

# **Risk and Rewards in Commercial Space**

## **NASA Lunar Lander Challenge Recognition Ceremony**

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Good morning. I want to thank Doug Comstock for inviting me to say a few words this morning. I apologize that I cannot stay longer. I'm not one to pop into a ceremony, spout congratulatory platitudes, and hand out a big check to the winner, like Ed McMahon from Publisher's Clearing House. Sorry, that just isn't me. If I had any style, that wouldn't be it.

So instead, I would like to take this opportunity to speak about something of interest to me and many of you assembled here: the role of prizes, such as NASA's Centennial Challenges, in spurring innovation through competition. I also want to talk about how and why NASA not only should, but must, pursue and nurture appropriate partnerships with the emerging commercial space sector when it is reasonably within the grasp of such firms to meet our needs. I believe that these issues are important, and I have been consistent in my emphasis upon them throughout my tenure as Administrator.

Prizes in general, and NASA's Centennial Challenges in particular, are a high leverage tool to stimulate innovation. But we must realize that prizes are simply one tool in the toolbox of various procurement instruments available to the government. One size does not fit all. We must be judicious in thinking through the risk and rewards, costs and benefits of prize competitions versus other

procurement vehicles such as research grants, cost-plus-award fee or firm-fixed-price contracts, or Space Act Agreements. Thus, while I am an advocate for the use of the prize authority we have had at NASA since 2005, something for which I especially want to thank our Congressional authorization committees, I want us to be realistic about their utility. For example, I think it would be fruitless for the American taxpayer to sponsor multi-billion dollar prizes for manned missions to the moon or Mars, as some have suggested. The high upfront cost and technical complexity of such missions render them unrealistic for a private concern to undertake. It's an interesting thought experiment, but not an idea which would gain much traction in the real world, in my opinion. So, if it continues to be the policy of the United States government to establish a human presence on the moon, or carry out a voyage to Mars – and I hope it does – then we need to commit proactively to doing it. We should not establish a prize for the accomplishment, and then sit back and wait to see whether or not it is claimed. We should either care enough to make it happen, or not bother at all.

In the case of the Northrop Grumman Lunar Lander challenge, I want to congratulate Doug, the X-Prize Foundation, and many others in formulating and organizing a thoughtful prize competition at just the right price-point and level of technical difficulty for the competing teams. Doug tells me that the twelve teams who competed for this Challenge spent nearly 70,000 man-hours, and the equivalent of \$12 million, trying to meet the challenge before them, all to win this \$2 million prize. So this investment offers a 6:1 leverage of taxpayer dollars against the total \$2 million in prize money available, and more than 30:1 against the \$350,000 that Armadillo has won. And there's still \$1.6 million on the table if one of those twelve teams is successful next year.

Prize competitions are most useful when government agencies like NASA or DARPA are actively seeking individuals and companies who would not normally participate in a traditional government procurement process. Prizes entice the kind of people who are repelled by the cumbersome nature of those processes. We're looking for the Wright Brothers tinkering away in the garage of their bicycle repair shop, or the patent clerk whiling away the hours contemplating the deeper meaning of space and time. We're looking for people like Charles Lindberg and the consortium that backed him in his pursuit of the Orteig Prize for the first non-stop flight from New York to Paris. And we're looking for people like Peter Homer, who used his experience in sewing boat sails, and who commandeered his family dining room and garage to build a better glove for our astronauts and win \$200,000 from NASA.

The competitors in a prize competition must be willing to take on the risk of obtaining upfront financing for the development costs of meeting the challenge. For this reason, we salute those who risk their money and time on the chance of winning such a reward. So, when government agencies like NASA formulate a prize competition, we must try to put ourselves in the shoes of the competitors. We must consider how they might recoup their investment beyond the prize money. For example, Burt Rutan's Scaled Composites team is building a commercial suborbital vehicle to follow to their highly successful *SpaceShipOne*, and Peter Homer is now applying the design of his new glove to the next generation spacesuit. The prize competition itself was only a start.

Those of us in the government side of the space business must recognize a fundamental truth. If our experiment in expanding human presence beyond Earth is to be sustainable in the long run, it must ultimately yield profitable results, or

there must be profit to be made by supplying the needs of those who explore to fulfill other objectives. Think about the California gold rush, and Levi Strauss.

Space exploration today is primarily a government activity, but that will not always be so. In fact, we should work to see that it is not. We should reach out to those individuals and companies who share our interest in space exploration and are willing to take risks to spur its development. In that vein, I especially want to recognize the sponsors of the Google Lunar X Prize for their formulation of a difficult but eminently worthy prize competition for robotic landing and roving on the moon.

Commercial interests might have different motivations than the government for wishing to explore space, but we can respect those differences while capitalizing on our common interests. For example, while NASA is not in the business of space tourism, we should encourage those who are. A successful space tourism industry would offer many synergistic opportunities for private-public partnerships. As a matter of national policy to promote the growth of space enterprise generally, we should encourage such partnerships. Government agencies can and should turn to the private sector to meet their needs for goods and services that are not core governmental functions – a definition that can change with time. We have seen that transition in information technology. We will see it in other fields in the years to come, including micro-gravity parabolic flight services, suborbital launches, and cargo resupply to and from the International Space Station.

As many of you know, we hope to award our ISS Commercial Resupply Services contract later this month, just prior to Christmas. We hope that this will help to evolve our nation's low Earth orbit transportation industry to one that is

more cost-effective, and as reliable, as what we have today. When we retire the three Space Shuttle orbiters from service, we will need other means to meet ISS logistics needs. And while we must do whatever is necessary to sustain and capitalize upon our investment in ISS, I would much rather be spending taxpayer funds on U.S. commercial providers than otherwise.

NASA's COTS partners are making great strides. In late September SpaceX's Falcon 1 rocket flew successfully, and on November 22<sup>nd</sup> they conducted their first full duration static test of all nine Falcon 9 rocket engines. Orbital Sciences recently completed Preliminary Design Reviews for their Cargo Modules and designs for their launch facilities at Wallops Island, and design of their Taurus II launch vehicle is underway.

I've been asked on many occasions for my opinion on commercial crew transportation to ISS. We've made an initial \$500 million dollar bet on commercial cargo service capability to ISS. That is actually the more critical need, and while I certainly wish that I had more money to invest in developing COTS crew capability – and many other things – I think it unwise to raid other accounts to increase our bet on COTS crew capability.

For those who claim that NASA's systems, the *Orion* crew vehicle and *Ares I* launcher, will compete with commercial providers, I will again remind everyone that, in our plan, commercial systems are “primary” for ISS logistics. *Orion* and *Ares* are the backstop if U.S. commercial providers are not successful in developing such capability. They are sized for missions beyond low-Earth orbit, and will not be as cost-effective as commercial systems built specifically for ISS transport. We should not yield to the temptation to build yet another government system solely for access to LEO. As a matter of fiscal responsibility, we should

not design systems like *Orion* and *Ares* for low-Earth orbit operations, and then redesign them later for missions to the moon, the near-Earth asteroids, and Mars. And as a matter of strategic policy, the Earth-to-LEO market niche should be left to commercial providers, if they can fill it, and to government systems only if they cannot.

I spoke earlier of potential synergies between the nascent space tourism industry and government missions. I will reiterate what I have said in previous speeches: when the capability becomes available, we will purchase seats for various science payloads, microgravity experiments, and perhaps even astronaut crew training. NASA should be a customer for these suborbital flight services. Because such suborbital missions will have applications across the various mission directorates, our Space Operations Mission Directorate has been assigned the task of managing this effort, just as it does in procuring launch services for our satellite missions today.

There has been considerable discussion within NASA about how we might use these emerging capabilities, how we might adapt our existing unmanned suborbital program to enhance these experiments through human interaction, as well as how much funding we should plan to budget, and when those funds will be needed once such suborbital capabilities are successfully demonstrated. We are not interested in doing “junk science”, or in subsidizing this development as we are doing with COTS, but we do plan to leverage this new capability, when it emerges, to improve the science to be conducted or to lower our costs. You should see more about this initiative in next year’s budget request.

Parabolic variable gravity aircraft flight services represent another opportunity for us to turn to the commercial sector to meet our requirements. We

have conducted several flight tests with the Zero-G Corporation to determine whether they can meet the requirements for microgravity experiments that are currently performed on the government C-9 aircraft. These test flights included five experiments from small businesses developing technology under the auspices of NASA's SBIR program. While the tests are not yet complete, project managers are confident that Zero-G can meet NASA's needs. Thus, we are planning for the transition of all microgravity flight activities from the NASA C-9 to the commercial aircraft, while the C-9 continues to support Space Shuttle operations and acts as a backstop for the commercial microgravity service if necessary.

Companies large and small are finding ways to support NASA's exploration needs. For example, Armadillo Aerospace, today's winner of the \$350,000 Lunar Lander Challenge, is also working with us on a LOX/methane rocket engine to be tested in an altitude chamber at White Sands. Jen Allred, the project manager in the Propulsion Test Office at White Sands, describes this partnership as "a great demonstration of how two organizations who generally function in very different manners are able to approach a common goal: to get to the moon. Both NASA and Armadillo know their business very well, and are eager to share their technical knowledge and resources to achieve mutual success." This is exactly the type of relationship that we want to establish with the emerging commercial space community.

We need to maintain this perspective as we consider the larger context of the proper role of government in spurring innovation and leveraging commercial capabilities. The development of space simply cannot be all government, all the time, if we want to create a truly spacefaring civilization. Everything we have learned from history tells us that this is so, and we must plan our future with these lessons firmly in mind.

And so now let us return to our gathering today. We're here to recognize the accomplishments of a team – Armadillo Aerospace – in winning the \$350,000 Level One prize of the Lunar Lander Challenge, the biggest award yet for NASA's Centennial Challenges program. Thomas Edison once said, "Genius is one percent inspiration and ninety-nine percent perspiration." Today, we're here to recognize the genius – and the perspiration – of Armadillo Aerospace.

Thank you.