

NASA OFFICE OF PUBLIC AFFAIRS
303 E STREET, S.W., #P
WASHINGTON, D.C. 20546
(202) 358-1600

NASA's 50th Anniversary Lecture Series

**"THE ROLE OF SPACE EXPLORATION
IN THE GLOBAL ECONOMY"**

Keynote Speaker:

MICHAEL GRIFFIN, Administrator, NASA

Also Present:

ROBERT J. STEVENS, Chairman, President, and CEO,
Lockheed Martin Corporation

ALAN B. MOLLOHAN, Representative in Congress
from the State of West Virginia

[Moderated by David Mould, NASA Public Affairs]

September 17, 2007

[TRANSCRIPT PREPARED FROM DIGITAL RECORDING.]

P R O C E E D I N G S

MR. STEVENS: May I have your attention, please?

Thank you very much. Let me say good afternoon to each of you and thank you for joining us here today. My name is Bob Stevens. I am the chairman, president, and chief executive officer of Lockheed Martin. Lockheed Martin is a proud co-sponsor of today's event, celebrating the fiftieth anniversary of the National Aeronautics and Space Administration.

I don't know how it is for each of you, but I suspect, like me, most of you have had some moment in your life that was profoundly shaped by one of the scientific or exploratory missions that has been undertaken by NASA. For me, it was probably not an uncommon experience of being a young boy glued to a black-and-white television screen watching the exploits of Projects Mercury and Gemini and Apollo, and I know that I am not unusual in this regard. I have talked to so many Americans, and actually people around the world, who have been captivated by the exploration and science undertaken by NASA.

Certainly, the last 50 years have been absolutely amazing, and there is nobody better prepared to talk to us

about the last 50 years, but importantly, what the next 50 years might look like, than today's keynote speaker.

But first, it is my very great honor and a personal pleasure to introduce one of the very best friends the Space Program has ever had. Congressman Alan Mollohan is a leader and a visionary who has recognized and promoted the benefits of the U.S. Space Program.

He has been a strong and continuous supporter of scientific research initiatives, and these are the kind of initiatives that lead to genuine innovation, and that innovation leads to the creation of companies and to jobs and stimulates economic vitality all across the United States.

As Chairman of the House Subcommittee on Commerce, Justice and Science, his leadership has advanced science and technology, and improved the well-being of American citizens for generations.

I hope that you will please join me in offering a warm welcome to Congressman Alan Mollohan.

[Applause.]

REPRESENTATIVE MOLLOHAN: Thank you, Bob. What a wonderful crowd.

Good afternoon, and welcome to the first lecture in a series devoted to the fiftieth anniversary of the founding of one of this nation's most important scientific research organizations, NASA.

NASA was created when America was locked in a cold war with a challenging adversary. So the agency was truly born in a defense mode. It did its job well, taking us to the Moon and great heights of scientific discovery, while leaving the competition behind, and making at the same time lives better by creating a host of product spinoffs and industries.

Today, the agency is led by a gentleman I am pleased to introduce who retains a firm grasp on NASA's mission in the twenty-first century and is exercising the kind of leadership that the agency needs to further its goals for America.

Administrator Michael Griffin is gifted, highly educated, and experienced, just like the people of NASA that he leads today. He has been a businessman leading the efforts of some of our most successful private companies, a teacher at some of our most prestigious institutions of higher education, an author of technical papers and

textbooks, an active member of some of our most respected institutions, academies, and societies, and pilot and flight instructor with multi-engine ratings, and the recipient of the NASA Exceptional Achievement Medal, the Department of Defense Distinguished Public Service Medal, and a host of other awards and honors.

These accomplishments and experiences and half a dozen more of masters' and doctor degrees place Administrator Griffin in a very qualified and unique position from which to speak to us today.

Dr. Griffin was confirmed by the United States Senate and began his duties as the eleventh Administrator of NASA on April the 14th, 2005. I have had the pleasure of working with the Administrator as Ranking Member and now Chairman of the Commerce, Justice and Science Appropriations Subcommittee, and I think everyone here can agree that one of the most refreshing things about Mike Griffin is his straight-talking nature. I greatly appreciate the clarity, credibility, and expertise he brings to NASA, and those characteristics are critical to helping NASA communicate with the legislative branch, with industry, and with the international community as NASA

seeks to fulfill its many missions.

I have seen the Administrator's impact most directly when he comes to the Hill to testify on behalf of the President's budget request for NASA, an annual duty that I am sure he loves, and which he performs admirably.

Although we may have some different opinions, and not many, on priorities and allocation of resources, I know I can always look forward to an open and honest exchange of ideas where our dealings always seek to accommodate the best of each other's intentions, and that candor, credibility, and dedication to accomplishing the mission is very refreshing.

Ladies and gentlemen, I am pleased to introduce to you, NASA Administrator Michael Griffin.

[Applause.]

ADMINISTRATOR GRIFFIN: Thank you, Mr. Mollohan.

I have to say if you hadn't inserted my name there, I wasn't going to be sure who you were introducing. It didn't sound like me, but thank you very much for those kind words.

I do have to say to this audience, and I think you know, that I have enjoyed enormously good support from

the Congress in my two and a half years on the job, and it is due to the Committee Chairman and Ranking Members that we have had, both on the Senate side and the House side, and none more so than Alan Mollohan who has been a very strong champion in the Space Program. He was the last time that I was here at NASA, he remains so today, and it has been a real pleasure to work with you.

You know, actually, this may say something about me that is not so great, but I really kind of did enjoy those budget hearings.

[Laughter.]

ADMINISTRATOR GRIFFIN: I mean, an opportunity to sit there for an extended period of time and talk about the Space Program to the people who oversee me and who fund us, that is a good day as far as I am concerned, and if you want some examples of bad days, I can give you those, too.

So that is not a bad day.

I also want to thank Bob Stevens and the Lockheed Martin Corporation more generally for their sponsorship of this Lecture Series. I think the fiftieth anniversary of NASA is something worth talking about, worth commemorating, and worth spending some quality time doing, and for Bob and

his folks to sponsor this year-long lecture series where in addition to me, we actually hope to get some notable people to talk about the Space Program, I am just thrilled, so thank you.

Thanks to all of you for coming today. I often talk about very large-scale themes with regard to space exploration and our science and aeronautics program, and today, my thrust is going to be to try to link some of that up to your daily life.

Congressman Mollohan mentioned spinoffs that we have produced. That is true. I have never been unduly fond of that term, but I do think that there is a very strong link, the strongest possible link between doing the hardest things that human beings do, which is flying in space, and how it benefits the rest of our economy and, indeed, our whole way of life, and I want to talk about that today.

We are gathered here to kick off this lecture series commemorating NASA's upcoming fiftieth, but we are celebrating more than what NASA has done and the benefits that have followed. We are also, when we do this, celebrating who we are and who we can be as an American

people.

Fundamentally, NASA opens new frontiers and creates new opportunities, and because of that, we are a critical driver of innovation, but not in a way that just creates jobs. We create new markets and new possibilities for economic growth that didn't previously exist. We have taken at NASA to calling this the "space economy." It is an emerging economy, but a robust one even so, and it is an economy that is transforming lives here on Earth in ways that are not yet fully understood or appreciated.

It is not an economy in space, or at least not yet, but space activities create products and markets that provide benefits right here on Earth, benefits that have arisen from our efforts to explore, to understand, and utilize the new medium.

In its last space report dated in November of 2006, the U.S. Space Foundation estimated the space economy at approximately \$100 billion in 2005, and over 60 percent of that figure derived from commercial goods and services.

That is a stunning statistic for an economy that arises fundamentally the world over out of government programs. This growing economy affects just about every aspect of how

we live, work, and play, and other emerging new markets are just around the corner.

Space economy enables satellites communications, including radio and television and telemedicine, point-to-point GPS navigation, weather and climate monitoring, and a host of space-based national security assets. It also includes the nascent space tourism industry and the development of space logistics services that will transform space transportation into a viable commercial enterprise.

Fifty years ago, space was a far-off place. It was the stuff of science fiction. Today, it is pervasive in our lives, critical to a range of activities that create and provide value to human beings. It grew from NASA's roots in space exploration, and I would like to talk to you about that for just a few minutes.

People all across our country, all across the world, find what we do exciting. They find it inspiring, and they find it so for many different reasons. Among them are the courage and competence of our astronauts, the dedication of the engineering teams that put them into space, the quest for knowledge that is realized by

awe-inspiring pictures of distant galaxies or Martian craters from a robot perched on the rim, the challenge of the frontier, the final frontier, the frontier that begins anew on each planet and with each new discovery, the way we take on seemingly impossible tasks, tasks that challenge human skill and ingenuity to the utmost, like building a million-pound Space Station as a toehold on that final frontier.

What we do at NASA is quite simply larger than life. It is bolder than the boldest dreams, and we know it. So everyone knows and appreciates NASA, but to most people, what we do is literally out there. It is out of this world. The daily immediate connection between what we do and its impact on our lives is either unnoticed or taken for granted. In part, this is due to circumstances or, more properly, a change in circumstances because it wasn't always so.

NASA was born and came of age during the cold war in a historical context that is difficult for many who were not there at the time to appreciate. It was a time when our very way of life was being called into question. The Soviet Union had declared that our democracy was too weak

and too inefficient to compete with communism, and after the successful launch of Sputnik, there were many people in our country and in the world who feared that they might be correct, and there were many others who were committed to proving them wrong.

The Moon race was more than exploration for its own sake, and it was a lot more than an exercise in national pride. It was considered a real-live test of the viability of an open society, a vindication of the very concept of freedom. The American people admired NASA's expertise, our daring do or can-do attitude. These were a reflection of America itself. People marveled at our ability to meet John F. Kennedy's challenge to land a man on the Moon when we did it in just eight years and two months, a feat that seems ever more wondrous the more distant we grow from it, but it was even more than that.

The Soviet Union had shown that success on the frontier of space could, and did, translate into power and influence in the world. In the cold war, we were in a strategic competition for just such power and influence against a totalitarian regime whose core values were abhorrent to most Americans.

So, when Americans watched the Moon missions depart, our belief in freedom and in our way of life and in our hopes for a better life for our children and their children were riding along with the astronauts. For a moment, we could leave our anxieties behind, leave our anxieties about the larger struggle of the cold war behind, and let our spirits soar into the skies, but we knew always in those years that we were locked into that struggle, and it was playing out most visibly on the space frontier, and that we were finally winning.

Because of this, the connection between what we do at NASA and the daily lives of Americans at that time was immediate and intense. Even more, these events were inspiring to the world, not just to the United States.

Friends of mine who have come here from other lands tell me directly that the world was cheering us on because of the sheer magnitude of the accomplishment that we attained. Americans self-confidence, our belief that we can do what we set out to do, drew admiration from across the world then as it does now, and NASA then as now was the embodiment of that spirit.

Today, we are in a very different world. The

military and political competition has largely receded into the background. Today, we are primarily engaged in an economic competition around the world. We increasingly live in a global economy where rising wealth and living standards also mean ever-heightened levels of competition from places we never even considered. There are now more software engineers in Bangalore, India, than in Silicon Valley. Japan, Taiwan, and South Korea together generate a fourth as many patents as does the U.S. every year, and their percentage is growing rapidly.

The products of this innovation are all around us in what has become a world marketplace. How many of you have a cell phone, a television, or a car that was manufactured in the United States? These things are now a world commodity.

I don't think I need to spend more time on these points. They are superbly treated in Tom Friedman's book, "The World is Flat," and in the report, "Rising Above the Gathering Storm," by my friend and colleague, Norm Augustine of the National Academy of Engineering.

But I think the bottom line is that we all want our economy to continue to grow. We want to compete

successfully. We want better lives for our children, but economic growth and competitive success result primarily from the introduction in new goods and services or from finding more efficient ways to produce existing ones. Economic growth is driven by technological innovation. Societies that foster it lead the pack, and others lag behind, but if technological innovation drives competitiveness and growth, what drives innovation?

There are many factors, but the exploration and exploitation of the space frontier is one of those. The money we spend, half a cent on the Federal budget dollar, and the impact of what we do with it doesn't happen out there. It happens here, and the result has been the space economy. So, if America is to remain a leader in the face of burgeoning global competition, we must continue to innovate, and we must continue to innovate in space.

There is another factor driving innovation, also, and in my opinion, it is too often overlooked, or if it is seen, it is too often dismissed. Success in an economic competition depends upon image as well as substance. Companies the world over have a choice as to where to do deals and with whom to do them.

The nation that appears to be at the top of the technical pyramid has taken a very large step toward being there in fact. Developing countries like China recognize the value of space activities as the driver of innovation, a source of national pride, and a membership in the most exclusive of clubs, that of space-faring societies, and it is no coincidence that we are seeing thousands of high-tech jobs starting up in China.

NASA is uniquely positioned to drive the space economy with both substance and style because our mission requires us to push the technological envelope every single day, and to do it in the most publicly visible manner of any human enterprise. Our human and robotic ventures into the solar system, our attempts to fathom the mysteries of the universe require for their accomplishment a voyage of discovery beyond the limits of knowledge, and they are accomplished for all to see on a stage of breath-taking scope and grandeur.

At once, we have an endeavor which places the highest possible demands on technical ingenuity, requires a calculated, but stunning audacity for its success, and returns a product with which all of the world is

fascinated, and even when we fail, and we do, we do so, in Teddy Roosevelt's words, "while daring greatly." That is why every year, the National Air and Space Museum is the world's most visited museum.

At NASA, we explore the frontier, and in fact, we create that frontier. To do it, we have to answer a lot of questions that wouldn't even have been questions without that commitment to the unknown, and the answers to those questions are answers that power our future here on Earth.

Because our mission is flight in all its forms in space and in the air, we think and work and do our engineering and science at the extremes, and that is where the discoveries are made.

In celebration of its own twenty-fifth anniversary, USA Today recently, back in August, offered a list of the top 25 scientific breakthroughs that have occurred since its founding. Nine of those come from space, eight of them directly funded by NASA.

We see the transformative effects of the space economy all around us through numerous technologies and life-saving capabilities. We see the space economy in lives saved when advanced breast cancer screening catches

tumors in time for treatment using methodology developed from image extraction from the Hubble Space Telescope, or when a heart defibrillator restores the proper rhythm of a patient's heart, or when GPS, which was developed by the Air Force for military applications, helps guide a traveler to his or her destination. We see it when weather satellites warn us of coming hurricanes or when satellites provide information critical to understanding our environment and the effects of climate change. We see it when we use an ATM to pay for gas at the pump with an immediate electronic response via satellite. Technologies developed for exploring space are being used to increase crop yields and to search for good fisheries at sea.

All of this is very nice, but sometimes a personal example carries I think more weight than the most comprehensive set of factual data. So let's consider the case of a woman, Sarah Moody, and her young nephew, Steve, who was born with a very rare disorder. He had no sweat glands, and he couldn't cool his body in the summer and would overheat dangerously. After one too many close calls, Sarah thought to herself what many have thought and many have written: If we can put a man on the Moon, why

can't someone figure out a solution to this problem? So she called NASA and was put through to what is today our Innovative Partnerships Program.

NASA scientists were able to adapt cooling technologies developed for the Apollo Lunar astronauts to develop a cooling vest for Steve. It worked. She started a foundation that has delivered 650-some vests to other people suffering similar disorders. Her foundation also turned to NASA for help with kids who had to live in dark rooms to avoid suffering tumors when exposed to ultraviolet light. NASA's contractors helped create suits that blocked the UV, allowing those kids to go outside. Sarah Moody died a few years ago, but her legacy lives on.

Gary Thompson was an athletic 50-year-old man with a family history of heart disease, but he was given a clean bill of health in a series of tests with several doctors a few years ago and then had a heart attack while running in a marathon. He survived, but subsequently heard of a new ultrasound imaging technology derived from algorithms used to process images of Mars at NASA's JPL. He was diagnosed correctly using the new technology, something all the other tests had failed to do, and was so

impressed, to us a takeoff from a commercial of early years, he started a company. Medical Technologies International, Incorporated, now makes this new technology more widely available. It is in use in 50 States all across the country.

These examples only begin to tell the story. All of us today can be proud that they exist, but equally and in all fairness, we recognize that we wouldn't create a Space Program in order to get these collateral benefits. But it is more than that. NASA and work in space generally is transformative. We don't just help develop technologies. We inspire whole new industries. We revolutionize existing ones, and we create whole new possibilities.

In that vein, I often wonder if it might be possible to quantify the value to society of upgrading the standards of precision to which the entire industrial base of that society operates. Any company bidding on space projects, military or civilian or commercial, any company who wants to be a subcontractor or a supplier, any company that even wants to supply nuts, bolts, and screws to the space industry must work to a higher level of precision

than human beings have ever had to do before.

How do we value that asset? I don't know, but I am absolutely convinced that it is real, and that without the space industry, we wouldn't have it.

In a related vein, another benefit to the space economy is the way that it inspires people to go into the technology sector. Our host today, Bob Stevens, was talking about exactly that experience of being a little boy watching a grainy black-and-white television set. Other people, Steve Jobs, Bill Gates, Burt Rutan, tell similar stories and immediately come to mind, but what is more important to realize is that a huge number of technology professionals in all fields first got hooked on space and then were inspired to pursue technical careers.

This is truly one of the best spinoffs we have, and the space exploration enterprise should receive due credit for it. At a time when we are concerned about declining enrollments in engineering and science and mathematics, this ought to be no small factor in our thinking. Space exploration inspires kids to study hard things, so that they can be part of it.

Most of you know how the demands of space flight

sparked the revolution in integrated circuitry. In the early years, our rockets couldn't compete with the throw weight of Russian rockets, and so in the United States, we embarked on a process to lighten the payload, and out of that, we got integrated circuits. But we didn't only get integrated circuits. We got all of the other technologies that make them possible. These capabilities now permeate our entire industrial base, and the use of integrated circuits themselves is so ubiquitous in devices whose very existence would have been almost unimaginable only a few years ago that we no longer even notice it.

Cell phones are given away as a competitive inducement to select one rate plan over another. Devices that can store gigabytes of information, a capability once beyond price, are given away as keychain fobs in promotional advertising. Built into your checkbook can be a calculator that Newton or Gaius would have given years of their career to have. For a few hundred dollars, you can buy a device that will allow you to navigate to any address in the country that can ever be found on a map. Who even notices anymore?

Today, NASA is again among those at the forefront

of computational development, as evidenced by recent demonstrations of first computer chips that can work at 500 degrees Centigrade in very hostile environments and by recent demonstration of a quantum computer chip, a device that operates at the limit of our understanding of the physical universe and makes us of the very strange and elusive properties of quantum mechanics, properties that even physicist friends of mine themselves refer to as "quantum weirdness."

Quantum computing won't be just one more incremental improvement in present-day computing. It will revolutionize it. It is the kind of breakthrough you get when you set the bar possibly high, simply because the rigors of space exploration demand that it be so.

To stimulate economic growth, to increase our international competitiveness, create better lives for our citizens, we must stimulate technological innovation, and NASA's own programs accomplish this in one way, but as we have seen, the space economy today at \$180 billion around the world is much bigger than NASA and is becoming more so.

But NASA has another role to play, and that is as a catalyst for new ideas and new technology by setting

extraordinary goals and then engaging the imagination and drive of entrepreneurs in the private sector.

One such program, one such effort is our program to enable the creation of new low-cost commercial space launch capability using as an anchor market the logistics requirements for the International Space Station. The COTS program, short for Commercial Orbital Transportation Services, is intended to demonstrate capabilities to provide low-cost transportation to orbit for cargo and crew. If this experimental effort is successful, NASA will purchase commercial services for delivery of cargo and crew to the ISS. We envision multiple flights per year beginning after Shuttle responsible in 2010. To me, this is exactly analogous to the way that government policy, the way that public policy, enlightened public policy spurred the aviation industry of the 20th century, and it gave us the system that took us in 100 years from cloth and sticks and string to a transportation system where you are more likely to die from being struck by lightning than in an air transport accident. It is a stunning achievement, and we need to do it in space.

Fifty years into the space age, the greatest

obstacle to the exploration and utilization of our solar system remains the very high cost of space transportation.

No government effort has yet made a successful attack on the problem, but when we do have it, we will find that commercially viable, low-cost space transportation will be as transformative to the economy as the transition from steam to diesel power or the achievement of powered flight that I spoke of a moment ago. It will open up possibilities that now appear impractical, if not outlandish.

And this takes us to the Vision for Space Exploration, laid out by the President in 2004 and enacted in the NASA Authorization Act of 2005. In the wake of the Columbia tragedy, it calls for NASA to extend human and robotic presence to the Moon, Mars, and beyond. As the President's science advisor, Dr. Jack Marburger stated in his March 2006 speech at a Goddard symposium, quoting now, "As I see it, questions about the vision boil down to whether we want to incorporate the solar system into our economic sphere or not," end quote. Precisely so, perfectly said.

Every aspect of human knowledge will be tested

and advanced, physics, chemistry, biology, and their practical applications in engineering, material science, medicine, computer science, robotics, artificial intelligence, power generation and storage, many other fields, and I didn't even mention rocket science. This is a legacy that the crew of Columbia would be proud to know that we had carried forward.

Reaching for the unknown, making our lives bigger and our horizons broader, achieving things never before possible are the heart and soul of what we do at NASA. By pushing beyond the future, by setting for ourselves seemingly impossible challenges, we are transforming our lives for the better here on Earth, even as we explore new worlds in space, and if, as Shakespeare said, life is but a stage, then NASA takes the play to the grandest possible stage, and in doing so, we create the space economy.

At NASA, we are making the future happen, and we are doing it now. Thank you very much.

[Applause.]

ADMINISTRATOR GRIFFIN: Now, I was flogged unmercifully by my guys to not exceed my time, so that we could leave 15 minutes for Q and A, and we have done that.

So, David, if you will moderate, I will endeavor to answer.

MR. MOULD: All right. Any questions, just throw up your hand, and we will get as many in as we can.

Yes, in the back. I'm sorry. If you could wait, we have got microphones going around the room. So, if you could wait for those to get to you, and ID yourself, please. Thanks.

QUESTIONER: Clinton Parks from Space News.

You had mentioned COTS in your remarks. I am just wondering about how many -- with the trouble that Rocketplane Kistler is currently having, if they do forfeit on the COST program, about how many companies do you expect to compete for the reissuing of COTS, and about how much money is left to reissue, and when would you expect to make the final decision after the competition is through?

ADMINISTRATOR GRIFFIN: I don't know off the top of my head how much money is left, but the quick answer is almost all of it because, as you were alluding, Rocketplane Kistler has not met their milestones, and so, therefore, they haven't been paid for meeting those milestones. So most of the money is still available.

We will be conducting the competition as expeditiously as possible. The world has changed in the two years since we did the first competition. We want to see who is out there. This is a product we very much want.

I don't know how many companies will engage in that competition. We welcome them all from large to small. This is a free and open competition for a funded Space Act Agreement with NASA.

I would hope that by around the end of the year or shortly thereafter, we can have a new selectee.

MR. MOULD: Yes.

QUESTIONER: Luka Bortog [ph] with NASA Science Mission Directorate. Thank you very much for a sensational talk. I think I feel proud to be a NASA employee.

ADMINISTRATOR GRIFFIN: Thank you.

QUESTIONER: I wanted to make a couple of comments, and that is how NASA science is actually directly contributing to space economy.

Living With a Star is a NASA science program that really goes after sort of imparting its science that has societal relevance, and in this context, society is very well prepared to Moon and Mars. That becomes society, and

what it studies is really our variable magnetic star, the sun, and its interaction with an environment which is magnetosphere, ionosphere.

Most of the examples that Dr. Griffin gave, geospace, ionospheric disturbances, telemedicine, satellite, these are all affected by the sun's harmful radiation in the form of solar flares, coronal mass ejections, as they bombard into our magnetosphere and ionosphere, and what this program is trying to do is come up with a predictive approach, an intuitive approach to give a better prediction to people who are actually utilizing these satellites and are dependent on the technologies. So this is another way NASA science is contributing toward space economy.

MR. MOULD: Thank you. Next?

QUESTIONER: David Loggs [ph], U.S. Chamber of Commerce.

Dr. Griffin, in your comments, you mentioned about high-tech competitiveness and NASA's impact over the years in high-tech competitiveness. Next year, we have two distinct anniversaries that have come up, the 50-year anniversary of NASA, but also the 50-year anniversary of

the National Defense Education Act.

How can we align with two distinct anniversaries and come up with a distinct message and theme that focuses on NASA and its impact on high-tech competitiveness and how to move forward?

ADMINISTRATOR GRIFFIN: That is a great idea. I don't know. I am merely a simple aerospace engineer from a small country town, but I do have an excellent education czar in Joyce Winterton, whom I thought I saw here today.

There. Yes, there she is.

If you would work with Joyce, I would be -- I am separately from this lecture series which we are kicking off today. I am planning on half of a dozen speeches of my own, in non-traditional meaning, outside the aerospace community venues over the course of the year. If you can, working together, develop a theme that I can put into words that makes it sound like me, I would be happy to have one of those half-dozen speeches devoted to that topic. If you can find somebody who is more enthralled by education than I am, I would like to meet the poor wretch. So I think that would be a great theme. So dial 1-800-JOYCE and see what you can come up with.

Another question? No more questions is great, too, but next time, I won't listen when they tell me to leave time for questions.

[Laughter.]

ADMINISTRATOR GRIFFIN: Yes, ma'am.

QUESTIONER: Hi. I am Carol Lynn Breedlove from the National Education Association, and one of our members, Barbara Morgan, went up on STS-118. We were so thrilled. We got to go and actually witness that.

But one of the things that we learned at that conference -- and this goes to the earlier gentleman's remarks -- is that you all have a real problem with your employment that you need to have a lot more people coming in through the pipeline, and I wondered if you would speak a little about that.

ADMINISTRATOR GRIFFIN: Sure can. It is an extraordinarily difficult problem for both -- and I have spent about half my career in DoD space and about half in civil space. Okay? So I think I can safely comment that our problems on both sides of the Potomac River are quite similar because, fundamentally, NASA can't hire people who aren't clearable, which generally means U.S. citizen or

green card, absent very special exceptions, and I have experiences reported back to me where our guys at very senior levels will go out and do a talk at a university, to a university engineering class or something like that, and come back and say, "You know, I talked to a grad student class of 30 people, and there were three people in there who were citizens or green card, and everybody else was from another country."

That is scary. Okay. That is scary, not the part about us teaching citizens from another country. That is good. It exposes them to America, to American values, to what life is like here, and they go back, and I think in general the balance of experience is that they become friends rather than adversaries. The scary part is that we don't have our own folks there.

No one needs me to say, because I think with the media exposure that it has got, that American enrollment in technical subjects of all types is down in this country in any terms you care to look at it, and I don't imagine that anybody thinks that's good.

Now, NASA spends a lot of money on education, directly and indirectly, several hundred million dollars.

That is beyond dispute. That is not our biggest value. Our biggest value is in doing exciting things, as I said a few moments ago, that make kids want to study difficult subjects to be a part of it.

If you have a smart kid, you have got to find a way to induce that smart kid to study astrophysics or aeronautics or, for that matter, zoology, rather than being a stockbroker. If being a stockbroker looks more interesting and exciting than being a botanist figuring out how to take plants to another world, so that human beings can grow them to eat, we are not going to have plants to eat when we go to other worlds. We have to figure out ways to make education in difficult subjects exciting for our smart kids.

Space flight, space exploration in all the forms that we do it achieves that. That is what we do, and we need to make that point more strongly.

Lori?

QUESTIONER: Hi, Mike. Lori Garver with the [inaudible] Group.

NASA has done some studies, surveys, and focus groups of the public these last couple years that I think

have really been a fabulous outreach tool, a way I think to help channel these forums to talk about the benefits that the public really can connect with the Space Program, but at some level, when we go out to the public and ask them what they want to see in our Space Program, what they like to see, it should also change our program, should it not, obviously within the whole overall format of the National Space Policy and the authorization bills?

It seems to me, we are trying to maybe just form-fit what we are actually doing into what -- and telling the public they want to hear versus how the program can adapt somewhat to what the public who pays for it wants to hear.

I am wondering if you can just address what you heard from the public, what you are hearing in these focus groups, and if that has caused any change within NASA to what we are actually doing to better respond to their interests.

ADMINISTRATOR GRIFFIN: Well, it is certainly -- it is impossible to argue anything other than that in a representative democracy, the people paying the bills should get what they want.

I think, in all fairness, that has to be moderated by the question of expertise. Not everybody is equally qualified to determine a programmatic direction that will produce the most benefits.

I don't go to a lawyer or a doctor or an accountant and tell them what advice they have to give me about how best to conduct my financial planning. If I think I am a better financial planner or physician than the people that I go to, then I need to change jobs.

We are the experts in space programs, and to a certain extent, the administration, and confirmed by Congress, should hire people that they believe can shape a beneficial space program and then evidence a bit of trust and allow them to do that, but although on a longer time -- that is on a shorter time scale.

On a longer time scale, yes. If you look across the program and you find that several years have gone by and the program is at variance with what the American people want, then that is not a good outcome. So I think there's two sides of the coin, and both have to be looked at.

Now, what do I hear when I go out in the world?

You know, I go frequently to universities, and I get university professors telling me that they love the initiative to return to the Moon and go to Mars. Why? Because their kids are excited about it. Their kids recognize that they're 20 years old and this program is going to be going on when they are 40, and they are going to get to work on it. They are going to be mid-career people when exciting things are happening, and they tell me that they love it.

Until I had to have a rotator cuff operation, I spent a lot of time on the golf course, and I hope to again, and it is inevitable, as any of you who are golfers know, you get into a foursome of people that you don't know when you are on travel, and everybody says what do you do, and I tell them what I do, and I get pounced on. People are fascinated by space, and I get a lot of comments about, "Gee, when are you guys going to get done with the Space Station, so we can get back to the Moon or go to Mars? We need to do that."

To me, that says we haven't done a very good job of explaining why the Space Station is a step along the way, but that is communication style, not substance.

I get an awful lot of interest in the Mars Rovers. Mars Rovers are our surrogate for being there ourselves, and then they immediately say, "When are we going to go?" I tell them, "Well, 2030-ish," and then they are disappointed. They want it to be sooner. These are things I get. I am not making this up. This is what I really get.

People are fascinated by Hubble, and then I explain to them that Hubble has helped us discover that 96 percent of the known universe, we didn't know anything about until a few years ago, that everything you see around you is 4 percent of the actual universe, and they are stunned by that.

I tell them that we are building James Webb Space Telescope, so that we can see the birth of the universe, 14 billion years ago, that we can see it right back to the earliest moments that you can see, and they are stunned by that.

People are fascinated by what we do, if we can explain it to them. They are also fascinated when I tell them about materials for artificial knees that come out of the Materials Science from NASA, and they love that. They

love the connection to their daily life, but they love what we do on its own merits if it is explained to them, if it is explained to them how it fits.

I have people, for example, routinely, everyone from congressmen to playing partners at golf, who will say, "Well, we went to the Moon. Why do we need to go back to the Moon?" I say, "Well, I have several answers," and I find that people like them.

One of the answers is, "Well, you know, by the time we want to go to Mars, we will not have been off the Earth for 50-some years, minimum, more than that, and our total experience being out of Earth orbit is less than a man-month on the Moon. Do you think we really should set out on a three-year voyage for Mars with that basic experience?" Then they say, "Oh. Well, that makes sense."

Then I say, "Well, when we get to Mars, we are going to have to learn how to live off the land a little bit because we can't take everything with us that we need. We are going to start that process on the Moon," and then they say, "Oh. Well, that makes sense."

You sort of explain all that stuff and "Oh, by the way, the Moon is a world as large as the surface of

Africa. Do you think you know everything about it that might be useful to human beings from one month?" Then they say, "Oh. Well, that is interesting." They don't know these things, and when you tell them, they are fascinated.

So those are the kinds of reactions I get.

People like what NASA does, and when you connect it up and say, "By the way, you wouldn't have the BlackBerry on your hip if it hadn't been for the Space Program." Now, that is not just NASA. That is military and civilian, but you wouldn't have that BlackBerry if we hadn't had the Space Program, and then they say, "Oh. I didn't know that." It is just extraordinary, the approval that we can get.

I end up promising to send people stuff from our Education Office to their kid's school. People that I meet randomly, they are just fascinated by what we do in space.

It is the part that I said in the speech about what we do is larger than life, and they know it, and they love it.

A couple more. I think I have time for another question.

Hi, Frank.

QUESTIONER: Hi, Mike. Thank you.

ADMINISTRATOR GRIFFIN: You can call me up, you

know, in my office. You don't have to come here to ask me a question.

[Laughter.]

QUESTIONER: I understand, Mike, but sometimes I like to hear you say things in public.

[Laughter.]

QUESTIONER: Not to put you on the spot.

You mentioned the competition that got us into the first race to the Moon and the cooperation that we have had in Space Station and other areas. You mentioned China, and to follow up a little bit, I have a couple of questions.

Do you think that our friends on the Hill and elsewhere in government understand what we can do internationally to help the situation around the world in many areas through space, or the general public that you talk to, both internal and external, I guess, understands the competition we face in that area from China, India, and others that really would like to take the lead away from us if we will hand it over, which we could do if we don't fund it fully?

ADMINISTRATOR GRIFFIN: I don't think people

broadly understand how capable today Russia, China, India are, not that we need to regard any of those people as adversaries or that Europe and Japan are, and that it lacks only the decision to do it for those nations or societies to do exciting and prominent things.

I personally believe that China will be back on the Moon before we are. I think when that happens, Americans will not like it, but they will just have to not like it.

I think we will see, as we have seen with China's introductory manned space flights so far, we will see again that nations look up to nations that appear to be at the top of the technical pyramid, and they want to do deals with those nations. It is one of the things that made us the world's greatest economic power.

So I think we will be reinstructed in that lesson in the coming years, and I hope that Americans will take that instruction positively and react to it by investing in those things which are at the leading edge of what is possible.

QUESTIONER: The up and downsides of that, I know show up in the media all the time, and this is a

politically charged question, but do you see any way for us to work with the Chinese and the Indians and others around the world, more productively in a way that can leverage everybody's powers, rather than turning it into a competition?

ADMINISTRATOR GRIFFIN: Well, certainly, that is possible. We do it every day in the Space Station program, and in a future Moon or Mars program, I certainly hope to do the same thing that we do on the Space Station and to extend that to include more partners.

A topic for a different speech, one of the best values we get from our Space Program is almost all of it is cooperative. Sixty-some percent of our science missions are cooperative, and 100 percent of our human space flight program is internationally cooperative. These are things we do that other people are excited by. These are things we do that make other people want to do them with us in a nonthreatening way. These are things which tie us to the rest of the world civilization in a very positive way, and there are other things the United States needs to do in the world that are not so positive.

So we should look. We should look hard for

things that we as a nation and as a society can do that cause other people to want to bind themselves to us. To do that, we have to be a leader. People don't love us so much that they want to partner with us from behind. We have to be a leader, but when we do, it returns incalculable dividends. People work with us, and they go away thinking, "Well, they are not so bad after all." What price does that have?

I have said a number of times, there's three kinds of national security. The first and most obvious one is you got to be able to win any conflict you are in. The most expensive thing there is, is the second-best army. The next step -- and I am really fond of George Washington's quote, "If you would have peace, prepare for war," the goal being be so strong, other people don't want to take you on. And the third level is be the kind of society that makes other people want to be your ally and your partner, rather than your adversary, and space exploration is one of the things that makes us that kind of society. Other people want to do this with us, and it overcomes some other things where our responsibilities as a global strategic power don't necessarily allow us to get

along with everybody that we would like to.

So I think there is huge value there. Huge.

I think I am out of time. I was told to finish by five of. So I think we are done. Thank you very much for being here today and listening to me again.

[Applause.]

MR. MOULD: Well, thank you all for attending the first installment of the NASA Lecture Series. We appreciate you coming.

We will have more installments as we go forward.

We will communicate those plans as they unfold, and a special thanks again to the Lockheed Martin Corporation for co-sponsoring the event. Thank you all for coming, and have a great afternoon.

[Applause.]

[End of Lecture Series with Michael Griffin.]

- - -