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GLOBAL EXPLORATION STRATEGY AND LUNAR ARCHITECTURE

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[Moderated by Dean Acosta, NASA Press Secretary]

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P R O C E E D I N G S

MR. ACOSTA: Good afternoon, and welcome to Johnson Space Center here in Houston for today's exciting announcement for the Global Exploration Strategy and Lunar Architecture announcement. I am Dean Acosta, NASA Press Secretary.

It is an exciting day at NASA and exciting week, and joining us for today's announcement, to my right, is NASA's Deputy Administrator Shana Dale. To her right is the Deputy Associate Administrator for Exploration Systems Directorate, Doug Cooke, and to Doug's right is the Associate Administrator for Exploration Systems Directorate, Scott Horowitz.

We are going to go through a presentation, and then we will get to your questions and have a question-and-answer session later in the announcement.

So right now, I would like to turn it over to Deputy Administrator Shana Dale.

DEPUTY ADMINISTRATOR DALE: Thank you, Dean.

I am so pleased to be here today with Doc Horowitz and also Doug Cooke to announce another important milestone in terms of the Vision for Space Exploration with

the creation of the Global Exploration Strategy as well as the U.S. component to that, and that is the Lunar Architecture.

You know, I want to take just a brief moment to say how pleased we are at NASA that we were able to lure Doc Horowitz away from industry. He has done such a fantastic job leading the Exploration Systems Mission Directorate. He is absolutely the right guy for the job, and we are so happy that he is here.

Also, for Doug Cooke, he has been so important in terms of what has been done with the Global Exploration Strategy as well as putting the fundamental parts together with the Lunar Architecture.

So I thank you guys. It is a real treat for me to be able to work with these two, and they are such good guys. Thanks, guys.

You know, this is a truly remarkable week for NASA. As Dean noted, we are moving this week into the Exploration Conference where we will talk about the Global Exploration Strategy and the themes and objectives coming out of that as well as the Lunar Architecture.

At the end of the week, NASA, with Doug Cooke,

will be meeting with international partners to have further discussion about the elements of the Lunar Architecture and where international partners are interested in playing a role.

On Thursday, we plan to launch the Space Shuttle Discovery. This will be the third launch in 2006 and the first night launch in 4 years, and hopefully, by Sunday, assuming that the Space Shuttle will be docked at the International Space Station, Sweden's first astronaut, Christer Fuglesang, and his crew mates will be docked at the same time Dr. John Mather, NASA's Civil Service Scientist, will be in Stockholm to receive the Nobel Prize for Physics, so truly an incredible week for NASA.

In terms of the things that we are going to be discussing today, obviously what we are doing is guided by the Vision for Space Exploration which was overwhelming endorsed by Congress in the NASA Authorization Act of 2005. Some of the elements are obviously completing the International Space Station, safely flying out the Space Shuttle into 2010, creating the Crew Exploration Vehicle by 2014 and testing it, and also going to the Moon by 2020.

We are also very interested, as the Vision guides

us, on pursuing international collaboration as well as participation with commercial entities.

Our approach is one in which the architecture is definitely driven by the strategy that has been developed, the Global Exploration Strategy. The Global Exploration Strategy developed themes and objectives, and these objectives have led directly into the Lunar Architecture.

The Global Exploration Strategy saw contributions from over 1,000 people and 14 space agencies, and there are two overarching issues that we are dealing with, and that is why we are returning to the moon as well as what we hope to accomplish when we get there.

As I mentioned, the Global Exploration Strategy resulted in themes, and these are crystallized into six themes, and that includes extending sustained presence, human presence on the Moon, international collaboration, the Moon's usefulness as a unique laboratory, economic advancement and technological innovation that will be important to space exploration as well as benefitting people here on Earth, preparing for future human and robotic missions to Mars and other destinations, and also pursuing a vibrant exploration program that will engage and

inspire and educate the public, bringing hope to young and old alike.

In terms of what we are going to do, that portion of the Global Exploration Strategy, 180 objectives were defined, and those were put into 23 categories, including such things as astronomy, life support and habitat, power, communications, and in situ resource utilization, just to name a few.

The Lunar Architecture Study is one in which the team gathered to develop a baseline architecture as well as a concept of operations, and key decisions had to be made.

And that includes, if you go to the next chart, whether we were going to engage in sorties or outpost, and it goes to the fundamental lunar approach. The Lunar Architecture Team concluded that the best approach would be to pursue an outpost, and that has been confirmed by Mike Griffin, our Administrator.

This weaves into two of the themes that we have mentioned from the Global Exploration Strategy, extending sustained human presence on the surface of the moon as well as preparing for future exploration to Mars and other destinations. It also enables global partnerships, allows

for maturation of in situ resource utilization, and results in a path that is much quicker in terms of future exploration. Also, many science objectives can be accomplished in terms of pursuing an outpost.

The next logical question, after you have made a determination about an outpost, is location, and what we are looking at is polar locations, both the North Pole and the South Pole. Definitely, we seem to have a focus on the South Pole, but determinations will be made after results from the Lunar reconnaissance orbiter, which will be making detailed maps of the Moon.

From the point of discussion in terms of polar location, it is safer. It is thermally much more moderate. It allows for initial use of solar power, and we can definitely move later into nuclear power, but that will be much easier in terms of operations in the beginning.

From a resources perspective, the potential for hydrogen and oxygen as well as other volatiles, flexibility, including the need for just one communication asset and a backup, as well as the fact that it is exciting, we don't know as much about the polar regions, and from a scientific perspective, many scientists within

the Science Mission Directorate are excited about the idea, particularly, of exploring the South Pole.

Now, Doug, I would like to turn it over to you for the next several slides and just other things that you would like to say about the Lunar Architecture.

MR. COOKE: Right. The Lunar Architecture Team was a team that was made up of engineering discipline experts from across NASA who took the objectives, the themes, and worked to understand the implementation, what does it take to satisfy these or enable these objectives, and they did develop mission concepts, options on the architecture, different approaches. They, through the process, developed the key questions that Shana just referred to and other questions that we have not yet gotten into, but it was important to understand what are the key drivers and how then do you develop a capability and implement an architecture that leads us to a sustained lunar presence, lunar base, while through commercial endeavors, international participation, discovery in science, while we prepare to send people to Mars and explore. So this was a very important aspect of it, to figure out how to implement this. So we have a point of

departure at this point.

If we go to the next chart, an example of a location, Shana was mentioning polar regions. An example of one that we have studied, it is not to say this is the final choice or anything, but it is one that we probably know most about at this point until we fly a lunar robotic orbiter. There is an area on the edge of Shackleton crater at the South Pole that is almost permanently sunlit a very high percentage of the time, 75 to 80 percent of the time, and it is adjacent to a permanently dark region in which there are potentially volatiles that we can extract and use.

So this area shown in the slide is the fact that this sunlit area is about the size of the Washington Mall. So it is a large area. The team has looked at how the base lays out in a location such as this, so that we understand where the functions are developed.

DEPUTY ADMINISTRATOR DALE: And, Doug, if you want to talk about the lander basic architecture?

MR. COOKE: Sure. If we can go to the next chart, as we get into the architecture, a key aspect of all of this focuses on the lander itself.

The end-to-end transportation infrastructure, the launch vehicles that we have talked about implementing and the achievements that are possible at the Moon, all come together in the design of the lander, and in looking at the lander, it is important to, as we discovered through this process, maximize the landed mass. What you can put on the surface allows you to develop a capability much more quickly, the more you can land and the better it is, and in the process of doing that, you minimize the other parts of the lander where you can, including the ascent vehicle that sends the crew back up to lunar orbit to dock with Orion.

So the lander is a key feature of this, and the way those optimizations occur, as we understand those more in the future, this is a key element in this discussion.

If we can go to the next chart, it shows a potential layout of a base, the beginning of a base, where you use a lander to provide the various components that you hook together and can then have a more sustained capability to achieve and enable the objectives that Shana discussed.

DEPUTY ADMINISTRATOR DALE: One other point in terms of the architecture is that we are going to be preserving the ability to fly human sorties as well as

cargo missions with the human lander.

The implementation philosophy that NASA has followed is one in which the U.S. will build the transportation infrastructure as well as initial communication, navigation, and EVA capabilities. It is definitely an open architecture and one in which NASA welcomes the participation of other countries around the world as well as commercial entities.

In terms of the open architecture that I just mentioned and the infrastructure, I think we have a chart related to that, and it shows different elements here.

As I mentioned, the United States is developing transportation capability as well as initial communications, navigation, and EVA capability, but having said that, the door is wide open in terms of participation by internationals, and that includes power, habitation, mobility, in situ resource utilization, robotics missions, logistics resupply, and other specific capabilities.

Just to wrap up, 2005 marked the development of ESAS and the architecture for our transportation elements. 2006 has been important for development of the Global Exploration Strategy and the first phase of the Lunar

Architecture, which, again, I have to commend Doug. It is an outstanding job for all the things that have been put together.

2007 will mark continued work with the Global Exploration Strategy, continued work with the international partners and the commercial entities, as well as working on a framework for potential cooperation. Phase II of the Lunar Architecture, I should emphasize that these are open architectures and also evolving. These are living documents for us.

The other thing I would mention is that we haven't figured out the exact destinations yet, but Office of External Relations is going to be working on which countries I need to visit. Doug will be going with me on many of those trips, and that is really an opportunity in 2007 to start to have extensive dialogue with other countries about the ways in which they want to participate in exploration activities.

With that, I would like to see if Doug has any other comments he would like to make about either one of these.

MR. COOKE: All right. It is an important point

in time.

We have at this point, after the last few months of effort, a very good understanding of what is achievable at the Moon, why we are going to go, what we can actually achieve as we go, and we have a very good understanding on an approach to implementing that. That is a point of departure for our discussions outside the agency with internationals, with commercial entities, industry, the science community, for understanding how to build on the architecture and begin the discussions of what is possible and who is interested in collaboration and the negotiations that follow.

So it is an important point in time that will lead us to a lot further conversations with the external community.

DEPUTY ADMINISTRATOR DALE: Doc, I believe you have some comments you would like to make as well.

DR. HOROWITZ: Thanks, Shana.

First, I really want to thank Doug Cooke, Tony Levoy and his team who have worked really hard this year. They have brought in a tremendously diverse group, including 14 space groups from around the world

representing all the different nations' space programs. They have brought in the commercial world, our contractor team. They have also brought in people from the science community and came up with all of these objectives and were able to boil it down to basically six basic tenets that we were going to follow to come up with the strategy.

It doesn't sound like a big deal, but that led us to the conclusion that we are going to go after a lunar base, and so a lunar base will be the central theme in our going-forward plan for going back to the Moon and preparation to go to Mars and beyond. So it is a very, very big decision. It is one of the few where I have seen the science community and the engineering community actually agree on anything, where we finally have a place that is very interesting from an operational and engineering perspective because of continual sunlight, because of the ability to maybe get after materials on the moon, and also have such interesting scientific sites that are near the poles.

It is also interesting to note that we know very little about the poles on the Moon. In fact, we know more about Mars than we know about the poles in the Moon. So it

is really important that we get the information from the upcoming orbiters that are going to the Moon.

A quick status of where we are in exploration, again, in 2004, we received the Vision. In 2005, we did the studies based on what information we knew that led to the transportation that will support these types of missions. We have the large launch vehicle Aries V that can launch enough mass to support sending the lander that Doug described to the Moon, to be able to put enough infrastructure there and then to eventually get us on to Mars. We have the Aries I launch vehicle coming along in development which will get the crew safely to and from orbit.

In fact, Constellation has just completed its program-level SRRs which gives us the confidence to move forward in the development of these vehicles in support of the architecture that we have outlined.

We have LRO, the Lunar Robotic Orbiter. It will be flying with LCROSS, and those will fly in October '08. So this is a living document, as has been pointed out. We are going to learn a lot from these missions and other missions which the international community is flying also

that will advise and be fed into decisions; for example, is the North Pole or the South Pole the most interesting pole and what parts are there and what surprises are we going to find when we analyze the data that comes back from those missions that will better inform as we move forward in development.

We are going to flight-test the Launch Abort System. We will start their tests in about 24 months, and the Aries I first flight test will occur in about 29 months, a full-scale version of the Aries I with a simulated second stage.

This is an evolving program. It is not about a single point in space in time. We are after a generational program, and in fact, I could sum it up that what you are seeing here is the foundation, and the vehicles we are designing are the vehicles that will be flown by the next generation of space explorers.

So, Shana, thank you very much and Doug and your team for a tremendous job to bring us to this point today.

MR. ACOSTA: Thank you very much. That will conclude the presentation.

Now we will go the questions here. We will start

off with JSC. Then we will go around to the other field centers, NASA field centers. What I ask, though, is please wait for the microphone before you ask your question, and then identify yourself and who your question is for.

All right. We will start right up here, up front.

QUESTIONER: Leonard David with Space.com and Spacenews.

You used "outpost" and "base" interchangeably. I assume they are the same. What in your mind would a base really constitute as far as people, a time frame of how many years it might take to build up a substantial presence?

MR. COOKE: We do use them somewhat interchangeably. We begin, of course, with what you might think of as an outpost and gradually build the capability to where you get longer and longer stays.

The first stays, we are looking meeting the President's Vision which is doing this by 2020, if not before hopefully. We begin with relatively short missions and build up the capability, so we can stay longer and we get up to a point where we can stay 180 days and

potentially have a permanent presence there, and that is what is necessary to begin this effort and develop and understanding and learn from being there in that situation and look to where that capability can lead for a more sustained presence through external participation involved in the entire effort.

QUESTIONER: Just a quick follow-up. When you start approaching international partners and going overseas, I think some reactions you hear from internationals is, is this going to be the Space Station program politics, because a lot of the countries have issues that have come out of the Space Station program.

Are you looking for a new model of international cooperation along with this strategy?

DEPUTY ADMINISTRATOR DALE: Well, that is definitely something that we are going to be working on in 2007, what type of framework.

I wouldn't necessarily see it evolving in the same way as the International Space Station. It could be something where the basis is many bilateral arrangements, but it is yet to be determined.

I think one of the points that have really

resonated when we have talked to other countries is bringing them in so early in the process. When we developed the April 2006 workshop and bringing them in as well as commercial and academic community, they really were here in terms of the ground floor in the development of the themes and objectives.

As I mentioned, 180 objectives were defined, were put into 23 categories. Of those 180 objectives, not all are ones that NASA wants to pursue. It really was a collection of the thought process of all of the participants and the other space agencies that were included. So I think the international community views this in a much different light in terms of the way we have gone about this process, and they know from the very beginning process that we want them to be involved in defining what we are going to be doing.

Obviously, every country is going to have their own objectives, the United States as well as anybody else, but there are common objectives that we are going to need to pursue, and we are going to be developing the framework in 2007. I think it remains to be seen exactly how it is going to come together.

MR. ACOSTA: And as you have said, it is a living document. This is the starting point. So it is interesting.

MR. COOKE: I guess I would like to add one thing, and Shana mentioned it earlier. It is a process by which we have brought them in early, and the points about what we intend to build, which is the transportation infrastructure, early navcom, early EVA, leaves wide open a lot of infrastructure on the surface, and it certainly doesn't preclude the parallel developments. It is not one integral vehicle like the Space Station. So there are a lot more options to work with, we feel.

We have all learned through our past experiences, and I think we are finding opportunities where this can be very positive.

MR. ACOSTA: Let's go to the next question.

QUESTIONER: Gina Sunceri, ABC News, for Shana Dale.

Financially, how critical is international partnership to making this succeed?

DEPUTY ADMINISTRATOR DALE: I think it is very important. This is something that in terms of the

international collaboration and the commercial involvement that flows directly from the Vision for Space Exploration, and it is a program that is intended to be sustained and generational in nature. It is the next step, the next logical step, in what we do in space in terms of moving beyond low earth orbit with the ability to go back to the Moon, hopefully on to Mars, and other destinations, and it is critical that we have international participation and commercial participation along the way.

One of the great benefits -- and I would just say one of the benefits of International Space Station -- has been the great international collaboration that has come out of that, and it is something that I think is key to the future.

MR. ACOSTA: Mark?

QUESTIONER: Thanks. I am Mark Carreau from the Houston Chronicle.

I wonder if you could sort of parse out the North and South Poles as potential basing sites, what makes them so attractive, and what, as best you know now, might differentiate the two.

MR. COOKE: I will take that.

The North and South Poles, our interest is they have relatively easy access. Shana mentioned some of the other features earlier. The temperatures are more moderate. There is potentially permanent sunlight in places. We don't really understand that entirely yet because we don't have a full year of coverage from orbital assets, which we intend to get with the Lunar Robotic Orbiter.

So we will want to pin down more closely what we think the right location would be as we get more information, but they both have features that I mentioned. They both also have the permanently dark craters where there could be volatiles.

So they are of high interest. There are differences, but I think we will want to wait and see what we learn. When we do these missions, we always learn something we didn't expect. So we will go forward from there.

MR. ACOSTA: Mark, I think you have got a quick follow-up?

QUESTIONER: Yes.

If your plan is to return to the Moon by 2020,

could you discuss when you sort of have to make a decision, one way or another, or do you have the freedom really of going kind of down to the wire?

I guess it might be good to talk a little bit about when you would have to start developing the lander that you envision.

MR. COOKE: We don't have to decide right away in terms of a landing site. What we will do, though, is take form Lunar Robotic Orbiter our best understanding from that information, and we do intend to build a robotic lander that we will want to send to the most likely place, and that will be after 2010. So we will have time to take that step, and we will go from there. That is not to say that we have to absolutely land it at the specific spot, but we will probably send it wherever it is most likely.

The development of the lander is planned. We are not right on the edge of that, although what we are studying right now is the features that it needs and the top level requirements.

DR. HOROWITZ: I would like to add a couple comments, Mark, to that.

One of the things we have to remember here is we

are developing a system that has flexibility. A basic high-level requirement for the lander system is to be able to go anywhere on the Moon. Just because we are going to go to a base doesn't mean that every single sortie will go to the base. We may find something very interesting to go to an equatorial site in the future, maybe on the back side of the Moon. I don't know.

So it is very important that people understand we are looking at all the possibilities. Of course, we are going to focus our resources on handling the places of most interest, and so the base is where we are going to really focus on, everything we need to assemble the base, but we do have a system that has the basic capability to launch fairly large masses, to be able to send a lander to just about anywhere on the surface of the Moon whenever we like. So we are making sure that we have the flexibility, and as we get more knowledge, we are going to be able to go do different things.

The designs of the lander are only in pre-phase A right now. This is very early studies, which is a great place to be because we can play all of these "what ifs" and look at all the different features and bring in the data

that will eventually give us the data to support the preliminary design review, which won't be until the '11 to '13 time frame. So we have a lot of time to absorb all of this information and make sure, just like we are doing with Orion, the Crew Exploration Vehicle, make sure we have a system that is extensible to do a lot of things because we don't get to build these capabilities very often. So we want to make sure they are extensible.

The nickname I use for the lander is it is a "Pickup Truck." You can put whatever you want in the bed. You can take it to wherever you want, and so you can deliver cargo, crew, do it robotically, do it with humans on board. These are the types of things we are looking for in these systems.

MR. COOKE: Just to follow up on what Doc said, the chart that we had with the lander is very conceptual. It is a very notional idea to illustrate the features that we are looking at. It shouldn't be thought to be the final design or anything, so just to make that clear.

MR. ACOSTA: I like that name, "Lunar Pickup Truck." I am going to use that possibly later.

All right. We are going to come back to JSC for

some questions, but let's go over to Headquarters in Washington, D.C., for a series of a couple questions.

QUESTIONER: This is Seth Borenstein from Associated Press.

For Doc or Doug, in terms of when the outpost will be permanently staffed, what date are you aiming for to start permanent staffing, and in terms of the decade that follows, what are the staffing levels you are looking at? Are we looking at 5, 10, 3, 4 for the permanent staff of the outpost and what kind of international mix of astronauts/cosmonauts are you looking at?

DR. HOROWITZ: Well, Seth, our goal right now is by 2020 to have our first lunar missions. The first lunar mission will deliver four astronauts to the surface of the Moon. So, right away, on those initial missions, we are going to have four people for short periods of time, as Doug had pointed out, until we build up the base.

It will probably take several years, probably into the 2024 time frame, before you see a fully functional base where you could have a continual presence with rotating crews, like we have on the International Space Station today. How fast that builds up and how many crew

members get sent to that base is going to be hugely dependent on the other people that are interested and how much involvement they want because we are going to get that initial capability.

We know we can send four down at a time, but if other nations want to supply modules or they want to maybe develop their own transportation systems also, you could see a traffic model that could support an even larger number, depending on the different levels of cooperation.

I don't know, Doug, if you have any more thoughts.

MR. COOKE: That is right on the mark.

MR. ACOSTA: All right. Let's go to the next question in Washington.

QUESTIONER: Yes. This is Jeff Morris with Aerospace Daily.

I wonder if, I guess, Doug and Doc could talk a little bit about surface mobility once the astronauts are there.

I believe one of the charts mentioned a pressurized rover in 2027, if you could maybe talk a little bit about your plans there. How much mobility do you want

them to be able to have? How much of a range from the base and so on?

MR. COOKE: All right. Mobility is an important discussion, and it is not independent of our EVA capability. We are going to have to look at those combined capabilities and come up with a very efficient approach to putting people on the surface.

We are going to put together a big effort to get them there. So it is going to be important that we make them as productive as we can. So I think we are going to want to look at various options in combining the mobility and EVA capability, so that we provide the best capability for return for being productive and achieving the objectives that we have laid out.

The traverse distances are probably yet to be determined. If you look at the range of objectives, there are various activities that kind of get lumped together. One is in placement of equipment. Sometimes it is wide-reaching, sometimes it is a central location, but if you look at a lot of the objectives, it involves in placing things.

There are other objectives that are basic

operations. There are others that possibly cause you to do construction or assembly, and these cause you to do different things.

So, depending on what the mix is and what the priorities are in science and in operations and exploration that will tend to determine the ranges that we will traverse. If it is a very far distance, we may very well do a separate sortie mission, as Doc described.

So we really haven't nailed those down, but possibly, a pressurized rover combined with easy access to suits, allows you to go distances without having a person in a suit 100 percent of the time, there are different tradeoffs we don't understand yet that we have discussed and begun to think about.

MR. ACOSTA: I know there was a reference to the presentation. Just so everybody knows, the briefing charts that were used will be posted on NASA.gov/Exploration. So we will put that up again at the end of the briefing, so you will have an opportunity to go back and reference those charts.

All right. Next question is at Headquarters.

QUESTIONER: Thanks. It is Tracy Watson with USA

Today.

Can you talk a little bit about how much this is going to cost, what it will cost to establish a lunar base and operate it, both U.S. costs and then I guess the total cost once you wrap in what our international partners will do and where you are going to envision the money coming from?

Thank you.

DEPUTY ADMINISTRATOR DALE: Well, I will just lead off, and I am sure Doc and Doug will want to have some comments as well.

The first thing to realize is that we are operating under a sustained budget over the foreseeable run-out. The Vision for Space Exploration also laid out a program that is supposed to be sustainable and affordable and one which we go as we can afford to pay.

What we have done is, obviously, with the Crew Exploration Vehicle and the Crew Launch Vehicle, we are developing alternate human space flight capability not only for low earth orbit, but to go beyond and replace the Space Shuttle capability.

So the funding that you see in the out-years for

Space Shuttle will be ramping down, obviously, by 2010, and the wedge that is created there will move directly into our exploration components.

I don't know that we can speak at this point in terms of what internationals are going to bring to the table. It is really too early to make that determination, but those are the fundamental tenets under which we operate. So it is not an increase above our baseline budget.

Doc, did you have anything?

DR. HOROWITZ: No, Shana. That is a good summary.

NASA basically has a fixed budget. It is approximately .6 percent of the national budget, and we have several knobs we can turn whenever we take on any endeavor. We have cost, we have performance, and we have schedule.

If you are given a fixed cost to work under, which is where NASA is today, then basically the amount of performance which is the number of vehicles, the capability of those vehicles, that is one of the things that you can trade as well as when you can do it.

Now, we do have some timelines we have to meet. So we have to meet our 2014 deadline of getting our Crew Exploration Vehicle operational and be back on the Moon by 2020.

The international participation I think is what makes this so much richer because you can get so much more capability by working together.

There are certain primary objectives that we have determined are critical for us to accomplish what we need to do to get ready to go on to Mars, but once you get to putting this lunar base in place, the amount of opportunities for other things -- scientific exploration, commercial opportunities and all of that -- are yet to be known by us.

So, to kind of come back to the basic question, we have a fixed budget, and we basically tweak how much performance and what capabilities we are going to build, and, of course, that gets multiplied by the help from the international partners.

MR. COOKE: I guess I would add one thing. As the Architecture Team went through their development of this implementation as a plan of departure, the concepts

that were looked at are defined at a pretty high level, but at least from a first order standpoint, a costing analysis was done that shows the first order that follows very closely the budgets that Doc and Shana described.

MR. ACOSTA: All right. We have got a couple more questions from Headquarters. Then we will come back to JSC and then go to KSC, so a couple more from Headquarters.

QUESTIONER: This is Mark Kaufman with The Washington Post.

On the issue of international cooperation and involvement, could you tell us a little bit about the nations that appear to be very interested at this point?

Also, do you foresee, in terms of that cooperation and involvement, something as intimate as that initial team of four including international participants?

DEPUTY ADMINISTRATOR DALE: Well, I would just lead off by mentioning some of the countries that participated in development of the Global Exploration Strategy. I am probably going to miss one. So you guys jump in.

Australia, Canada, China, European Space Agency,

France, Germany, Italy, India, Japan, South Korea, Russia, Ukraine, obviously United States, and I may have missed somebody, but these are the space agencies that actually participated in developing the themes of the Global Exploration Strategy as well as the objectives.

I think it probably stands to reason that our current partners on the International Space Station are likely to be interested and have shown great interest in terms of pursuing exploration work. So we would fully expect that, but we also expect others who have not been participating in the International Space Station to also become a part of the exploration work, and we will be working on that during the next year in 2007.

MR. ACOSTA: All right. Two more questions from Headquarters and then we will move on and have a hard out at 2 o'clock.

QUESTIONER: Hi, there. Geoff Brumfiel with Nature Magazine.

I was wondering if you could talk either about the scientific objectives of this Moon base or how you will determine those objectives.

DEPUTY ADMINISTRATOR DALE: I will just lead off

by saying in terms of the science objectives, one of the things that we are relying on is input from the scientific community, and there are two formal routes right now for that.

That includes the NASA Advisory Council which is convening a workshop on lunar science objectives in February of 2007 as well as an ongoing study that is being conducted by the National Academy of Sciences that is supposed to be complete by the summer of 2007. Both of these activities will feed directly into determinations of the science objectives that will be accomplished in terms of the Moon.

Doug, I know you have other stuff to say about solar Earth.

MR. COOKE: We have had wide participation so far in the beginnings of these discussions, and we have briefed and gotten comments back from the science subcommittees of the NASA Advisory Committee, but there is a workshop coming up in late February, early March, where those folks will get together and take a really good luck at this.

We have collected a large number of objectives from a range of science communities, a range of elements of

the science community, including, of course, geology if you are at the Moon, but life sciences and earth science and far space science as well.

Probably, the range of scientists that we normally talk to have put in objectives, and, of course, as we get into it, the process by which science is funded at NASA, of course, goes through these processes, and priorities are put in place for the full range of science possibilities. So that process will take its own form and will produce really what the primary priorities are.

DEPUTY ADMINISTRATOR DALE: And I would just note one of the things that I find particularly interesting is the idea of an array of telescopes on the far side of the Moon. At this point, it is way too early to make any determinations about what we will actually pursue, but I find that to be particularly interesting.

DR. HOROWITZ: There are a lot of really exciting opportunities on the Moon, and it is amazing once we go out to the science community.

One of the things that everyone has to keep in mind is exploration is enabling the science. The Exploration Mission Directorate isn't going to define the

science. That is the science community, as Shana has pointed out, and they have a process for doing this, but, again, there is the exciting opportunities of having a quiet zone on the back side of the Moon for the folks that are looking at the radio frequencies to look out into the universe, to be able to look back at our own planet, to be able to look at history of the formation of our solar system that has probably been preserved on the Moon. All the different walks of science will have their day.

The important thing for us as we develop the capabilities is to listen to the science community, to get those objectives which Doug and Tony and the guys have done a really great job, so that we make sure that as we develop the capabilities and the designation of going to a base is a direct output of listening to all the stakeholders, and science, of course, is a huge stakeholder in this. So we want to make sure we don't preclude any good science. That is really one of our major goals.

MR. ACOSTA: Interesting.

All right. One more question at Headquarters. Then we will come back to JSC for one question and then to KSC. Headquarters?

QUESTIONER: Warren Leary, New York Times.

I guess for Ms. Dale or perhaps some others, on your trips this next year to international partners to talk about this architecture, will that include China, and how seriously will those discussions be?

Secondly, once we have a lunar base there, will it be required that people who use it or someone who goes there be a partner in the project, or someone that has an independent capability to get to the Moon, will they have access to that base and its facilities?

DEPUTY ADMINISTRATOR DALE: On the first question in regards to China, as you know, Administrator Griffin did go to China at the behest of the President earlier this year, and that was really just to initiate dialogue with the Chinese and understand more about their capabilities and share more information about our capabilities.

At this point, we are in the initial process of perhaps pursuing discussion about sharing earth science data and also talking about orbital debris, collision avoidance, those types of things, and it remains to be seen in terms of human space flight cooperation. That is not one of our charges thus far. So we await further

direction, but at this point, it is the very initial process of pursuing cooperation in the areas of things, as I mentioned, potentially data exchange from earth science satellites.

The other question you mentioned was independent capability. That is something that we welcome. For instance, if the Russians and perhaps the Europeans combine together to create their own space transportation capabilities, one of the lessons that we have learned from the International Space Station is that it is important to have redundancy and critical path capabilities. So that is definitely something that would be welcome.

I am not sure I got the gist of the other part of your question. It was something about requiring partners.

Did you understand that one?

MR. ACOSTA: I think the way I understood the question -- and certainly, jump in, Warren, if I got it wrong, but the question was to go to the outpost or to the base, would it be a requirement to be a partner to get there, or, for instance, if it was a commercial entity that had the capability to get there, but they weren't a partner, would they be allowed, is that going to be one of

the requirements, and maybe it is too early to tell, something like that.

DR. HOROWITZ: So the basic question is what are you going to charge them for a night's stay in the outpost.

[Laughter.]

DR. HOROWITZ: I think it is really too early to say. Obviously, it is going to depend on what the different cooperations we set up are, whether it is in-kind cooperation or whether it is a commercial utilization of the facilities that we develop. That is pretty far out in the future right now.

MR. COOKE: I do think, though, to characterize the activity that we have had underway to this point is that we are trying to be inclusive and try to be open, have an open architecture and allow for possibilities maybe that we don't even foresee at this point. So that is an important aspect of what we are trying to do.

MR. ACOSTA: All right. Let's come back to JSC for a question, and then we will go out to KSC.

Guy?

QUESTIONER: Guy Gugliotta from National Geographic.

Probably for Doug. Could you talk a little bit more about the volatiles you expect to find at the poles, and if water rights doesn't turn out to be one of them, would that alter your thinking on a polar base, or are the advantages of climate and sunlight enough so that you would pick the polar base regardless?

MR. COOKE: That is an excellent discussion we have had over and over in that where we always come down is the polar side is interesting for a number of reasons, and it is a very important point that it is almost permanently sunlit, these locations that we are looking at, because that allows you to go and develop these capabilities early with solar power.

We know there are high concentrations of hydrogen. We know there is oxygen almost universally on the Moon on the order of 40 to 50 percent content. The craters can, do, and probably have over 4 billion years collected volatiles from cometary ice. Once there, it says basically, unless impacted somehow.

We know there are high concentrations of hydrogen. We don't know what form it is in, and if it is water ice, that is one thing, but in the discussions that

we have had, if we learn one way or the other, I don't think that would affect that decision.

MR. ACOSTA: All right. Let's go to Kennedy Space Center in Florida for a question.

QUESTIONER: This is Dan Billow from WESH TV for Dr. Horowitz.

What is the year of the first launch, the first test launch, other than the one you talked about in 2009? Is that 2014? Is there still any talk of trying for 2012, and do you have the budget right now, the numbers that you know of, to support what you are talking about, as early as 2014?

DR. HOROWITZ: The test flight program is a series of test flights because in test flight you use what we call the build-up approach. So that kicks off with the launch abort system tests that are going to occur in '08 and start in there, and then in '09, we will pick up, as we talked about, with the first full-scale version of the Aries I rocket which will have the simulated second stage.

As we are getting ready for 2014, there will have to be test flights leading up to that, and we foresee that the first of those full up with a fully active second

stage. It would occur in about the 2012 time frame, and, yes, our budget does support a flight test program, and we are working on the details of exactly what that flight test program is going to look like as we get more definition as we are going through the design and the system requirements review for each of the projects.

DEPUTY ADMINISTRATOR DALE: And I would just add to that, that hitting all of the milestones that Doc just mentioned requires stability in our budget profile and making sure that we get the funding that is actually being sought in terms of the request and the budget run-out.

MR. ACOSTA: All right. Let's bring it back to JSC for a couple of questions. We have about 5 minutes left.

QUESTIONER: Robert Pearlman with collectSPACE.com.

Comparing this approach to the Apollo approach where sorties were viewed as a geologic mission to go gather different samples and given that the early designs of the lander seem to minimize return, what role does sample return play in this approach, and what has the science community said about that so far?

MR. COOKE: As Doc mentioned earlier, we have preserved the ability to do sortie missions, and in fact, we have talked about the possibility of sending robotic missions to other locations for placement capabilities or scouting out a location before we send a sortie even, whether we send a robotic mission from Earth or from the Moon once we have an outpost. So we have not precluded that. In fact, we want to make sure that we retain that capability to go in a sortie mode for a specific high-priority interest, if and when the case arises. So we want to preserve that capability.

In looking back toward Apollo, the Apollo missions, of course, were tremendous, and most of us are here because we were watching those at the time as we grew up. They were limited by the capability that they took in any one location, and the stays were limited. The hardware was limited to basically what they did.

In the approach that we are taking, we are looking at this more permanent capability that will allow longer stays and a lot more in the way of achievements from the realm of objectives that we have looked at.

MR. ACOSTA: All right. A couple more questions.

We will go to Mark.

QUESTIONER: Mark Carreau, Houston Chronicle.

Could you just give us a sense of some of the things that partner nations might do at a lunar base that would help everybody in the sort of sense you are talking about?

DR. HOROWITZ: Sure, Mark. That is really interesting because we have identified in our architecture the primary things we have to get done. You have to have a ride to get there. You have to get down on the surface. You have to provide for basic habitation.

One of the points we brought up was, for example, we are going to take advantage of the solar insulation because the poles have a lot of that. If we are able to build up more robust power conversion techniques, that allows more capability that we might not need for initial objectives, but other people might want to provide it. We might be able to get more habitation volume from other contributors, whether they be inflatable technologies or just other modules, similar to what we are doing on Station.

Mobility. Doug talked about mobility. I see

mobility as a huge range, everything from walking around in a space suit to driving around in a full-up pressurized rover with a backhoe on the back to go dig up dirt and move things around. So there is all kinds of capability, from heavy lifting to in placement to maybe even buying things commercially. ISRU may start off as a Government activity to determine if we can do it, but it may become a commercial activity to actually buy resources.

If I could buy oxygen to supply the people in my base or use that as an oxidizer for fuel and somebody can provide that in a commercial sense, that might even be commercially provided, or it could be provided by another country. So there is a tremendous number of opportunities, and I see them everywhere from transportation to infrastructure to capabilities as well as all the science activities that are going on.

MR. ACOSTA: Shana, do you have anything to add?

DEPUTY ADMINISTRATOR DALE: No.

MR. ACOSTA: We will leave it, the last question here, with Leonard.

QUESTIONER: Leonard David with Space.com, Spacenews.

You have got an experiment going underway now with COTS, and this gets to your commercial activity. To what extent do you see COTS as a template for potential commercial applications for lunar exploration, and if it doesn't work, do you have other strategies in mind or other types of mechanisms that might involve the commercial entities?

DR. HOROWITZ: Basically, I think the COTS model is an excellent model. This is where, as you know, we are providing some seed money and support through our funded Space Act agreements, and the idea is if we can buy the capability from the commercial sector, one, more cost effectively, just save money, but also free us up to go do the exploration, get on to Mars, and go do the other things that we need to do, I think that is a great model.

Is there some risk? Of course, there is some risk in doing this, and we are going to learn as we go through this, but the commercial world and the entrepreneurial world will evolve with us. So I don't have plans on how I am going to change the way business does business. I am just going to encourage them and make sure that we provide the environment, and so far the feedback I

have gotten is that we are doing a good job of providing the correct environment, and I see that having direct application going on to the Moon because we do want to extend the sphere of human influence, if you will, which includes commercial opportunities.

So I think the model we are using is good. If we have troubles, we are going to learn from that. Just like businesses evolved over years, I think the space business and the Government versus commercial partnership is going to evolve over time. Just like we are doing with this, we are going to continue to learn, and we will modify as required to make sure that we are enabling the commercial world to work with us.

MR. ACOSTA: Great. Well, that will be the final word for today's briefing. I want to thank our panelists for an exciting and informative hour of information. Thank you, Doc. Thank you, Doug. Thank you, Shana. That will close it out, as I mentioned.

For more information on today's briefing and the presentation charts that were used, please go to our website at www.NASA.gov/Exploration.

That will do it for today's briefing. Have a

great afternoon, and we will see you later in the week.

[End of press briefing of December 4, 2006.]

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