

To Explore Strange New Worlds

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Good afternoon. Since I am most likely the only thing between you and dinner, I will try to keep my remarks brief, then we can quit for dinner or use the time for any questions you might have. Before going further, I want to thank the organizers of this conference, who for thirty-nine years have brought together the community of lunar and planetary scientists to share the many exciting results of our missions, and to preview coming attractions.

This annual conference began in time of Apollo, in the year of the first manned lunar landing. To me, the spirit of those early years will always be best captured by President Kennedy's words, which stir our souls, or at least mine, even today: "We choose to go to the Moon in this decade and do the other things, not because they are easy, but because they are hard, because that goal will serve to organize and measure the best of our energies and skills, because that challenge is one that we are willing to accept, one we are unwilling to postpone, and one which we intend to win." No one in politics talks like that today. I wish they did.

Now, right up the road is NASA's former Manned Spacecraft Center, renamed the Johnson Space Center decades ago, for the President whom his biographer, Robert Caro, called *Master of the Senate*. Unlike Kennedy, Lyndon Johnson was not known for his stirring oratory, but he did offer a number of practical and very direct comments on the importance of space in human affairs. One of these is, for me, particularly notable: "In the eyes of the world, first in space means first, period; second in space is second in everything." I think this was true when he said it, and that it will become ever more obviously the case as the twenty-first century plays out.

Moreover, when I talk or write about the importance of "space", I'm talking about the entire range of activity in our space enterprise. Human and robotic spaceflight. Defense, intel, and civil space. The advancement of technology, and the advancement of science. Frontier research, and practical applications. All of it. It is all of a piece to me; it has to do with embracing the possibilities inherent in this still new arena, and our nation's understanding of how important it is to do that.

This conference has continued for thirty-five years since the last human lunar landing, two generations during which our grasp of this key insight has, in my view, been far too tenuous. The Lunar and Planetary Institute should be congratulated for its persistence in keeping the spirit of exploration aglow with

scientific results from robotic missions out beyond low Earth orbit, and for keeping the flame alive that mankind would return to that arena.

If he is not remembered for his oratorical skills, LBJ is recalled for his dogged persistence. NASA celebrates its 50th anniversary this year, due in no small measure to the persistence of Lyndon Johnson, who in the wake of the launch of *Sputnik* was one the principal national leaders calling for a more concerted effort in space. He was also a driving force behind the enactment of the *National Aeronautics and Space Act of 1958*, which established NASA. The principles and direction to our Agency as outlined in the Space Act have withstood the test of time. It is truly a lasting legacy.

Talking about the Space Act reminds me of the kerfluffle that ensued, a couple of years ago, when I changed our mission statement to be consistent with our legislated responsibilities. I thought the ensuing squabble was “Much Ado About Nothing”, and that a larger point was missed. To me, the person who best captured NASA’s true mission was Gene Roddenberry, with his immortal line about the mission of the Starship *Enterprise*, “To explore strange new worlds. To seek out new life and new civilizations. To boldly go where no man has gone before.” That’s almost perfect; I think we’re more likely to *create* new civilizations than to find others, but I love those lines, and if it wasn’t for the royalties we’d have to pay, and of course the split infinitive...

All joking aside, there are several nuggets of wisdom in these words, nuggets that speak not only to the public's perception of what we do at NASA, but also serve to provide a deep sense of purpose to the work you all perform as lunar and planetary scientists. *You* here today are the ones who explore strange new worlds, seek new life, and who go where no one has gone before. Do you ever think about what life might be like for working scientists a few hundred years from now, maybe by comparing the trails we are blazing today with those cleared for us by Galileo, Tycho Brahe, Kepler and many other astronomers and planetary scientists? Could they have ever imagined what we are doing today? Can we possibly foresee anything of the world of, say, the 26th Century?

We are living today in exciting times. Planetary science is going through a true Renaissance age; some of the discoveries of this age will be discussed at greater length right here at this conference. For example, it had been 33 years since NASA last flew by the planet Mercury with *Mariner 10*. But just two months ago, *MESSENGER* recorded spectra and snapped over 1,200 images of previously unseen features on the planet Mercury's surface, and we will see even more this October during its next flyby. I can't wait. Meanwhile, in orbit around the planet Saturn, *Cassini* will fly within 50 kilometers of Enceladus this Wednesday to sample water-ice samples and other gases. Previously, *Cassini* revealed that Saturn's planet-sized, organic-rich moon Titan has hundreds of times

more liquid hydrocarbons than all the known oil and natural gas reserves here on Earth. And who among us was not awed last year by the time-lapse images from *New Horizons* when it observed a spectacular 200-mile-high volcanic eruption from the Jovian moon Io, and spotted the infrared glow from at least six other active volcanoes?

We are exploring strange new worlds today, and you are the scientists who are making it happen. It may not be as dramatic as portrayed in science fiction – but it's not fiction. It's real. NASA's Science Mission Directorate is currently operating over fifty flight missions in the various Earth and space science disciplines, and Alan Stern's team has heeded the advice of the science community in formulating a more balanced portfolio of missions – large, medium, and small missions – while addressing the priorities articulated by the Congress, President, and various science communities.

While we might all wish we had more money to fund each and every space mission ever desired or proposed, it is a fact across, stretching across multiple Presidential Administrations and Congresses, that NASA simply does not have the budget resources to accomplish all of the many and varied space and aeronautics missions that our many constituencies would like us to do. The President's request for NASA in FY 2009 is \$17.6 billion out of \$3.1 trillion for all U.S. government spending, less than 6/10ths of a percent of the entire Federal budget. We don't get

anything like the 24% of the budget that the average American thinks we receive, and so we must set priorities, establish a careful balance between them, and ask members of the space community to respect these priorities as well as NASA's other mission areas, human spaceflight and aeronautics research, as worthy and noble endeavors in their own right, beyond some critics' self-interested definition of science.

Within the Science Mission Directorate's resources for FY 2009 and the five year budget runout, NASA and its stakeholders in the White House each recognized that our nation's investment in Earth Science has paid dividends in our understanding of the forces and effects of climate change. Thus, an additional \$570 million over the next five years was requested for the Earth Science portfolio for their decadal survey missions. Within the overall SMD budget (approximately \$4.5 billion per year in direct funding), the other three disciplines contributed about equally to provide the additional money for Earth Science. I know you have your head in the sky, but you live here on Earth as we all do, so I hope you will agree with me that this investment in our home planet is timely and important.

Then, within the budget for planetary sciences, we attempted to address the major concerns as expressed by the recent National Research Council "report card" for our planetary exploration efforts. We received an "A" for our Mars program, a

“D” for our outer planets program, and a “C” for our Research & Analysis efforts. We have rebalanced the planetary science portfolio accordingly.

As I have discussed elsewhere, we have learned more and have more questions to answer about the many other planets and moons in our solar system. So after MSL, we are now planning in earnest for an outer planets flagship mission to Europa, Titan, or Ganymede. This is a rare opportunity to advance our knowledge of the outer solar system.

Not many people realize that NASA funds over 3,000 diverse research grant activities within SMD. Regarding those, we also added significantly more money to our planetary R&A budgets so that you might turn the ones and zeros of the data coming in from all across the solar system into meaningful knowledge and discoveries.

We are also planning several new, small science missions to the Earth’s Moon, our closest celestial neighbor. Of special interest to the lunar and planetary sciences community, we plan to launch the *Lunar Reconnaissance Orbiter* and *LCROSS* mission in late 2008. NASA also has two instruments on India’s *Chandrayaan-1* spacecraft which is set to launch in a few months, and we are sharing data for further research and analysis of our Moon with many other countries. Along with the tandem spacecraft *GRAIL* mission in 2011 to generate a high-quality gravity field map of the Moon, we now plan to fly the *LADEE* lunar

atmosphere and dust environment explorer mission, and then by 2013/2014 the first nodes in a network of small lunar landers to study the moon in various ways. In total, NASA is now planning to fly seven small and medium class missions to the Moon by 2014. Along with our international partners and with the privately-funded teams competing for the *Google Lunar X Prize* there is now an exciting, robust portfolio of lunar missions which combine the best elements of science and exploration. I know that these efforts will be the subject of conversation at this conference, and I am looking forward to seeing this data come in over the next several years and seeing it used to determine where the next footsteps on the Moon will boldly go.

I spoke last week at the Goddard Symposium about the marriage between human and robotic space exploration, so I will not repeat myself here. Members of the Lunar Planetary Institute, in particular, know the importance of the two communities working hand in glove to advance mankind's knowledge and ability to use the resources of our solar system, to incorporate space into our economy, and for mankind to begin to spread out beyond planet Earth.

And while I hope that America will continue to lead such efforts on the new frontier, even more importantly my hope is that other countries will stay with us on that journey, as they have in constructing the International Space Station. Our human spaceflight efforts are centered around that partnership, and even today

over half of NASA's robotic spacecraft missions involve some form of international cooperation. My hope is that astronauts from many nations will soon be walking on the Moon, learning to exploiting its resources to our own ends, and then that we will together undertake journeys to the near-Earth asteroids and to Mars.

This journey is well underway. We are honoring prior commitments to our international partners on the Space Station, so that we might use this facility as a laboratory test bed for technologies and biomedical countermeasures to take longer strides in space exploration. But more importantly, by acting as good partners through thick and thin, my hope is that other countries will want to join the United States on future endeavors to the Moon and Mars. I believe that this commitment to continue our journey together, to venture boldly beyond low Earth orbit to new destinations, is the lasting legacy of the crew of the Space Shuttle *Columbia*, who perished in the skies over Texas five years ago. We honor their memory by continuing this journey together with resolute purpose.

We are making great progress, "taking longer strides", as President Kennedy once put it. Last month, we installed the European *Columbus* module to the International Space Station, and this past weekend, an *Ariane V* lifted off from French Guiana with the long-anticipated *Jules Verne* Automated Transfer Vehicle. We all hope to have our first successful ATV docking and delivery to the ISS in

less than a month. Tonight, we hope the Space Shuttle *Endeavour*, commanded by Navy Captain Dominic Gorie, will launch from Cape Canaveral to deliver the Japanese *Kibo* logistics module and the Canadian *Dextre* robotic arm to the International Space Station.

We are also laying the keel for the next generation of manned spacecraft with the *Orion* crew vehicle and the *Ares* crew and heavy-lift launch vehicles, which will take us back to the Moon and then beyond. We are harnessing the energies and skills across this great nation in meeting that challenge. In late January, we began testing the J-2X power packs at the Stennis Space Center in Mississippi. In a few months, we plan to conduct emergency pad abort tests out at the Army's White Sands Missile Range in New Mexico with a full-size *Orion* test vehicle. Next spring, we plan the *Ares I-X* test launch from Pad 39B at Kennedy Space Center.

I will leave this thought by challenging you, the science community, to consider how we might use these new capabilities in pursuit of your own dreams. The old *Saturn* family of vehicles was barely used for anything beyond human spaceflight, and not much for that, a fact that I have always considered among the most tragic failings of the early space age. Let's not make the same mistake this time. Let's embrace this new transportation architecture, and let's figure out how to put it to work for all of NASA.

While my talk this afternoon has been mostly about what we're doing in planetary science, I want to remind everyone again of the "big picture" that I see. Our endeavor is spaceflight in all its many forms, and the world will see and will notice whether we are first, or not first. We must get it right. Space exploration is the grandest expression of human imagination of which I can conceive, a journey which will never end, as we explore strange new worlds and boldly go where no one has gone before.

Thank you.