COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

NASA Human Spaceflight Past, Present, and Future: Where Do We Go From Here?

Thursday, September 22, 2011
10:00 a.m. – 12:00 p.m.
2318 Rayburn House Office Building
Overflow room: 2237 Rayburn House Office Bldg

Purpose

The hearing will examine 1) the strategic goals and priorities of America's human space exploration program, 2) the importance of space access and demonstrated leadership among space-faring nations, 3) the inspirational role of human and robotic space exploration, and 4) the role of the Space Launch System and Multi Purpose Crew Vehicle and a healthy industrial base in achieving those goals. The hearing draws on our Nation's long history of space exploration to help frame challenges confronting our present human spaceflight position and explores paths forward.

Witnesses

Mr. Neil A. Armstrong, Commander, Apollo 11

Captain Eugene A. Cernan USN (ret.), Commander, Apollo 17

Dr. Maria Zuber, E.A. Griswold Professor of Geophysics and Head of the Department of Earth, Atmospheric and Planetary Sciences, Massachusetts Institute of Technology

Dr. Michael D. Griffin, Eminent Scholar and Professor, Mechanical and Aerospace Engineering, University of Alabama in Huntsville

Overarching Issues and Questions

With the retirement of the Space Shuttle, America's human spaceflight program faces a transition. Congress, the Administration and industry are exploring paths forward within current fiscal constraints. Coupled with that is the desire to take on new challenges in deep space and keep ahead of other space faring nations who also share ambitions for deep space missions.

As our nation embarks on a new path forward, key questions remain; What are the compelling reasons to pursue human space exploration? How is our stature as a world power affected if the U.S. is not active on the human space frontier when others are? What is the effect on our national security if the U.S. is no longer regarded as a preeminent world power? What destinations should be pursued, and has NASA selected the right vehicle architecture for a successful program? Has the administration and congress allotted the appropriate resources to accomplish our national objectives?

In 2009, the National Academy of Sciences Committee on the Rationale and Goals of the U.S. Civil Space Program explored many of these broad issues and made the following recommendations:

NASA should be on the leading edge of actively pursuing human spaceflight, to extend the human experience into new frontiers, challenge technology, bring global prestige, and excite the public's imagination. These goals should be accomplished by;

- *Setting challenging objectives that advance the frontier, scientific and technological understanding, and the state of the art;*
- *Establishing clear goals for each step in a sequence of human spaceflight missions beyond low Earth orbit that will develop techniques and hardware that can be used in a next step further outward;*
- *Focusing use of the ISS on advancing capabilities for human space exploration;*
- *Using human spaceflight to enhance the U.S. soft power leadership by inviting emerging economic powers to join with us in human spaceflight adventures.*

The hearing is an opportunity to consider a logical path forward for NASA, and discuss next steps, destinations and capabilities, and the resources and policies needed to achieve them.

Background

The Bush Administration and the NASA Authorization Acts of 2005 and 2008

In the aftermath of the Space Shuttle *Columbia* accident the Bush Administration proposed a new vision for space exploration which would extend human capabilities beyond low Earth orbit for the first time since 1972. In the NASA Authorization Act of 2005 Congress directed NASA to "*establish a program to develop a sustained human presence on the Moon, including a robust precursor program, to promote exploration, science, commerce, and United States preeminence in space, and as a stepping-stone to future exploration of Mars and other destinations."* [P.L. 109-155]

Subsequently, NASA created the Constellation program consisting of the Ares 1 rocket and Orion crew capsule, the Ares 5 heavy lift launcher, and the Altair lunar lander. Constellation was designed to accommodate this stepping-stone approach, and was Congressionally-authorized by the NASA Authorization Act of 2008 "*to ensure that activities in its lunar exploration program shall be designed and implemented in a manner that gives strong consideration to how those activities might also help meet the requirements of future activities beyond the Moon*" and a range of future destinations "*to expand human and robotic presence into the solar system, including the exploration and utilization of the Moon, near Earth asteroids, Lagrangian points, and eventually Mars and its moons.*" [P.L. 110-422]

The Obama Administration

Initially the Obama Administration retained the Congressionally-authorized policy of returning Americans to the Moon, noting in NASA's FY2010 budget request that, "*Funds freed from the Shuttle's retirement will enable the Agency to support development of systems to deliver people and*

cargo to the International Space Station and the Moon," and, *"The Agency will create a new chapter of this legacy as it works to return Americans to the Moon by 2020 as part of a robust human and robotic space exploration program."* Yet in spite of these assertions the Administration's FY2010 budget eliminated funding for the continued development of the Altair lunar lander and the Ares 5 heavy-lift launch vehicle, and cut more than $3 billion from NASA's five year Exploration Systems budget (relative to the FY 2009 budget request).

Concurrent with the FY2010 budget proposal the Administration established an independent review committee chaired by retired Lockheed Martin executive Norman Augustine. *The Review of Human Spaceflight Plans Committee* delivered its final report in October 2009 with the overarching conclusion that "*Meaningful exploration beyond low-Earth orbit is not viable under the FY 2010 budget guideline*" but that "*Meaningful human exploration is possible under a less-constrained budget, increasing annual expenditures by approximately $3 billion in real purchasing power above the FY 2010 guidance*."

Despite the Augustine Committee's finding that the FY2010 budget profile was insufficient for meaningful human space exploration, the next year the administration reduced the FY2011 Exploration Systems budget to $4.3 billion, which was $1.8 billion below the FY2010 runout plan.

Subsequently, in NASA's FY2011 budget request the Administration proposed canceling the Constellation program, claiming it was "*trying to recreate the glories of the past with the technologies of the past.*" At a speech at the Kennedy Space Center on April 15th 2010, the President said that with respect to the Moon, "*the simple fact is, we have been there before. There is a lot more of space to explore….*" He announced that the U.S. would send humans to an asteroid by 2025, followed by a human mission to orbit Mars by the mid 2030s.

With the abrupt cancelation of *Constellation*, the Administration's FY2011 budget sought to fund development of "commercial crew" transportation services (three or four, according to NASA) and postpone construction of human exploration systems for a least five years. Instead the administration proposed an exploration technology development program and deferred any future launch vehicle decisions until no earlier than 2015. Furthermore, the administration seemed to exclude the Moon as a future destination, but mentioned visiting an unidentified asteroid in 2025 and orbiting Mars in the mid-2030s.

Neither the administration nor NASA provided Congress with any plans or programs to accomplish those goals. In fact, the funding available for human space exploration in the administration's FY2011 budget request was essentially the same as the FY2010 budget that was deemed "not viable" by the Augustine committee just months earlier.

If one compares the FY2011 budget plan and outyear funding profile with that of the Augustine committee's "less constrained" budget, the administration proposed plan through 2025 (the date of the asteroid mission) is $47 Billion less than what the Augustine committee deemed necessary to make any exploration options viable. As a result, after extensive review and debate, Congress in its 2010 NASA Authorization Act reversed the Administration's approach and directed the agency to build upon the capabilities of the Shuttle and Constellation programs and immediately begin developing the SLS and MPCV. The SLS and MPCV were to continue developing the advanced human safety features of the Orion project, and be capable of evolving into a heavy lift launch system that could eventually carry 130 tons to orbit to enable human exploration beyond Earth orbit. Congress did not endeavor to define a full-up exploration program. Rather, the goal was to

keep alive development of critical hardware – the SLS and MPCV – that would enable NASA to undertake an eventual deep space exploration program once a destination, schedule, and resources had been agreed to.

The NASA Authorization Act of 2010 [P.L.111-267]

Last year Congress passed the NASA Authorization Act of 2010, which was signed by the President on October 11, 2010 [P.L.111-267]. The Act provided policy guidance and recommended funding levels for three years, and called for a National Academy *"review of the goals, core capabilities, and direction of human space flight, using the goals set forth in the National Aeronautics and Space Act of 1958, the NASA Authorization Act of 2005, and the NASA Authorization Act of 2008, the goals set forth in this Act, and goals set forth in any existing statement of space policy issued by the President.*" The review is to be completed by next year.

Congress again reaffirmed the policy of the NASA Authorization Act of 2005 (42 U.S.C. 16761(a)), *"that the United States shall maintain an uninterrupted capability for human space flight and operations in low-Earth orbit, and beyond, as an essential instrument of national security and of the capacity to ensure continued United States participation and leadership in the exploration and utilization of space."* [§201(b)]

Section 202 (a) stated that, *"The long term goal of the human space flight and exploration efforts of NASA shall* ***be to expand permanent human presence beyond low-Earth orbit*** *and to do so, where practical, in a manner involving international partners."* Section 301(a)(1) stated, *"The extension of the human presence from low-Earth orbit to other regions of space beyond low-Earth orbit will enable missions to the surface of the Moon and missions to deep space destinations such as near-Earth asteroids and Mars."*

Section 2(9) of the NASA Authorization Act of 2010 states, *"While commercial transportation systems have the promise to contribute valuable services, it is in the United States' national interest to maintain a government operated space transportation system for crew and cargo delivery to space."*

As a result, **$10.8 billion** was authorized through FY2013 for the continued development of a Shuttle- and Constellation-derived heavy lift launch system (the Space Launch System and Multi-Purpose Crew Vehicle) to enable human exploration beyond low Earth orbit. NASA was directed to proceed immediately, and told to modify existing Shuttle and Constellation contracts with the goal of making the system operational by 2016, and ensure a national "*capability to serve as a backup system for supplying and supporting ISS cargo requirements or crew delivery requirements not otherwise met by available commercial or partner-supplied vehicles.*" [§302(c)(1)(D)]

Even though the Space Shuttle has been retired the U.S. still has the responsibility of providing crew transportation to the International Space Station for both NASA and our international partners (other than the Russians). The importance of ensuring the development of a national "backup" system has only grown with delays in commercial cargo demonstration flights and the recent loss of the Russian Progress vehicle on a Soyuz rocket.

Last Wednesday, September 14, 2011, the administration and NASA announced plans to build the Space Launch System (SLS). The SLS, together with the Orion Multi-Purpose Crew Vehicle (MPCV), are intended to give NASA the capability to explore space beyond low-Earth orbit – a

capability the U.S. has not had since 1972 – and provide access to the International Space Station if commercial entities or our international partners cannot do the job.

FY2011 Full Year Continuing Resolution

On April 15, 2011 a full year continuing resolution established spending levels for the balance of FY2011. As noted in the table below, for the Space Launch System, amounts provided are slightly above authorized levels. Subsequently, on June 15th NASA provided Congress with an operating plan based on the continuing resolution (FY11 CR column below) and gave notice that *"(A)dditional information on NASA's progress in selecting an architecture and acquisition strategy will be provided to Congress in the Updated Report on MPCV and SLS in summer 2011."* As noted earlier, NASA announced on September 14th that it was moving forward with the development of the SLS.

NASA FY12 Budget Req - Space Launch System & Multi Purpose Crew Vehicle

($ = million)

	FY11		FY12			FY13	
	Auth	CR	Auth	Budg Req	CJS Appro*	Auth	Budg Req
Space Launch Sys	1.631	1.786	2.650	1.690	1.985	2.640	**
Multi Purpose Crew Veh	1.120	1.196	1.400	0.916	1.063	1.400	**
Total	**$2.751**	**$2.982**	**$4.050**	**$2.606**	**$3.048**	**$2.640**	**$2.591****

*As approved by the CJS Subcommittee on July 7.

** Budget provided no breakout.

Recent FY2012 Appropriation Activity

On July 7th the House Appropriations Subcommittee on Commerce, Justice, Science, and Related Agencies reported an FY2012 appropriations bill providing a total of $3.65 billion for Exploration Systems, that included the following provision: *"Provided, that not less than $1,063,000,000 shall be for the multipurpose crew vehicle to continue existing vehicle development activities to meet the requirements described in paragraph (a)(1) of section 303 of Public Law 111–267, and not less than $1,985,000,000 shall be for the heavy lift launch vehicle system which shall have a lift capability not less than 130 tons and which shall have an upper stage and other core elements developed simultaneously."*

On September 15th, the Senate Appropriations Subcommittee on Commerce, Justice, Science and Related Agencies reported an FY2012 appropriations bill providing a total of $3.775 billion for Exploration Systems, including $1.2 billion for the Orion Multipurpose Crew vehicle, and $1.8 billion for the heavy lift launch Space Launch System. The Committee provided specific direction into the development of the SLS requiring initial human capability by 2017, the use of fixed price contracts wherever possible, and a imposing a strict cost cap of $11,500,000,000 through fiscal year 2017. Likewise, direction was provided for the Orion Multipurpose Crew Vehicle such that it should be developed as an alternative access to low Earth orbit, including the ISS, by fiscal year 2014, use fixed price contracts wherever possible, and should be managed under a strict cost cap of $5,500,000,000 through fiscal year 2017.