is just not good for business.

One final point. A lot of folks seem to be waiting for somebody up top to come rushing in and give us the game plan; to tell us the direction, to give us a destination, to choose the architecture, or to select the optimal vehicle configuration with which to go forward. There are a lot of important people in the process, that's for sure: the President, the Congress, OMB, the NASA Administrator. But maybe this is the time for a new way of doing business; perhaps more

of a bottoms-up approach, or even a horizontal network, with agency teaming, public/private partnerships, international collaboration, corporate alliances, and alternative investment and funding mechanisms. Who knows, maybe some of those approaches would allow achievements that would not otherwise be possible, at least in the short term.

So if you have a vision for how the new space economy can work, if you have a passion for satisfying those new space markets that haven't even been identified yet, please let me know. I am committed to doing what we can to work with you, in order to enable you, and the nation, to be successful in space.

John Sculley, the person who fired Steve Jobs from Apple, had been hired away from Pepsi by Jobs himself a couple of years earlier, with one soul-searching question: "Do you want to sell sugar water for the rest of your life, or do you want to come with me and change the world?"

I know there aren't many folks here today who sell sugar water for their livelihood. In fact, I suspect that there are a number of people who not only work in the space business, but who feel quite passionate about space and what we need to be doing to explore the solar system and to operate successful businesses in order to conquer the Final Frontier. So because of that, I am quite confident that if we work hard, if we work smart, and if we work together, we really can change the world by embracing innovation and by being open to at least some level of risk and uncertainty. After all, that's what the future is all about. Add in a robust partnership between government, industry, and academia, and I think we could continue to have an exciting and inspirational space program, one that truly is worthy of a great nation.