Remarks to the
NASA Advisory Council
Science Subcommittees

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Good morning and thank you for inviting me today. While I normally like to have an open dialogue and discussion without reading from prepared remarks, I hope you don't mind me speaking from prepared text for a bit before opening up the dialogue with Q&A. The reason I chose to do so today is that I wanted to put before you some carefully-considered decisions about the future direction of our science programs, and I wanted to make sure to elucidate the many various factors behind those decisions, as I seek your advice going forward. Moreover, I want to make sure that my rationale is made available to the wider science community via our website.

We celebrated our nation's 230th birthday, our Independence Day, this week. One of the great strengths of our country is the principle of freedom of speech, of entertaining vigorous debates on the great issues of the day. For NASA, the great issue before us is how we carry out our nation's civil space program—in space science and human spaceflight—and our aeronautics research programs.

We are a nation of laws, and to that end NASA is governed by the Space Act of 1958 as our founding charter, just as the Declaration of Independence and the Constitution are the founding charters of our nation. The NASA Authorization Act of 2005 and Presidential policy—the Vision for Space Exploration—provides the long-term direction for our investments of time, resources, and energy in the nation's space and aeronautics program. And each year's budget and appropriations legislation provides detailed guidance in crafting an overall portfolio of missions in space exploration, scientific discovery, and aeronautics research. Thus, all NASA programs are "go-as-far-as-we-can-afford-to-pay" at the national level.

When it comes to space science priorities, we are guided by the decadal surveys of the National Academy of Sciences, and I'm glad that we'll soon have a decadal survey for Earth science priorities. This brings us to your role. We've specifically asked for your collective and personal advice as to how we carry out NASA's science programs—astrophysics, heliophysics, planetary science, and Earth science. In this town, advice is often freely given, but in your case, we're actively seeking it. You are some of the most senior representatives and emerging leaders of your respective fields of endeavor. So, I offer my thanks to you all for agreeing to be part of the NASA Advisory Council's science subcommittees.

One of the issues where we need your advice concerns the fact that human exploration of the Moon, Mars, near-Earth asteroids and the rest of the solar system is not solely science-driven. However, given that this effort will be undertaken, we are seeking the counsel of the science community as to what science can be done in the course of the human exploration of the solar system. Jack Marburger framed this issue very well in his speech in March at the 44th annual Goddard Memorial

Symposium. “The question about the Vision boils down to whether we want to incorporate the Solar System in our economic sphere, or not. Our national policy, declared by President Bush and endorsed by Congress last December in the NASA Authorization Act, affirmatively answers that question: The fundamental goal of this vision is to advance U.S. scientific, security, and economic interests through a robust space exploration program.” Scientific discovery through human exploration is one goal of the Vision for Space Exploration, but is not the only goal.

We will definitely add to the scientific body of knowledge for our civilization about the real estate values in the vicinity of planet Earth, and we will conduct scientific experiments along the way, much in the fashion that Meriwether Lewis and William Clark gathered specimens, made careful observations in their journals, and drew detailed maps of the great American West 200 years ago.

Like Lewis & Clark’s maps of the newly-acquired territories that expanded our nation’s economic sphere, NASA’s Lunar Reconnaissance Orbiter will provide detailed terrain elevation data for future exploration and use of the resources of the Moon, just as the Mars Global Surveyor

and Mars Reconnaissance Orbiter are mapping details of the surface of that planet in the search for evidence of potential subterranean flowing water and future landing sites for robotic and human exploration. But what other scientific endeavors should we pursue in low-Earth orbit, or on the Moon, Mars, and near-Earth asteroids, during the course of human exploration of our solar system over the next several decades? We need the scientific community to help us answer that question.

As we organize our endeavors, I'd like to call your attention to the recommendations from the 1990 decadal survey in astronomy and astrophysics of the National Academy of Science, commonly known as the Bahcall report. Back in 1990, this NRC committee studied the suitability of the Moon for possible astronomical facilities and found that, in the long term (though not even in the next decade), the chief advantage of the Moon as a site for space astronomy was that it provided a large, solid foundation on which to build widely separated structures such as interferometers.

This same report from 1990, along with the next decadal survey, "Astronomy and Astrophysics in the New Millenium" in 2000, and the

annual report from the NRC's Astronomy and Astrophysics Advisory Committee have helped me to make some difficult decisions recently by informing me as to how the science community viewed certain priorities. In 1990, both SOFIA and Astrometric Interferometry Mission, since re-named the Space Interferometry Mission (or SIM), were regarded as moderately priced programs compared to large programs like SIRTF/Spitzer. Obviously, this survey underestimated the complexity, cost, and schedule for both of these projects, but the decadal survey ranked SOFIA as a higher science priority than SIM.

Even before I became NASA administrator in the spring of 2005, I knew of problems with the SOFIA program, due to gross underestimates of the technical complexity of integrating a 2.5-meter telescope onto a Boeing 747 airborne platform. Costs grew to the point of making SOFIA a large program, and the schedule kept slipping further to the right.

Earlier this year, I believed that the best course of action at that time was to withhold funding in FY 2007 for SOFIA, until we conducted a thorough review and carefully considered the next steps for this

project. That review included the option of terminating it. Having received this report, I now believe the best course going forward is to continue SOFIA, with some significant management changes.

After a careful and independent technical and management review this past spring, NASA's Program Management Council concluded that the remaining technical challenges for SOFIA, like the stability of the telescope within the aircraft's Cavity Door Drive System, were not insurmountable. However, we decided that we needed a team in place to manage SOFIA having a greater level of management experience with research aircraft. Thus, we decided that the Dryden Flight Research Center should lead the development and flight tests of SOFIA, and we need to simplify the contracts to ensure that Dryden project managers have direct authority over the contractors actually performing work on the aircraft. Dryden operates several research aircraft and has considerable hands-on experience with such issues. Ames Research Center will continue to retain science management responsibility for SOFIA, though we may later re-evaluate the science management responsibilities as the project continues.

Following the PMC's technical and management review, we then sought to determine whether SOFIA represents a better investment for space science funding than other projects in the Universe/Astrophysics portfolio. For this analysis, we were informed by the 1990 Bahcall report, where SOFIA was ranked as a higher priority than SIM, the 2000 decadal survey which reaffirmed those recommendations, and the NRC's annual report from the Astronomy and Astrophysics Committee last March, which said: "With a substantial expenditure on Hubble Space Telescope servicing, increases in James Webb Space Telescope's construction cost, and significant funding for SIM (despite its not earlier than 2015-16 launch date), the Astrophysics program is overly biased towards large missions. The science return from such missions is not in doubt, but the lack of balance will impact future opportunities and the diversity of scientific investigations. As discussed in more detail in the report, substantial delays in the Shuttle availability for HST SM4, any further cost growth in JWST, and the funding profile for SIM are all issues that need to be considered. (SIM has a high lifecycle cost because of both current significant spending and early ramp-up.)"

In addition to SOFIA, the Universe/Astrophysics theme has a diverse portfolio of projects, ranging from "Great Observatory" missions like the Hubble Space Telescope, James Webb Space Telescope, SOFIA, and SIM, as well as smaller-class missions such as Kepler, WISE, GLAST, Herschel, and Planck. Despite losing the opportunity to make some observations in conjunction with the Spitzer Space Telescope, SOFIA can still fulfill its science objectives to a degree commensurate with our investment, and has the potential to produce "Great Observatory" science over its 20-year design life. As an airborne platform more readily able to incorporate and test a wide range of astronomical instruments than a space telescope, SOFIA has a great deal of flexibility and can benefit a broad range of astronomers while complementing the capabilities of NASA's space telescopes. As a research aircraft, SOFIA can also provide hands-on training and education for future astronomers.

Thus, in order to continue SOFIA out of the $1.5 billion spent per year in NASA's astronomy and astrophysics portfolio, we plan to refocus SIM as a technology and research effort for finding Earth-like

planets in other solar systems, a portfolio of projects which includes the Kepler Space Telescope. NASA will then be informed by the priorities in astronomy and astrophysics from the upcoming decadal survey, to be initiated in two years.

I have made this consideration carefully, and I believe that it is the best course of action for SOFIA as well as the rest of the astronomy and astrophysics portfolio.

As I have told Charles Elachi, I am sensitive to the impacts to scientists and engineers at JPL who worked on SIM. I have been laid off twice in my career. He has my commitment to maintain JPL's overall workforce at its present level, with the assignment of other work as necessary to do so. However, the priorities of the decadal surveys in astronomy and astrophysics are clear, as is the advice of the NRC's annual report.

Clearly, we in the broader space community have a credibility problem with our stakeholders in managing the technical complexity, costs, and schedule for our programs. The science community must be careful to not underestimate the costs and complexity of the missions

they propose. NASA cannot afford everything our many constituencies would like us to do.

However, having been a part of several Nunn-McCurdy breach reviews for NPOESS and reading reports concerning other major DoD programs, this problem is broader than NASA, and I have discussed it extensively with former Congressman Dave McCurdy, Tom Young, my counterparts in the DoD, and members of Congress. Our stakeholders in Congress are concerned that NASA not under-estimate the costs or complexity of our programs. To that point, the NASA Authorization Act of 2005 requires even more stringent management actions than those in the Nunn-McCurdy legislation for NASA missions costing more than $250 million and which exceed their baselined costs. I would ask everyone in the science community who proposes missions to NASA to become familiar with that legislative provision, which is now the law of the land and which I and my managers must follow.

In the future, decisions such as whether or not to continue missions like SOFIA will not be left to the NASA Administrator, but will go to the Congress. My #1 request to Mary and Colleen is that they bring

forward realistic, executable programs within their budget. We will need your help in this. Every time we have over-promised on a program, we have lost credibility with our stakeholders.

Speaking of stakeholders, it's now the time of the year when the House and Senate committees mark-up their bills for the following year's appropriation. Recently, the chairman of NASA's appropriation subcommittee, Congressman Frank Wolf, displayed real leadership by curtailing individual member's earmarks for NASA and NSF.

"One person's priority is another's earmark," Jack Marburger points out, and he's absolutely right. I believe the science community is best governed by merit-based, peer review procedures. Our hope is that the science community can form a consensus on its priorities, as with the decadal surveys, which would argue against funds being diverted for one person's earmarks. Back in FY 1997, specific direction for NASA constituted only $74 million for six specific projects. In FY 2006, NASA was earmarked at a total of $568.5 million for 198 site-specific and programmatic increases, with $48.3 million in site-specific earmarks from NASA's Science Mission Directorate and $63.4 million from our

Education programs. As members of the science community, we need your help in curtailing this level of earmarking among your colleagues. NASA simply cannot afford everything that everyone would like us to do. Chairman Wolf recognizes these difficult choices, and the need to focus limited resources on programs most critical to our Nation. We are working closely together on this.

I have also discussed with Chairman Wolf the need for more discussions within the planetary science community to set priorities for missions to the outer planets and moons of Jupiter and Saturn. These missions will cost a minimum of several billion dollars. While a mission to Europa was ranked as the highest planetary science priority in the decadal survey published in 2003, since then we have learned that liquid water might also be found on Enceladus, one of Saturn's moons, and Titan also has an interesting methane-rich atmosphere with volcanic activity. Neither of these two moons has a harsh radiation environment like that of Europa, whose extreme radiation field could cripple a multi-billion spacecraft in its orbit before it completed its science mission. Thus, I believe that the best course of action moving forward is to permit the science community to

determine the next outer planets mission, through a competitive selection process under the New Frontiers program.

I would also like to note for the science community that, if you advocate large missions exceeding the capabilities of the current EELV fleet, you should consider taking advantage of new heavy-lift capabilities currently under development for human exploration.

While the planetary science community may not have liked my decision, as part of the FY 2007 budget formulation, to place the national priorities of completing the International Space Station, retiring the Space Shuttle by 2010, and bringing the CEV on-line no later than 2014, higher than the goals of missions to the outer planets like Europa, I want to assure you that our nation will carry out such missions. It simply will not occur as soon as some might wish that mission to be. Does that make me less of a fan of missions to the outer planets? Absolutely not. I'm trying to put forward an affordable and credible portfolio of missions within NASA in accordance with the law of the land and national policy, and to avoid making promises the Agency cannot keep. I strongly believe this to be in the best interests of the overall space program.

These are the issues at the forefront of my mind today as I look out at the landscape of NASA's broad portfolio of science missions. We're asking for your advice on the journey ahead. This has been a momentous week for NASA, with the second Return-To-Flight Shuttle mission underway on July 4th, and I'm glad to be spending some time with you now. After this mission is completed, I will convene a group of senior NASA managers to help me decide the best course ahead for a servicing mission with the Shuttle to the Hubble Space Telescope.

Meriwether Lewis observed the following perspective in his journal on July 4th, 1805 which speaks across two centuries to many of us in NASA: "We all believe that we are now about to enter on the most perilous and difficult part of our voyage, yet I see no one repining; all appear ready to meet those difficulties which wait us with resolution and becoming fortitude."

We have a lot of work to do. We are asking for your advice as to how we carry out that work. Let me now open this dialogue to your questions.