

Assessing the Options of the Augustine Committee for Human Spaceflight

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Space Policy Under Review

- New Administration efforts
 - Space Posture Review (Defense)
 - Augustine Committee (NASA)
 - Presidential Study Directive (NSC-led)
- FY2011 budget proposals in work along with the outcome of latest Quadrennial Defense Review

2004 National Goals to Directives to NASA

- ✓ Complete the International Space Station
- ✓ Safely fly the Space Shuttle until 2010
- ✗ Develop and fly the Crew Exploration Vehicle no later than 2014
- ✗ Return to Moon with goal of 2015 and no later than 2020
- ✓ No later than 2008, begin a series of robotic missions to Moon
- ✓ Develop supporting innovative technologies, knowledge, and infrastructures
- ✓ Promote international and commercial participation in exploration
- ✓ Aggressive in-situ resource program and robust precursor program
- ✓ Sustained human presence on Moon for national preeminence, scientific and economic purposes, leading to Mars and other places

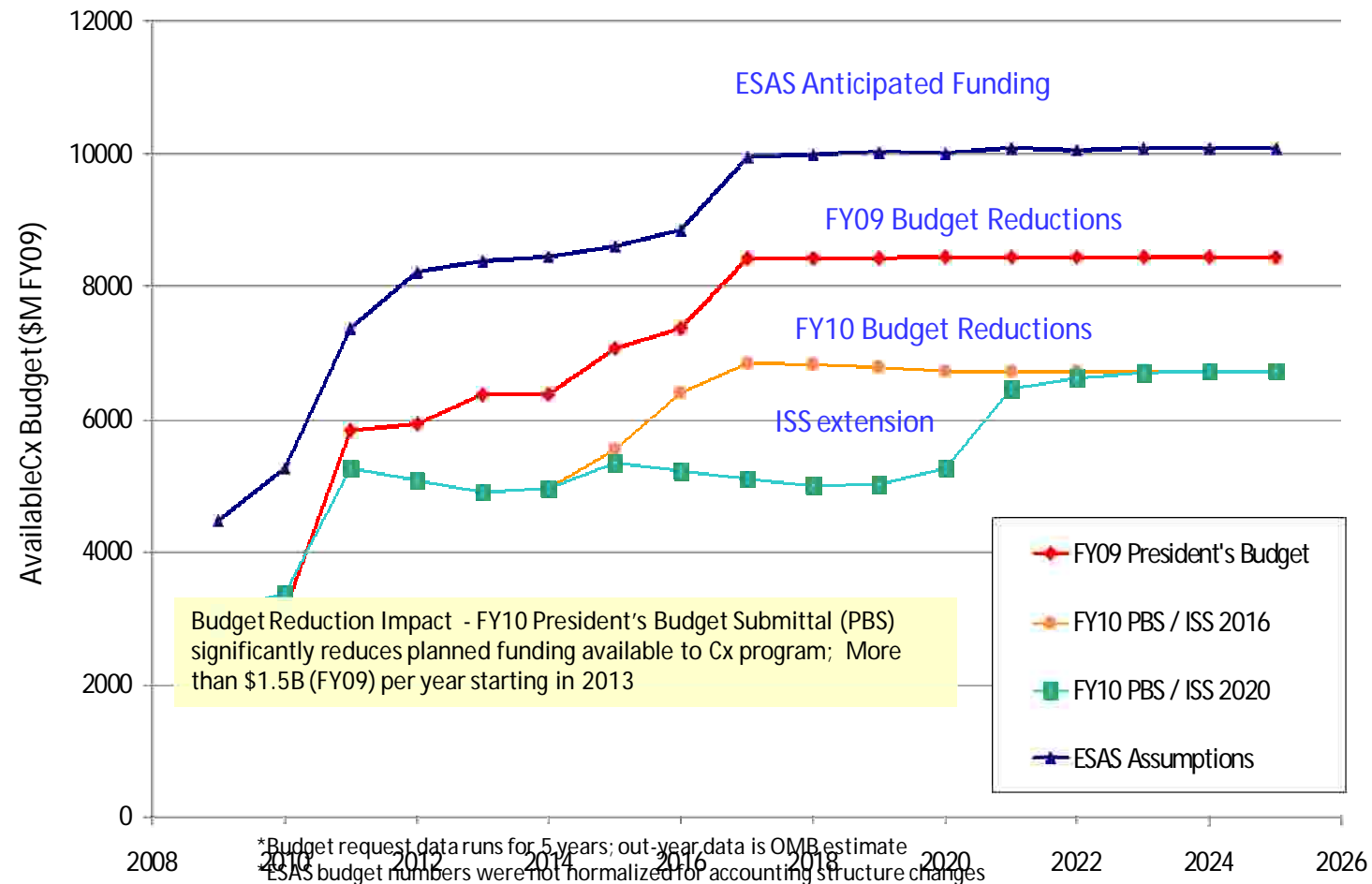
\$3B Out-year NASA Budget Gap Concentrated in Exploration

Budget Authority (\$ millions)	FY 2008	FY 2009	FY 2010*	FY 2011*	FY 2012*	FY 2013*	FY 2014*
	Actual	Enacted					
FY 2010 President's Budget Request	3,299.4	3,905.5	3,963.1	6,076.6	6,028.5	5,966.5	6,195.3
Constellation Systems	2,675.9	3,433.2	3,505.4	5,543.3	5,472.0	5,407.6	5,602.6
Advanced Capabilities	623.5	472.3	457.7	533.3	556.5	558.9	592.7
FY 2009 President's Budget Request	3,143.1	3,500.5	3,737.7	7,048.2	7,116.8	7,666.8	-
Constellation Systems	2,471.9	3,048.2	3,252.8	6,479.5	6,521.4	7,080.5	-
Advanced Capabilities	671.1	452.3	484.9	568.7	595.5	586.3	-
Total Change from FY2009 President's Budget Request	156.3	405.0	225.4	-971.6	-1,088.3	-1,700.3	

*Following the human spaceflight review, the Administration will provide an updated request for Exploration activities reflecting the review's results.

	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	Projected at 2.4% inflation	
Projected: FY 2005 Pres Budget	15,378	16,244	17,002	17,815	18,001	18,034	18,483	18,777	19,267	FY 2013	FY 2014
% change from previous year		5.6%	4.7%	4.6%	1.0%	0.2%	2.4%	1.7%	2.6%	2.40%	2.40%
Projected: FY 2010 Pres Budget					FY 2008	FY 2009*	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014
% change from previous year					17,401.9	18,784.4	18,686.0	18,631.0	18,613.0	18,607.0	18,858.0
*Includes Recovery Act						7.9%	-0.5%	-0.3%	-0.1%	0.0%	1.3%
Nominal difference between FY05 and FY10 requests							223.0	-146.0	-654.0	-1,122.4	-1,344.9
											total FY10-14
											-3,044.3
Projected: FY 2010 Exploration Budget					FY2008 Act	FY2009 En	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014
FY 2009 Exploration Budget Request					3299.4	3905.5	3963.1	6076.6	6028.5	5966.5	6195.3
Change from FY2009 President's Budget Request					3143.1	3500.5	3737.7	7048.2	7116.8	7666.8	total FY09-13
					156.3	405	225.4	-971.6	-1088.3	-1700.3	-3,129.8

Projected Constellation Program Funding has seen Significant Reductions since ESAS



Budget Proposals are Policy

- Between the FY2005 budget request when the Vision for Exploration was announced and what was actually appropriated in FY08, there was cumulative total of \$11.7B in reductions (\$3.9 billion) and costs absorbed (\$7.8 billion, primarily for Shuttle Return to Flight and to complete assembly of the International Space Station) within NASA's budget between FY05-10.
- Congress provided an additional \$1 billion for NASA in FY09 recovery funds, including \$400M for Exploration, to which the Obama Administration allocated \$90M for COTS from these Exploration funds.
- The Administration requested \$18.686 billion for NASA in FY2010, a \$904 million increase or slightly over 5%. This is helpful in the transition years now underway but the additional funding does not accelerate Orion/Ares I.
- FY2010 budget proposal had \$3B less in out year budget for Exploration. NASA's budget for FY2011-2014 does not keep up with inflation – assuming inflation is greater than 1.36% This represents a \$10.7B difference for Exploration in the seven years of FY2014-2020 if continued.
- Operating Shuttle into 2011 for the current manifest cost \$2B and operating the International Space Station through 2020 may cost \$15B for a total of \$17B in additional burden if there is no supplemental for NASA. This would likely impact to Exploration even further.

Augustine Options

	Budget	Shuttle Life	ISS Life	Heavy Launch	Crew to LEO
Constrained Options					
Option 1: Program of Record (constrained)	FY10 Budget	2011	2015	Ares V	Ares I + Orion
Option 2: ISS + Lunar (constrained)	FY10 Budget	2011	2020	Ares V Lite	Commercial
Moon First Options					
Option 3: Baseline - Program of Record	Less constrained	2011	2015	Ares V	Ares I + Orion
Option 4A: Moon First - Ares Lite	Less constrained	2011	2020	Ares V Lite	Commercial
Option 4B: Moon First - Extend Shuttle	Less constrained	2015	2020	Directly Shuttle Derived + refueling	Commercial
Flexible Path Options					
Option 5A: Flexible Path - Ares Lite	Less constrained	2011	2020	Ares V Lite	Commercial
Option 5B: Flexible Path - EELV Heritage	Less constrained	2011	2020	75mt EELV + refueling	Commercial
Option 5C: Flexible Path - Shuttle Derived	Less constrained	2011	2020	Directly Shuttle Derived + refueling	Commercial

Some Underlying Policy Issues

- From Mike Griffin's testimony 15 September 2009:
 - whether or not there is a need for independent U.S. government human access to space, and if not, the identification of those entities upon which we are willing to depend for such access;
 - whether or not it is in the larger interests of the United States to invite international partnerships in regard to capabilities which are on the so-called "critical path" to a desired common goal;
 - the degree to and roles in which the U.S. government should foster the development, and embrace the capabilities, of "commercial space" in the furtherance of national goals;
 - the proper role of NASA in guiding the human expansion into space, and in particular NASA's disparate functions as 'innovator and technology developer' vs. 'designer/developer/smart buyer' of new systems, and 'system operator' vs. 'service customer'.
- Major options are: 1) add money back, 2) change goals, 3) take more risk
 - Add \$3-4B per year to maintain exploration program and extension of ISS operations
 - Defer exploration beyond low Earth orbit -- similar to the 1996 national space policy
 - Plan for commercial crew service prior to demonstration of commercial cargo capabilities and independent of private sector financing. Accept risk of longer reliance on the Russians, likely need to waive or drop some human flight rating rules, and industrial base impacts. Accept lack of internal NASA systems engineering capability going forward and likely workforce loss.
- Will NASA request and get an over guide in the FY2011 President's Budget?

What is the Future of Humans in Space?

1. Can humans “live off the land” in space and function independently of Earth for long periods?
2. Are there economically useful activities in space that can sustain human communities in space?

	Nothing commercially useful	Commercially sustainable
Live off the land	Antarctica	Settlements
Cannot live off the land	Mt. Everest	North Sea oil platform

See also Harry L. Shipman "Humans in Space: 21st Century Frontiers"

- We don't know which of these outcomes represents our long-term future. Advocates and skeptics may believe one outcome or another is most likely, but no one actually knows.
- Options that help us answer these questions more effectively should be preferred over those that don't.