"The Corps of Discovery"

Dr. George C. Nield
Associate Administrator
for Commercial Space Transportation

Commercial Space Transportation Advisory Committee Meeting

Washington, DC

May 8, 2014

Thank you, Mike [Gold]. And good morning, everyone. Over the last few months, I've been hearing a lot of talk about exploration, both in the space community itself, and on Capitol Hill. And I think that's generally a good thing. But exploring is not exactly a new topic for the science enthusiasts among us, or for our government leaders for that matter. In fact, next week marks the 210th anniversary of one of the most famous scientific expeditions in American history.

It was on May 14, 1804, that the Corps of Discovery, a select group of U.S. Army volunteers, set out from St. Louis to explore the newly purchased Louisiana Territory. Thomas Jefferson, the President at the time, had commissioned the Corps, and had tapped Meriwether Lewis, his personal secretary and a former Army officer, to lead the expedition. Lewis in turn selected William Clark, another former Army officer and a good friend, as his second in command. Their primary mission was to find a practical water route to the Pacific Ocean. Why? For the purposes of supporting commerce. Other objectives, as spelled out by Jefferson, included engaging with and learning about the local Indian tribes, and making note of the animals, plants, and climate that they would encounter along the way.

Jefferson seems to have been actively involved in the training and preparations for the trip. He arranged for Lewis to study medical treatments under Benjamin Rush, a physician and humanitarian. He also enabled Lewis to be tutored by Andrew Ellicott, an astronomer, who taught him how to use a sextant and other navigational instruments. Finally, Jefferson invited Lewis to have full access to his personal library at Monticello, which was said to include the world's largest collection of books and manuscripts related to the geography of North America.

Recognizing that the expedition would involve considerable unknowns, including the possibility of encountering hostile inhabitants, the President provided some guidance on this topic as well. "To your own discretion therefore must be left the degree of danger you risk," he instructed. "[O]nly saying we wish you to err on the side of your safety, and to bring back your party safe even if it be with less information." Sounds like some good advice in balancing risk and reward, don't you think?

Supplies for the lengthy journey included specially-minted silver medals, inscribed with messages of friendship and peace; boats; tents; firearms and ammunition; knives; cooking utensils; medicine; blacksmithing supplies; and cartography equipment. They also carried numerous blank leather-bound journals and a generous supply of ink, for recording all of their observations. It sounds like an iPad and some digital cameras would have really come in handy.

From start to finish, the expedition lasted 2 years, 4 months, and 10 days, and covered more than 8,000 miles. Lewis and Clark and their team did manage to reach the Pacific, although they were not successful in finding the hoped-for continuous water route to the ocean. Along the way, they made note of more than 200 plant and animal species that had previously been unknown to Europeans and Americans. Just a couple of examples: the grizzly bear and the prairie dog. They did ship a prairie dog back to President Jefferson for his amusement, but decided not to tangle with the grizzly for some reason. The group also recorded contact with at least 72 different Indian tribes. There was only one fatality during the trip: Sergeant Charles Floyd died suddenly in what is now Sioux City, Iowa, apparently of acute appendicitis.

All in all, the mission was highly successful, and if one were to make a list of the most important

milestones in 19th century exploration, the Lewis and Clark Expedition would most likely be

among them. For the 20th century, a majority of people would probably put the Apollo moon

landings at the top of the list. But looking forward, what kind of achievements should we expect

to see during the 21st century?

Well, the National Space Policy calls for crewed missions beyond the moon, including sending

humans to an asteroid by 2025. It also calls for us to conduct human missions to orbit Mars and

then return safely to Earth by the mid-2030s. Based on the history of our space programs to date,

one might assume that these missions will be designed, directed, and operated by the

government, with the assistance of its support contractors. And as you know, NASA is currently

hard at work developing a heavy-lift booster, the Space Launch System; and a multi-purpose

crew vehicle, Orion; to be able to accomplish those kinds of missions.

But given the current budgetary environment, I think it will be very important for us to keep an

open mind about how we might be able to take advantage of public/private partnerships and

other forms of cooperation and involvement by industry, even for missions beyond low Earth

orbit. The National Space Transportation Policy, which was published last November, mentions

some of the capabilities we may need. In addition to the development of a heavy-lift space

transportation system and crew vehicles, it talks about in-space refueling technologies and more

efficient in-space transportation systems. It also talks about trying to identify and implement

measures to enhance the long-term affordability and sustainability of the exploration initiative

itself. It seems to me that one way to do that would be to be open to significant commercial participation in the missions.

To their credit, NASA seems to be thinking along these same lines. You may have seen their recent call for ideas on new commercial partnerships, or their announcement of several unfunded Space Act Agreements for the development of lunar landers. So to my colleagues at NASA, let me say, "Keep up the good work"; but I think there is even more that can be done in this area.

As I try to imagine what kinds of things private industry will be doing in space over the next 10 years, I see three major categories of activities: operating suborbital reusable vehicles, providing transportation to and from low Earth orbit, and providing the government with complementary capabilities for our nation's exploration activities, such as we were just discussing.

A number of suborbital reusable vehicles are being developed and tested right now, all without any significant government investment. They are intended to be used for space tourism, scientific research, and technology demonstrations, among other missions, and we may well see commercial operations beginning later this year.

Transportation to low Earth orbit is already a fait accompli for cargo, with both SpaceX and Orbital conducting delivery missions to the International Space Station. With respect to commercial crew, NASA plans to select one or more companies in the August or September time frame to provide crew transportation services to and from the ISS. The target date for having a

capability up and running is 2017, but the actual date will obviously be dependent upon the level of Congressional appropriations received and on the progress made by the commercial partners.

The third category of activities that I see private industry carrying out over the next 10 years is providing the government with complementary capabilities for exploration. This is probably the most uncertain and most tenuous of the three, and not everyone may agree that it makes sense. Why should the government involve private industry in its exploration programs? My answer to that question is, "For the same reasons that the government should at least consider commercial involvement in all of its programs." I can think of a number of different potential benefits. For example:

1. Lower costs. There are numerous examples of industry being able to develop systems for less money, if they are doing so on their own, rather than as part of a typical government program.

2. Increased innovation. The government has a tendency to be rather prescriptive in its RFPs. When there is an existing way to get the job done, we will usually specify the need to keep doing things the same way we have always done them. And recognizing that government programs usually take several years to get off the ground, it's no wonder that it can take a long time before advanced technologies start to show up in our operational systems.

3. Greater risk tolerance. It's sad, but true: government program managers tend to be extremely risk averse. There are certainly advantages to minimizing risk, but the end result may not be consistent with the idea of our nation having a bold space program.

4. New customers and new markets. Some of you may want to push back on this one. After all, it's hard for us today to see how a company could profitably send people to and from Mars, unless the United States government was paying for the mission. But lately, we are seeing a plethora of companies who are starting to do serious design work on projects like telescopes that will be able to track near Earth objects, commercial human missions to explore the moon, space stations in lunar orbit, and asteroid mining.

5. New sources of funding. IPOs, Kickstarter campaigns, lotteries, car washes, bake sales. There are all kinds of ways to raise money these days, other than with Congressional appropriations. Unfortunately, most of those approaches are not going to get us anywhere near what we will need to pay for a space program worthy of a great nation. However, according to Forbes, which just published its 2014 Billionaires List, there are now 1,645 billionaires in the world, 492 of them in the U.S. And the interesting things is, a number of those folks appear to be quite passionate about space. Whether you view it as philanthropy, wanting to establish an impressive legacy, or just being willing to pay for a very expensive hobby, more and more people seem to be putting a significant amount of their own money on the line in an effort to accelerate humanity's progress in space exploration and in space operations.

Those are some of the potential benefits I can see for incorporating commercial involvement in our nation's exploration programs. Given the potential upside, I think it's certainly worth considering.

So much for the future. Let's talk a little bit about what's happening today. I see four key issues facing the Office of Commercial Space Transportation and the industry right now, and I'd like to briefly share my perspectives on those issues, and then ask for COMSTAC's help and advice in determining how we ought to respond.

- The first issue is the pace of activity. In FY12, there were a grand total of 3 FAA-licensed or permitted launches. In FY13, we had 18 – a six-fold increase. I expect that we will exceed that number this year, and then increase by an order of magnitude over the next few years, as the new suborbital reusable vehicles become operational. That projection is based on a Suborbital Market Forecast prepared by the Tauri Group back in 2012. We are also in discussions with applicants from Texas, Georgia, Alabama, Colorado, Hawaii, and Florida, about the possibility of having additional Spaceports, over and above the eight that are currently licensed. If we assume that our budget will continue to remain flat, as it has for the last few years, keeping up with the needs of industry is going to be challenging, to say the least. So far, thanks to an extraordinary effort on the part of our staff, we have been able to get our essential work done (including issuing licenses and permits, completing environmental reviews, and conducting safety inspections as appropriate), without delaying any launches. But frankly, I don't consider the current situation to be sustainable. We're looking at streamlining our processes and implementing efficiencies where we can, and Mike Romanowski will be describing some of our ideas on that later on this morning. But we're likely facing the need to use some kind of prioritization scheme for deciding what programs to work on, and then using a first-come, first-served approach for handling the applications, in order to match our activity level to the level of resources we have been given. Not a good

situation for any of us, obviously, so I'd appreciate your thoughts on any other approaches you think we should consider.

- The second issue relates to closing the gap. As I mentioned in my testimony before the House Subcommittee on Space back in February, the FAA believes it is time to consider closing the current regulatory and safety gap between launch and reentry. As this group knows very well, collisions in space can have devastating effects. We'd like to have an opportunity to minimize and/or prevent them. Our goal would be to promote orbital transportation safety, including for orbital debris mitigation, for spacecraft whose primary function is transportation. Another reason for closing the gap is to decrease regulatory uncertainty. We have recently been approached by a number of companies who want to do things like perform on-orbit servicing, establish bases on the moon, or mine asteroids. They want to know who in the government they should talk to, to make sure that they will be allowed to operate their businesses in accordance with U.S. law and regulations, and they want to know the answers to those questions right now, so that they can begin to sign up investors. Now you might think that if there are no laws or regulations preventing these types of operations, there would be no problem. But not everyone agrees with that assessment, and that means that there is a fair amount of uncertainty around these issues. Regulatory uncertainty translates into business risk, and investors tend to dislike business risk.

  Our view is that the words in our current AST mission to "ensure protection of the public, property, and the national security and foreign policy interests of the United States" and to "encourage, facilitate, and promote U.S. commercial space transportation" are compatible

with, and make us a logical choice to oversee, these new types of operations, even though they would occur between launch and reentry.

- The third issue involves international leadership. An increasing number of foreign countries are developing or upgrading their space systems and capabilities. Some are intending to operate spaceports to accommodate both U.S. and foreign suborbital vehicles. Related to these efforts, several governments are now planning to develop their own laws and regulations governing space transportation. The 2013 National Space Transportation Policy instructs the Secretary of Transportation to advocate internationally for the adoption of U.S. government safety regulations, standards, and licensing measures to enhance the global interoperability and safety of international commercial space transportation activity. We've had a chance to do that on a bilateral basis with several different government groups who have asked for our help and advice. We've also been invited by ICAO, the International Civil Aviation Organization, to participate in a Commercial Space "Learning Group," which is intended to be less formal and less bureaucratic than a Working Group or Committee. We also plan to continue to participate in the United Nations Committee on the Peaceful Uses of Outer Space, as appropriate. Although engaging with international organizations has pros and cons, in this particular case, we have concluded that it makes sense to involve ourselves in these groups, in order to allow the U.S. to influence the development of an appropriate regulatory philosophy, and to ensure that U.S. industry will be allowed to successfully compete in foreign markets.

- The fourth and final issue is our quest for the continuous improvement of human space flight safety. At the House Hearing in February, I shared my belief that the current moratorium on regulations related to crew and spaceflight participant safety should be allowed to expire in

October of 2015. That is still my preference, especially when it comes to orbital space flight.

My rationale is that if those of us in the human space flight industry want to be viewed as

being part of a mature and responsible industry, that cares about safety, we ought to be

willing to put in place a regulatory framework that keeps out "bad actors", and that allows

developers and operators to defend themselves against frivolous lawsuits after an accident.

Let me emphasize that our office does NOT have a stack of proposed regulations in the files

that we are waiting to spring on you once the moratorium expires. In fact, I can't think of

any specific human space flight requirements that are necessary and appropriate to put out as

regulations at the present time. So my argument is a philosophical one, not one based on

actual observations of poor designs or unsafe practices.

But more important to me than whether or not the moratorium is extended, is what we as a

community are doing to prepare ourselves for the day after the accident. We know that day

is coming – it's just a matter of when. And when the accident does happen, will we be able

to say honestly, and with a clear conscience, that we had taken all reasonable steps to prevent

it from occurring?

Let me tell you what I think we need to do to answer that question without regrets. There are

three separate activities, and if you disagree with them, or if you have some other ideas for

what we need to be doing, I hope you will let us know.

First, last year we published a draft version of Established Practices for Human Space Flight Occupant Safety, and asked for your comments. We are currently in the process revising the document based on the feedback we received, and we plan to put out an update later this year. Our intent is to lay out a top-level framework and benchmark of all of the things that someone should think about in designing and operating a human space flight vehicle.

Second, because it seems like the right thing to do, and because we are starting to get some very strong encouragement from Capitol Hill, I'd like to see us pick up the pace on industry consensus standards. I know they are difficult to develop, and they take a lot of time and effort, but we need them. If industry would like AST to provide a carrot or a stick as an incentive to start making some progress, we'd be happy to oblige. Options include partnering with NIST, or reaching an agreement with SAE, ASTM, AIAA, or one of the other professional societies with standards experience to help us in moving forward.

Finally, I think we need to do a better job of data sharing. It's very nice to have a Lessons Learned Database, which we do, but if we are not capturing and communicating close calls, pilot errors, or potentially hazardous test results, we're not where we need to be as an industry. I'd like to see if we can build on or replicate the kind of Safety Reporting System that has been so successful in aviation, in which proactively fessing up to mistakes, or other safety-related happenings, would protect an individual from punishment or a company from an enforcement action.

Those are my thoughts. If you have other ideas, we'd love to hear them. Before we move on to our next presenter, let me take this opportunity to thank all of the members of COMSTAC for your time and your service. We really do appreciate what you do, and both our industry and the nation's space program as a whole, greatly benefit from your participation.