

Seeking the Right Stuff

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I want to thank Congresswoman Jane Harman for giving me the excuse I deeply desired to escape Washington for southern California, “God’s country”, and one of my former homes, with sunny weather and beautiful beaches. It is a great place for aerospace engineers to ponder the fluid dynamics of the waves as well, as well as those to be found in the Manhattan Beach Brewery. And I want to thank the Air Force for hosting us here tonight in a place commonly referred to as the Hollywood Air Force Base.

Tom Sheriden, the commander of the Space & Missile System Center, walks in the footsteps of giants in our business. One of my former mentors and personal heroes was General Bernard (“Benny”) Schriever, who came to Los Angeles in 1954 with a small, elite group of officers who built the *Thor*, *Atlas*, *Titan*, and *Minuteman* missiles, the foundation for all future aerospace systems launched into orbit. General Schriever also helped NASA in the early days of the space program and Project *Mercury*, the subject of Tom Wolfe’s elegant book *The Right Stuff*.

For that, NASA's and our nation's success in space exploration is due in part to the men and women of the Air Force Space & Missile Systems Center.

Since this evening's discussion is about seeking "The Right Stuff", I consulted Tom Wolfe's book to remind me of that unique author's definition of it:

"As to just what this ineffable quality was. . .well, it obviously involved bravery. But it was not bravery in the simple sense of being willing to risk your life... any fool could do that... No, the idea... seemed to be that a man should have the ability to go up in a hurtling piece of machinery and put his hide on the line and then have the moxie, the reflexes, the experience, the coolness, to pull back in the last yawning moment – and then to go up again *the next day*, and the next day, and every next day... There was ... a seemingly infinite series of tests. ... a dizzy progression of steps and ledges, a ziggurat, a pyramid extraordinarily high and steep; and the idea was to prove at every foot of the way up that pyramid that you were one of the elected and anointed ones who had *the right stuff* and could move higher and higher and even – ultimately, God willing, one day – that you might be able to join that special few at the very top, that elite who had the capacity to bring tears to men's eyes, the very Brotherhood of the Right Stuff itself."

This definition works well for our pilot astronauts; it doesn't do much for the scientists and engineers we hire, however. But that's not really the point. Tom Wolfe is a wonderful writer, who conveys to the reader a sense of intimacy with any subject about which he chooses to write. His prose speaks to us in ways that are poetic, timeless and inspirational. And, as I've said in several speeches, at a fundamental level, NASA is in the inspiration business. Space exploration inspires the questioning child in each of us to "explore strange new worlds, to seek new life and new civilizations, and to boldly go where no one has gone before." I believe that we will, one day, find a civilization on Mars. Ours.

The stuff of science fiction slowly turns into reality. The communicators and tricorders from *Star Trek* become the cell phones and PDAs that each of us have today. The computing power of the one in my pocket dwarfs the computing power of anything available during the *Apollo* era – and it's not even the best you can buy.

I recently read an essay written a few years ago by Michael Crichton, the author of many popular science fiction books, including *Jurassic Park* and *The Andromeda Strain*. In that article, Crichton highlighted the work of a privately-funded foundation called Space Camp, an intensive program for kids and adults to be exposed to the physics and engineering of space flight. Last year, after 25 years of operation, Space Camp graduated its 500,000th camper. In his essay, Crichton tells the story of a ten year-old boy who was interviewed on TV after graduating from Space Camp. “Asked about the future, he spoke of colonies on the Moon, and trips to Mars. The reporter said, ‘How are you going to get the Congress to pay for it?’” To which the young boy replied, “Maybe your Congress won’t, but mine will.” With your help, Congresswoman Harman, we are slowly turning dreams into reality, and science fiction into fact. We are re-writing the text books as well as the history books.

So I ask, why not dare to do the great things, the hard things, the meaningful things which makes our country great? It is a choice, a choice of strategic

importance for how we as a small group of people in this room tonight and as a nation choose to spend our time, resources, and energy. Do we choose to spend our time on things which will have lasting meaning and improve the lives of current and future generations, or do we choose to waste our time with trivial pursuits?

In 1962, when President Kennedy spoke at Rice University about his decision the previous year to “go to the moon in this decade and do the other things not because they are easy, but because they are hard”, NASA had less than ten hours of experience in human spaceflight under its belt in the *Mercury* program. But we had *The Right Stuff*.

President Kennedy fully recognized that “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”. It was a bold challenge to put service and sacrifice above self. It was what we could do for our country. However, at that time NASA had little experience and many, many naysayers in and around Washington. Not much different than today, actually. But NASA had *The Right Stuff* then, and still does, even though there seem to be even more pundits today who question the audacity of our mission or our credibility to carry it out.

When President Ronald Reagan proposed to the Congress in 1984 that NASA build a space station, he said, “We can follow our dreams to distant stars, living and working in space for peaceful economic and scientific gain.” In November, we will mark eight years of continuous human presence in space aboard the International Space Station. President Reagan’s dream became a reality.

Tonight, California native son and astronaut Greg Chamitoff is living and working onboard the International Space Station that President Reagan proposed. Greg grew up in Silicon Valley, and earned his bachelors degree in electrical engineering from Cal Poly the same year that Reagan first proposed that our nation build the Space Station. He taught lab courses in circuit design and had summer internships at Four Phase Systems, Atari Computers, Northern Telecom, and IBM. Greg then received his master’s degree in aeronautical engineering at Cal Tech, and while there, he became good friends with Rick Gilbrech, who now heads NASA’s Exploration Systems efforts, building the *Ares* rockets and *Orion* crew vehicles so that astronauts who will follow in Greg’s footsteps will be able to take the next “giant leap for mankind” beyond the shores of low Earth orbit – to the Moon, near-Earth asteroids, and Mars.

This will be the greatest challenge NASA has ever faced, but with current budget projections, I believe that it is eminently doable over the next fifty years.

But we must not lose focus, defer future possibilities, or wander in the desert of indecision and lost opportunities, as happened in the 1970s following our success with the *Apollo* moon landings. Even in retrospect, it is hard to credit that only three-and-a-half years after the historic voyage of *Apollo 11*, Gene Cernan and Jack Schmitt flew the last lunar landing mission on *Apollo 17*, because our nation and its elected leaders chose to curtail our nation's space program. The planned *Apollo 20* mission was cancelled a few weeks after the *Apollo 11* landing, and *Apollo 18* and *19* were cancelled some months later. With those actions, the space program as we knew it in the 1960s was over, finished, and done. NASA is often blamed for its so-called lack of vision after the apotheosis of the Apollo years, but frankly, after those decisions, it didn't matter what NASA did, or didn't do. Our elected leaders had lost the vision and sense of purpose for our nation in space, and we retreated to low-Earth orbit.

The abandonment of the capability our nation purchased at such great price during the *Apollo* years was a mistake of strategic proportions. NASA's spending declined from a high of 4.2 percent of our nation's federal budget to just under 0.6 percent today. The termination of the *Apollo* program, the failure to sustain America's journey beyond low-Earth orbit, the destruction of the industrial capability to produce the *Saturn V* rocket and *Apollo* spacecraft, and the loss of the future our nation could have had in space, was a policy decision perpetrated by the

Nixon Administration and ratified by the Congress of that time, essentially without debate. Our nation was distracted by other pressing issues, and our future on the space frontier suffered as a result.

And look where this has taken us. Last year, just prior to a Space Shuttle launch, I sat down for an interview with CNN just as one of their producers informed me that they had to cut away from their coverage of the Shuttle launch. There was breaking news of vital national importance from Los Angeles: Paris Hilton was going to jail. That was the moment when I realized how tough the NASA Administrator's job really is. NASA could not compete for the American people's attention against Paris Hilton.

During the opening ceremonies for the Beijing Olympics last month, I was struck by the athletes' creed: "The most important thing in the Olympic Games is not to win but to take part, just as the most important thing in life is not the triumph but the struggle. The essential thing is not to have conquered but to have fought well." And the camera turned to the faces of many, many American athletes who kept repeating that memorable phrase: "It's the not the triumph but the struggle. It's not the triumph but the struggle." That is *The Right Stuff*.

Next month, we plan to launch Space Shuttle *Atlantis* on the final servicing mission to the *Hubble* Space Telescope, one of the greatest machines NASA has ever built. The story of this scientific and engineering marvel is one of bold vision,

imagination, and audacious risk-taking, but also perseverance and ingenuity when, as sometimes happens, not all risks are successfully negotiated. It is a story that transcends science.

One of the astronauts on that mission is taking a small part of the Olympics with him. About one year ago, Mike Massimino was talking to his 13-year old son Daniel who is a swimmer. When Mike asked his son what special personal items he would like him to carry with him on the Space Shuttle, Daniel glanced over at a poster of Michael Phelps on his bedroom wall and asked, “why don’t you take one of Michael Phelps’ swim caps?” So, the Massimino family contacted Deborah Phelps, Michael’s mother who is also a principal at Windsor Middle School in Baltimore, Maryland. The two families became friends, and next month the crew of the Space Shuttle *Atlantis* will carry with them into space a small USA swim cap autographed by Michael Phelps. After the mission, the astronauts will return it and spend some time with the students of Deborah Phelps’ school. In this way, NASA is in the inspiration business. One thing about astronauts, they can capture the attention of teenagers for at least 5 minutes... which is more than I know how to do.

While I make light of this, the lesson here is that our media and nation are not focusing on what matters most. Thus, I believe it is necessary for us – all of us – to take the time to discuss openly the founding principles that led us our nation to

embrace space exploration fifty years ago, when it mattered to the whole nation that we overcome our slow start and become the world's preeminent spacefaring nation. We need to reverse the alarming trends in our nation's science, technology, engineering, and mathematics (STEM) workforce. While the vast majority of our nation's workforce is neither scientists nor engineers, the four percent who are create most of the goods and services, solve real-world problems, and produce new discoveries and insights about our planet and our universe.

We have become inured to what should be recognized as alarming trends, the subject of a recent hearing before the House of Representatives Science & Technology Committee. There are half as many bachelor's degrees in physics awarded today in the United States than when Sputnik was launched in 1957. The number of engineers graduating with bachelor's degrees declined by over 20% in the last two decades prior to a recent up-tick – but that up-tick is primarily due to an increase in the number of foreign students, who are increasingly returning to their home countries. In 2004, China graduated approximately 500,000 engineers while India graduated 200,000 and the United States graduated 70,000. In 2005, the United States produced more undergraduates in sports exercise than in electrical engineering. In 2006, only 15% of college graduates in the United States received a diploma in engineering or the natural sciences, compared to 38% in South Korea, 47% in France, and 67% in Singapore. The number of PhDs in

engineering awarded by U.S. universities to U.S. citizens declined 34% in a single decade. Two-thirds of U.S. engineering PhDs are awarded to foreign nationals. In some surveys, U.S. public schools consistently rank near the bottom in mathematics and science as compared to their global counterparts. We are surpassed by, among others, Azerbaijan, Latvia and Macao.

If we do not reverse these trends, other countries *will* surpass the United States in scientific and technical acumen. This *will* affect our country in arenas well beyond space exploration. It *will* undermine our ability to compete in the global marketplace.

These trends did not happen overnight, and they will not be fixed overnight. We face a critical shortage of people skilled in technical professions. NASA is not immune to the demographic trends of a retiring baby boom generation and a declining educational system. Many of the people who built the Space Shuttle, the Hubble Space Telescope, the International Space Station, and the Mars rovers are retiring. Who will replace them to build the space systems of tomorrow?

Perhaps we as a nation can learn something from China's play book with their strategic, multi-faceted approach. At their fantastic opening ceremonies for the Olympic games, they celebrated their nation's space program and their future in space exploration, with images of the planets of our solar system projected on the rim of the bird's nest stadium, and taikonauts dancing around a yellow sun and

new-age planet in a spectacular display of acrobatics. China's opening ceremonies for the Olympic Games, costing a reported \$300 million, were compared in the media to America's *Apollo 11* moon landing, as their statement to the world that they intend to be regarded as a superpower. According a recent report by the RAND Corporation, a few years ago China initiated a fifteen-year "Medium-to Long-Term Plan for the Development of Science and Technology" which clearly stated their nation's goals and means to achieve it. It stated that China aims to become an "innovation-oriented society" by 2020 and a world leader in science and technology by 2050, develop indigenous innovation capabilities, leap-frog into leading positions in new science-based industries, increase R&D expenditures to 2.5 percent of GDP by 2020 (from 1.34 percent in 2005), increase the contribution to economic growth from technological advances to 60%, limit dependence on imported technology to 30%, and become one of the top five countries in the world in the number of patents granted.

China is investing heavily in building space capability because they understand the value of these activities, both as a driver for innovation and a source of national pride in being a member of the world's most exclusive club. They understand what it means for a society to be pushing the human frontier. China today not only flies its own taikonauts, but also has plans to launch about a hundred satellites over the next five to eight years. It should be no surprise,

especially to those who have read Tom Friedman's book "The World is Flat" or John Kao's "Innovation Nation", that this environment in China is breeding thousands of high-tech start-ups.

The Chinese adapted the design of the Russian *Soyuz* to create their *Shenzhou* spacecraft. However, the similarity between the two ends at the outer mould line; the *Shenzhou* spacecraft is both more spacious and more capable. They plan to conduct their first spacewalks and orbital rendezvous operations, and to build their own space station – admittedly simpler than ours – in the coming years. While they have not stated an intention to do so, the Chinese could send a mission around the Moon with the *Shenzhou* spacecraft, as the United States did with the inspiring *Apollo 8* mission back in 1968. China could easily execute such a mission with their planned *Long March V* rocket, currently under development and reportedly rivaling the capabilities of any expendable rocket in the world today. After visiting their facilities and talking to their engineers two years ago, I have no doubt that they will have it in use, as they plan, by around 2013.

I've also visited India, and seen their space infrastructure. I was equally impressed.

I am not making these points to engender a new space race with China, or for that matter with India or anyone else. I am saying that I respect the way these countries are approaching the development of their nation's space capabilities, and

I am concerned that our own nation is not nearly as focused as we should be on the strategic implications of what is happening.

NASA is simply one element of our own nation's multi-faceted approach to technological innovation. There are many other government organizations and programs, and our nation properly leverages the private sector's investments in innovation. We ourselves are also leveraging the emerging commercial space sector, from commercial imagery satellites and launch vehicles like SpaceX's Falcon rockets, the Zero-G Corporation's Boeing 727 for parabolic flights which produce 30 seconds of weightlessness, reusable suborbital spacecraft like Richard Branson's Virgin Galactic Company's SpaceShipTwo, and the Commercial Orbital Transportation System to support the International Space Station.

History shows that nations that shrink from the frontiers of their time, shrink also in their influence on the world stage. Yet we see that Americans today do not feel the urgency for preeminence on the space frontier that we felt in the 1950s and '60s. Sometimes I wonder if we are a bit tired, or distracted by other urgent crises, to recognize what it is that preeminence means for America.

As we are seeing, other nations seem to realize the importance of space exploration. This is an enterprise in which we can afford to be a leader, and one in which we cannot afford to be a follower. Whether America takes part or not, human exploration of space will go forward in this century. It is only a question of

who those explorers are, what languages they speak, and what values they hold.

Make no mistake, those who explore space in the coming decades will have *The Right Stuff*. I only hope that Americans will be among them.

Thank you.