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These are dynamic times at NASA: Charlie Bolden was sworn in as the 16<sup>th</sup> Administrator (12<sup>th</sup> if you don't count those who were Acting); This past week we were busy with numerous events for old friends and colleagues to commemorate the 40<sup>th</sup> anniversary of the first lunar landing in 1969; Norm Augustine is leading a presidential panel to identify options for the future of Human Space Flight, the National Security Council is leading a review of space policy; and Congress is finalizing the FY 2010 budget.

In the meantime, the workforce has been focused on a busy agenda. The seven members of the STS-127 mission are completing a successful mission to the International Space Station where they conducted five spacewalks to install the Japan Aerospace Exploration Agency's Kibo laboratory.

The arrival of the STS-127 crew brought the ISS population to 13 – the largest ever congregation of space travelers in one location in space and a representation of all partners.

At the same time, the Hubble Space Telescope is starting to send back photos and data to verify that the latest upgrade completed by the STS-125 crew was successful and in September we will be treated to spectacular new imagery of galaxies far, far, away.

Farther out in space the GOES-O satellite that was launched from the Kennedy Space Center in June has made it to Geo-stationary orbit and has been turned over to NOAA to operate as GOES-14.

Over at the Moon, the Lunar Reconnaissance Orbiter has been sending back fabulous imagery of the Moon's surface, including many of the Apollo landing sites and hardware – Definitive proof to all but the most hopeless conspiracy idiots – that we, in fact, really did land astronauts on the Moon.

Meanwhile, back on Earth, our aeronautics team is leading the way to develop advanced technologies to address the long term needs of the Nation's growing air transportation system. They are also responding to Presidential priorities to improve energy efficiency and mitigate environmental impacts of flight through the development of Green Aviation systems and technologies.

Trying to get a fix on how well the public thinks we are doing is a mixed bag. Recent polling data reveals that NASA's overall public image remains strong with 72% who have a favorable impression of the agency, but only 59% see NASA activities as relevant to everyday life. 74% of respondents thought NASA should increase the amount of work it's doing to stimulate the economy or continue as usual so America doesn't fall behind in the global technology race. And while polling data suggests the public is sometimes confused over the mission of NASA, the average response when asked how much money goes to NASA was approximately a quarter of the U.S. budget – not the .05% that the agency actually receives.

During the Apollo 40<sup>th</sup> anniversary celebrations, many people asked: why can't NASA be as innovative as we were at the dawn of the Space Age? What will it take for NASA to reclaim the mantle of innovation leadership and once again be used as the standard for excellence: If we can land a man on the Moon, why can't we...

Innovation is about more than the development of new technologies and several issues affect our ability to innovate in the aerospace industry. Issues such as:

- The need for sustained political support for an aerospace agenda that consists of complex, challenging goals
- Stable funding that is adequate to execute the agenda
- Societal interest in what we're doing
  - Must be perceived as relevant
  - Student interest in science and engineering drives future workforce development
- An adequate, well trained and motivated workforce is needed
  - Average age at NASA today is ~ 47; average age during Apollo was late 20s.
  - We've gone from being an exciting upstart to middle-age bureaucracy and referred to as Dinosaurs, Aging Gladiators
  - Impact of NewSpace – the fun guys who seem to be doing everything right while the legacy companies do everything wrong
  - How do we bring the next generation in quickly and get them up to speed?
- Another issue that effects innovation is making sure we have efficient contracting and acquisition processes that allow government, industry, and academia to work together without imposing onerous and expensive reporting requirements
- Collaboration with industry is vital for innovation. Both legacy companies like Lockheed Martin, Boeing, Northrop Grumman and NewSpace entrepreneurs such as SpaceX and XCOR have a role to play in innovation
  - Are we organized to effectively facilitate learning and the flow of knowledge that results from our corporate collaboration?
  - What are the advantages and disadvantages to working with large and small organizations?
- Finally, are we pursuing global alliances that make the most of international partnerships to advance innovation?

If these are the issues that impact our ability to innovate, what can we expect from the Obama Administration to advance an agenda of innovation?

During the 2008 Presidential campaign, *candidate* Barack Obama promised to enhance the role of NASA as a premier institution of innovation: “engineers and scientists at NASA have developed state-of-the-art innovations across the technological spectrum in areas ranging from solar cells and imaging to communications and aeronautics. An Obama Administration would renew NASA’s commitment to innovation-driving basic research that the private sector can use to develop new products for American consumers.”

More recently, *President* Obama has said, “Starting with Sputnik, and through the Apollo era, NASA inspired a generation to devote their professional life to science, technology, and engineering. This has resulted in US leadership in innovation, and many scientific and technical fields.”

The most comprehensive statement on how the Obama Administration is thinking regarding space can be found in statements made by the President’s Science Advisor, John Holdrin. During his Senate confirmation hearing in February, Holdrin proclaimed, “American investments in science and engineering have driven most of the innovations that underpin our economy today. A wide variety of studies conclude that between 50 and 85 percent of the growth of the U.S. economy over the past half-century -- and two-thirds of our productivity gains in recent decades -- are directly attributable to scientific and technological advances. In today’s time of economic crisis, we must resist the temptation to reduce our investments in these foundations of our prosperity.

“U.S. scientific leadership requires both creating an environment that encourages private investment in research and development while maintaining strong and balanced federal research programs that support the promising areas of R&D that are too far from obvious application, too uncertain in outcome, too costly, or

too related to public as opposed to private goods to attract private funding.

“In this connection, I want to give special mention to the importance of R&D in our space program. Maintaining and expanding our capabilities in space is sometimes regarded as a “luxury” we should do less of in the face of more pressing earthbound concerns. But that would be false economy. Space is crucial to our national defense; to civil as well as military communications and geo-positioning; to weather forecasting and storm monitoring; to observation and scientific study of the condition of our home planet’s land, vegetation, oceans, and atmosphere; and to scientific study and exploration looking “outward” that is increasing our understanding of the physical universe and our place in it.

I also want to note the importance of the sustainability and predictability of the federal investment in science and engineering. The “boom and bust” cycles that have characterized much federal support in these domains over the past forty years are inefficient and disruptive of scientific progress.”

In response to the Administration’s emphasis on innovation, NASA established the Innovative and Technology Initiative, led by Chief Engineer Mike Ryschkewitch and Goddard’s Deputy Director for Space and Technology, Laurie Leshin. The group was chartered to develop options for future investments and activities that will address significant leaps in innovation throughout the agency. They began with an assessment of the major challenges we face in humans space flight, Earth Science and climate change, robotic planetary exploration, and aeronautics. They then took an inventory of the Agency’s current investments aimed at innovation.

Current NASA investments for innovation include:

- \$400M in the research and technology budget of the Aeronautics Research Mission directorate

- \$220M for Exploration Systems Mission Directorate, primarily for the Commercial Orbital Transportation System program
- \$300M in the Science Mission Directorate, mainly in the Principle Investigator-led research programs
- \$60M in Space Operation Mission Directorate for space communications and navigation research and development
- \$180M in the Innovative Partnership Program for the SBIT/STTR program

The Innovation Initiative has identified a number of barriers to promoting innovation within the Agency, which have also been highlighted in other reports, including:

- Instability of support for new technology development within programs and projects
- Inadequate focus on strategic investments that produce long-term, high-risk, high-payoff
- Cultural and organizational barriers such as an aversion to risks
- Inadequate coordination and portfolio management at the Agency level
- Inadequate partnering and leveraging of external innovation and innovators

The Innovation Task Group is developing a number of options could jump start a new phase of innovation within NASA. Specifically, they have identified several areas for potential overguide funding in the FY 2011 budget process, including:

- Early-stage innovation, such as though developed years earlier through the NASA Institute of Advanced Concepts
- Game-changing innovation produced through a DARPA-like organization within NASA
- Commercial space innovation produced through a NACA-like model

Each of these areas would explicitly include ideas for addressing broader national needs such as climate and energy, STEM education, Health and

Wellness, and National Security. Governance options are also being formulated and reviewed to determine how best to manage an innovation initiative within the Agency/

What will it take to spark a new aerospace community-wide wave of innovation?

Recall that we are part of a bigger picture.

- Political – we must work well within the political system, but should take advantage of the Administration’s early interest and support for innovation
- Economic – our activities we must demonstrate and provide value to the public in a time of tight resources
- Social – engage and serve society
- Technology – we should leverage existing capabilities that are developed outside the Agency, including other industries and other countries
- Workforce Development - NASA Academy of Program/Project & Engineering Leadership (APPEL)

We need to do a better job in communicating to the public the importance of the aeronautics and aerospace community for the national economic health.

Aerospace is one of the few remaining major industry sectors where the America enjoys a positive balance of payments. If we don’t want to replicate the experience of industries such as automotive, electronic, and chemical, then we must put a priority on innovation.

Closing thought -- Innovation in aerospace research and development requires leadership. With the arrival of our new Administrator, Charlie Bolen and with the help of officials within the Administration such as John Holdrin, I believe the accomplishments such as Apollo will be seen as a benchmark, and not the highest point of achievement for America’s space program. It is up to all of us to ensure that the future of space is as remarkable as the first 50 year.