Remarks at American Astronomical Society
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The arrival of a new year always provides time for reflection—looking back on past events, as well as anticipation—looking forward to future achievements and challenges. And that is my purpose today in talking about NASA's astronomy program.

To be certain, the idea of placing the New Year at this specific time in January is an artificial construct of human culture, one that largely owes its existence to humankind's fascination with the orderly migration of the constellations around the sky with the change of seasons. For example, the wintertime appearance of *Orion* high in the southern sky serves as an annual reminder of the beauty and majesty in the heavens that compel us to seek understanding of the universe around us, and how we got here. For my own part, I have always thought it to be one of nature's most beautiful facts that we ourselves are composed of nothing less than star stuff, the residual material from supernova explosions of earlier generations of massive, short-lived stars. I might say that say, that in a certain sense that we humans are a quarks' way of trying to understand other quarks. Then again, maybe you wouldn't say that. It might be something I would say. This is what passes for humor when engineers get together.

For many of us here, the brilliance of the night sky has helped guide our paths in life. No doubt many of you were first inspired to pursue a career in astronomy by a tantalizing glance through a telescope at a distant celestial body. The journey that brought me to this point in my career began over 50 years ago when, as a five year old child, I received from my mother a copy of *A Child's Book of Stars*, by Sy Barlowe. Although just about everything in this book is now known to be wrong, at the time it absolutely enthralled me, and despite the fact that this was several years prior to the launch of *Sputnik*, from then on I never really considered anything other than a space career. I must admit, however, that at various times I had difficulty deciding whether to be a physicist, mathematician, astronomer, or an engineer. In retrospect, I doubt it would have made much difference. We need all of these folks, and many more, in the space business today. But to put a finishing touch on this story, last year the crew members of the

Space Shuttle *Discovery* STS-114 mission did me the great honor of taking my copy of that book—moth eaten and beaten up as it was—onboard their flight. It is now framed and hanging in a wall display in my office, along with photos from the mission.

So astronomy was my first love among the scientific disciplines, and I will always be proud of having contributed in a small way to the Hubble Space Telescope project in the early 1980s. In fact, it is my deep appreciation of the importance of Hubble and all of the other great observatories, Chandra and Spitzer, to science and society that prompted my decision that NASA will, if at all possible, use one of the remaining flights of the Space Shuttle for Hubble servicing. Thanks, we still need to figure out if that's possible. And we still have one more test flight in our return to flight series to know what we've got in the way of a flying machine, but I am hopeful.

But whatever the future may bring in this regard, we are very fortunate that Hubble has successfully operated for 15 years now, and along with two of its fellow NASA Great Observatories, those I just mentioned—Spitzer and Chandra—continues to make discoveries of fundamental scientific importance. Some of those discoveries are being highlighted at this conference in a display I just toured through, including the release of a multi-filter mosaic of the Orion Nebula, made with Hubble's Advanced Camera for Surveys; Hubble's imaging for the first time of the close companion star to Polaris; the Spitzer Infrared Space Telescope's imaging of a remarkable nest of red super giant stars—14 supernovas in the making—and the Chandra X-Ray Observatory's investigation of the affects of giant black holes and hot gasses in elliptical galaxies.

Obviously, these tremendous accomplishments are the result of close teamwork between NASA project teams, contractors, and the astronomical community. But there also are individual heroes, and we must thank them for the existence of these great cathedrals of modern science.

Among these heroes was a gentleman with whom I was acquainted as a younger man during my time on Hubble accomplished much in a life that ended far too soon in 2005. In his 70 years John Bahcall was a legend in this community. His work on explaining the scientific mysteries of our sun in the 1960's was sufficient to enshrine John in any pantheon of scientific giants. Today, we are grateful that this was just the beginning of his significant contributions to many areas of astrophysics, and to the nurturing of talented young scientists around the globe and to the dramatic advancement of American astronomy. It was John, along with astronomers George Field and Lyman Spitzer, who successfully planted the seed and then tilled the soil for

the bold concept that became the Hubble Space Telescope. During Hubble's development, John served for more than a decade as an Interdisciplinary Scientist on the Space Telescope Science Working Group. After launch, he led the Hubble Key Program to measure the evolution of the intergalactic medium through the use of quasar absorption lines, and he used Hubble to verify that quasars indeed live in the heart of galaxies. Because of his stouthearted advocacy for Hubble's capability to observe at infrared wavelengths, the many discoveries from Hubble's Near Infrared Camera and Multi-Object Spectrometer are tributes to his foresight.

Of course, John Bahcall's contributions went much deeper than that. During his lifetime of service to this community, he led the National Academy of Science's Decadal Survey that set astronomy research priorities for the 1990s, and he served as President of the American Astronomical Society from 1990 to 1992. Three years ago, he was called on to help NASA determine the most effective way to conclude Hubble's mission, and he and his panel solicited and carefully weighed thoughts and observation from hundreds of you. And last year, he spoke out with his usual fervor for a Hubble servicing mission, noting that "what is at stake is not only a piece of stellar technology but our commitment to the most fundamental human quest: understanding the cosmos."

Like many in this audience, I have followed John Bahcall's career and long admired him for his scientific accomplishments and passionate advocacy for space-based astronomy. It is now my honor to ask John Bahcall's partner in life, Dr. Neta Bahcall, the distinguished astrophysicist and former AAS President to come forward to receive on behalf of her late husband NASA's Exceptional Scientific Achievement Medal. The medal's citation reads: "In recognition of his extraordinary service to NASA's space astronomy program throughout his professional career, including his leadership of the National Research Council's Decadal Survey and tireless advocacy for the Hubble Space Telescope." Neta, would you please come forward. We would have liked John could have been here today to make a few remarks, but in his absence Neta will speak for him.

Remarks by Dr. Neta Bahcall

Thank you very much. I want to thank you Dr. Griffin and all of our friends and colleagues at NASA for this very special award, for the many decades of the special relationship between John and the agency. John would be so proud to receive this award from the people in the agency that he admired. John respected, and appreciated, your tremendous efforts at NASA,

your hard work and dedication, to make the space science program the shining star that it is. John's efforts on the development of the Hubble Space Telescope over the last 30-plus years, his successful lobbying for the Hubble with Lyman Spitzer, and his extensive work since then rested always on John's belief in the unique outstanding capabilities of this instrument to discover fundamental knowledge about the Universe. "We all have a deep desire to know what exists out there," John said. "A desire so basic, so beautiful, so much fun, that it unites all mankind." "The most exciting discoveries will provide answers to questions we do not yet know how to ask," John said. "And they concern objects we have not yet imagined." John would be pleased that the work that he so deeply cared about is continuing by the excellent done work by NASA and the general astronomical community to illuminate some of the most fascinating mysteries of our universe—extrasolar planets, black holes, dark matter and dark energy. The continuation of the Hubble Space Telescope servicing mission is a tribute to NASA and the entire astronomical community. The Hubble, Spitzer and Chandra flying above, the solar neutrinos which cause sunshine, quasars and the galaxies, the over 200 postdocs that John trained over five decades are part of John's extended family and legacy. In John's name, our children Safi, Dan, Orli and I thank you all very much.

Continuation of Remarks by Michael Griffin

Thank you Neta. Thanks to all of you for your recognition of John's work. He was a good guy. **O**ne of the wonderful qualities that John Bahcall brought to his work was a tremendous faith in the future, and so I would now like to address where we are headed with NASA's astronomy program.

Two years ago this week, President Bush gave our nation's space program clear direction and compelling objectives with his announcement of the Vision for Space Exploration. As the President said, the Vision is intended to advance America's "economic, scientific and security interests." NASA is now committed to executing it as practically and responsibly as we can, and in a way that does not hinder progress on our other important aeronautics and science programs. And I commend you at the AAS for your statement issued last July, in which you "embrace the opportunity to continue to work with NASA to implement the Vision on a sound scientific basis with broad input from the scientific community." We certainly welcome such input, and will listen to your views on how the implementation of the Vision will as you stated, "create opportunities for better scientific research, for more stimulating science education, and

contribute toward our nation's ability to compete in a world based on technology." I believe that those are all cogent observations concerning the value of the Vision for Space Exploration. In very practical terms added to that value is the same value that Neta was just talking about, in John's words, about the core desire that humans have to explore and understand. It takes many forms, but that is what we here about today.

So I would argue strongly with those who assert that human space flight is inimical to science. Our scientific initiatives go hand in hand with our extended reach into the solar system, encompassing questions as practical as Earth's evolving climate, as enticing as those regarding the history of surface water on Mars, and as profound as the origin and nature of the Universe. It is my conviction that in the 21st century we will see human civilization begin to spread out into the solar system, carrying with it the values we collectively cherish, including the value and practice of free and open inquiry, which is so essential to the scientific community.

I personally believe that astronomy specifically will benefit enormously in the long run from our commitment to seek out, explore and exploit new frontiers and new opportunities, such as the use of the Lagrange points in the Earth-Sun system, which offer ideal locations for the next generation of space astronomy. We will, among other things, learn to image Earth-like planets around other stars, perhaps even measuring their atmospheric composition, and continue to search for answers about the possible existence of life elsewhere in the cosmos. Other grand questions, such as the origin of stars and galaxies and the nature of dark matter and dark energy, will also benefit from opportunities to advance scientific inquiry that will flow from the Vision.

Having said this, I do recognize that there is significant concern within the scientific community generally and the astronomical community specifically about the near term, and whether or not the costs of the Vision will fundamentally alter our tradition of support for space astronomy. So my response is the same as the one I gave to the Earth Science community at the American Geophysical Union meeting last month, and have given to people in the space exploration community. It is not our desire to sacrifice present-day scientific efforts for the sake of future benefits to be derived from exploration. Our cost estimates for returning astronauts to the moon are conservatively structured to achieve our goals within budget. Also, while we certainly are not claiming cost savings that have not been proven, we very much intend to find ways to reduce the cost of the exploration program through improved technology, commercial involvement and international partnerships.

In short, we who run NASA today are doing our very best to preserve a robust science program in the face of, frankly, some daunting fiscal realities that affect all domestic discretionary spending. These realities dictate that we set priorities; NASA simply cannot accomplish everything that was on our plate when I took office last April. In space-based astronomy, and in other areas, we will have to make tough trade-offs between maintaining current missions, of which there are 14 ongoing, and developing new capabilities. The astronomy community has faced this same issue with respect to ground based telescopes as well.

We also, at NASA are in a position where we will try to phase out an old space program: space shuttle and space station, and phase in a new program of human spaceflight, the Constellation Program, the Vision for Space Exploration. And to do all this we are managing our science programs. These are very difficult times.

But if we look beyond our current fiscal circumstances, there is reason to be hopeful. First, we have some amazing astronomical capabilities in space, and we will soon add to them. We are looking forward to the next major high-energy astrophysics mission, the Gamma-ray Large Area Space Telescope, scheduled for launch in late 2007. GLAST will be a tremendous new facility for the astronomy, astrophysics, and particle physics communities. In addition to making observations of the highest-energy behavior of gamma-ray bursts – following on the breakthrough work of the Compton Gamma-ray Observatory – GLAST will open a wide new window on the gamma-ray sky. Cosmic gamma rays characterize the highest-energy phenomena in the Universe, they allow us to probe the history of star formation through their interactions with ultraviolet light, and, with GLAST's significant leap in capabilities they may also be messengers of as yet to be discovered laws of physics.

Turning to the search for extrasolar planets, the Space Interferometry Mission, now in formulation, will provide the ability to measure precise positions of stars and to search for Earth-like planets around them.

We also look forward to the launch of NASA's next great observatory, the James Webb Space Telescope. When placed at the Sun-Earth L-2 Lagrange point a million miles from Earth, and with five times the collecting area of the Hubble, JWST will allow detection and more detailed study of the most distant galaxies in their earliest stage of formation. The Webb's infrared sensitivity will allow us to see behind the veil of nearby interstellar gas to study the birth

of new stars in our own galactic neighborhood, regions largely hidden to Hubble's optical and ultraviolet instruments.

So we have considerable reason to look to the future with hopeful anticipation. In closing, let me reiterate my intention to work closely with your community to ensure that scientific achievement is integral to the goals of the Vision for Space Exploration. I'm convinced that NASA's greatest successes will continue to result from the various elements of the diverse space community working together to ensure that the pursuit of exploration and scientific progress complement each other. Thank you.