

THE SPACE POLICY INSTITUTE
PRESENTS A SYMPOSIUM ON

ASSESSING THE OPTIONS OF THE AUGUSTINE COMMITTEE
FOR HUMAN SPACEFLIGHT

SEPTEMBER 28, 2009

The George Washington University
1957 E Street, N.W. – 7th floor Conference Center
Washington, D.C. 20052

Welcome and Introductory Remarks

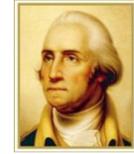
DR. SCOTT PACE, Director, Space Policy Institute

- Augustine stated \$3 billion per year by 2014 is needed to keep Project Constellation on schedule
- “Budget proposals are policy”
- Deferral of the U.S. Space Exploration Policy may be initiated by Obama administration, as opposed to an outright shift of course or cancellation
- There seems to be broad consensus to extend the life of the ISS to at least 2020
- Underlying Policy Questions:
 - Does there need to be a government option for human access to low Earth orbit on the table?
 - Should we invite international participation on the critical paths of access to space?
 - To what degree should the US government foster the development of commercial space activities?
 - What is the role of NASA?
- Three options exist for the administration, post-Augustine:
 - 1) Add money back
 - 2) Change goals
 - 3) Take more risk
- What is the future of humans in space? Posing clear questions would help organize and priorities human space exploration activities.
 - Can humans “live off the land” in space and function independently of Earth for long periods?
 - Are there economically useful activities in space that can sustain human communities in space?

Panel 1: Setting the Context for NASA

GEN. LESTER LYLES, Member of the Augustine Committee

- Committee’s final report will be released with detailed engineering, cost, and budgetary analysis behind all of the options
- Committee tasked to assess the following:
 - Present human spaceflight program
 - Future of Space Shuttle and ISS
 - The necessity of heavy lift
 - Crew access to low earth orbit and alternatives
 - Strategies and alternatives beyond low earth orbit
- Major themes kept in mind: safety, reliability, innovation, affordability, and sustainability
- Bottom line mandate: committee was to make **no recommendations**.
- Whatever alternatives addressed, they should come up with five options and two must stay within FY10 budget and extend to FY20.
- Federal Advisory Committee Act (FACA) mandates that everything the Augustine Committee does has to be of public record; no private meetings or major discussions that are not in a public forum
 - Somewhat of a constraint to their study
- Shuttle extension not out of the question
 - One more remaining External Tank could be flown for an additional mission not on the current manifest
- Summary of key findings of committee:
 - NASA needs the right mission with the right size
 - Without an adequate budget there is no way that NASA can take on the great things it is asked to and maintain a viable program for space exploration
 - International partnerships should be addressed in greater detail than they are currently – there is lots of opportunities for greater partnerships and activities
 - Shuttle program should be extended, whether it be for a few flights or longer, it makes sense to consider any way to minimize gap
 - “Great nations do great things” – human spaceflight is a task worthy of a great nation
 - Extending ISS a “no brainer”– bottom line is we are just now completing space station and the U.S. and its international partners have only just begun to utilize scientific capabilities
 - Could be extended to 2025
 - NASA needs heavy lift capability
 - Looked at Ares 1, Ares V, and Ares V Light
 - Did not recommend one or the other; rather it depends on your objectives in space
 - Committee views COTS program favorably; it should be continued
 - Strong potential for commercial space sector to service ISS



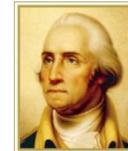
- A non-mission specific, basic space technology program should be established to support exploration
- There are human spaceflight pathways to Mars
 - Mars is the ultimate destination, but may not be the first
- Committee laid out alternatives for Moon and Mars and defined risks as best as they could

MR. A. THOMAS YOUNG

- The decisions made now about the direction of NASA's human spaceflight program will chart its course for the rest of the century
- Budgets, rather than policy are driving much of the debate for the future of human spaceflight; this is regrettable
 - Human spaceflight could be decided on just \$3 billion dollars per year, a small amount given its historical importance
- Augustine Committee framed the subject of human spaceflight in a meaningful way, now someone has to make a decision
- Three key findings from the Augustine Committee:
 - The current program is not executable within the current budget
 - People already knew that, but it takes a group with credibility and respect to highlight this item
 - There is no credible human exploration program executable for the current budget
 - ISS plays a significant role, but it is not human exploration
 - There is a family of options that are executable and deserve a lot of thought
 - They are executable with budget augmentations
- There are two findings that will be hopefully developed in the Augustine report
 - Continuation of ISS should continue beyond 2015, but significant thought has to be put into its mission – science can't be the only sell
 - International relations has an extraordinarily valuable role in ISS
 - How do we transport humans to ISS? There is not a demonstrated, mature commercial human spaceflight enterprise in this country
 - Commercial is moving in a positive direction but flying humans back and forth as part of a national goal requires an enterprise that is more developed than what we have today
- How do we put together a space program befitting of a world leader?
 - Question should be policy centered, not budget driven
 - In the 90s we relied upon an acquisitions strategy known as “faster, better, cheaper”
 - Took on more risk that results in \$11 billion worth of aerospace failure

DR. DOUG STANLEY, Georgia Institute of Technology

- From a space architecture perspective, the shuttle-derived option for Project Constellation was the least expensive and safest model but not good for ISS servicing
- EELVs made sense for Project Constellation for the ISS but not for a lunar mission



- Ares/Orion best fulfilled the ISS and lunar mission.
- If the Obama administration shifts goals and destination, a new architecture will be needed
- If the CEV had not been required to go to the ISS, the “2 launch” architecture in the ESAS would have been chosen over the “1.5 launch” architecture
- White House should decide immediately on:
 - ISS extension
 - Shuttle extension
 - Beyond-LEO human mission destinations and time-frames
 - Out-year available budgets
 - General policy towards commercial and international ISS crew transport
- After White House makes decisions, NASA should be allowed to then define design reference mission(s) and requirements and perform ESAS-like architecture study to:
 - Perform apples-to-apples cost/safety/risk comparison to Augustine-defined options and selected other combinations of options
 - Re-visit EELV/SDV trades – including side-mount
 - Perform detailed definition and economics analysis of propellant depots
 - Determine cost/risk of “commercial” crew transport
 - Examine workforce impacts of options
 - Define more detailed budgets to support 2011 budget cycle

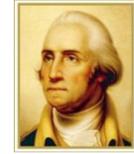
MR. “JT” JEZERSKI, Office of Rep. Pete Olson (R-TX)

- Selling NASA on the Hill is tough and requires getting back to the basics
 - Public support is a “mile wide and an inch deep”
 - There is bi-partisan support for the program as well as bi-partisan opposition
 - The space community should meet policy makers where they are and appeal to their constituents by conveying that space can promote innovation, create and secure jobs, and inspire the next generation of engineers and scientists
- Fiscal conservatives and Rep. Barney Frank are known opponents
- There’s frustration in the House with the Augustine Committee failing to follow the lead for human spaceflight policy in the last two NASA authorization acts and two Administrations
- The best contribution of Augustine was providing a number (\$3 billion) and the space community should rally around that number

Panel 2: Science and International Relations

DR. PAUL SPUDIS, Lunar and Planetary Institute

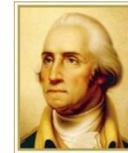
- There are four canons of faith in the Augustine report
 1. Mars is ultimate destination
 - Alternatively, our ultimate purpose in space should be to arrive, survive, and thrive
 - We are light years from this ability and will remain so as long as we depend on Earth resources for operation in space



- Settling the Moon first brings us closer to this ability because it's close, interesting and has material and energy resources to create new capabilities in space
- 2. Heavy Lift (> 100 mT lift) is needed
 - Heavy lift is essential for settling the Moon but there are alternatives.
- 3. American public needs to become enthusiastic about spaceflight
 - On the other hand, apathy may be asset rather than liability because gives lots of flexibility around how a program is built
 - Fundamental difference between Apollo and now:
 - Apollo used warlike atmosphere to motivate people.
 - People believed they were working against something important.
- 4. There is nothing wrong with NASA that cannot be fixed with more money
 - Augustine Committee should have focused on moving forward with a series of small incremental steps toward human settlements in the solar system
 - Public indifference seen in polling data should force us to think differently about space exploration and how it is marketed to the public

DR. TOM JONES, Planetary scientist, former astronaut

- Near Earth Objects (NEO) are a worthy destination of human space flight
- There is a NEO potential for resources in space
- In terms of rocket power, NEOs are more accessible than Moon.
 - In terms of mission duration, round-trip to NEOs are longer than Moon.
- There are several practical reasons for NEO as a human spaceflight destination:
 - Survival
 - We are a potential target for collision with NEOs, but we have the techniques and decision-making capacity to stop them.
 - By understanding and operating near them we can gain insight into how to stop them from destroying the Earth.
 - Scientific interest
 - Ancient, unaltered class of objects provide insight into formation of planets
 - Multi-month mission to NEOs increases our experience with long-duration spaceflight away from LEO. Stepping Stones to Mars and beyond.
 - Sustainability
 - NEOs differ greatly from each other, so NASA can select many different destinations that offer new information (unlike making the goal Moon or Mars)
 - Keep program going over many Administrations
 - Program can start off robotic and progress to humans
 - Public Excitement
 - Exciting destinations



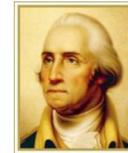
- Ties into human survival
- Resources
 - Asteroids are rich sources of resources
 - Different NEOs have different raw materials – nickel, water, etc.
 - Develop capacity for long-term human habitation in space
 - Industrialize and tax space in order to pay for later mission to Mars

DR. JOHN LOGSDON, Space Policy Institute

- There are several unarguable effects that will result from the Augustine Report
 - Space Station will be extended beyond 2016
 - International cooperation will increase
 - Presidential leadership is vital for the next step in space, space agency leadership alone will not suffice
 - Presidential Leadership led to internationalization of the Space Station
 - Reagan announced approval of Station in State of Union Address on Jan 25th 1984 and also stated would it involve international cooperation.
 - Clinton made agreement with Russians for their involvement in the Space Station in 1993.
- Will there be Presidential leadership this time?
 - President needs to make statement on commitment to international cooperation, especially commitment to ISS at least until 2020.
 - Station partnership should be broadened to include non-partner use
 - If President makes these statements, it will put us on productive path toward international cooperation in exploration.
 - The international cooperation in space employed by both the Reagan and Clinton Administrations serves as a model to be emulated by the Obama Administration

DR. ALAIN DUPAS, Collège de Polytechnique

- The post-Apollo era has allowed for considerable European participation in space that was not previously seen
- The Augustine report highlighted the following to the European space community:
 - Having clear, long-term commitment is extremely important.
 - If the U.S. is not clear on this point, people in Europe will begin to think the US is not serious
 - Europe does not see a clear commitment to exploration beyond low earth orbit. This must change if the U.S. seeks involvement from international partners
 - The ISS should be extended to 2020
 - This should become U.S. Space Policy, not a line in the Augustine Report
 - Considerable attention should be paid in the U.S. to post-Shuttle operation of the ISS
 - Human spaceflight as a global enterprise is too optimistic an outlook at this time
 - ESA accounts for 15% of human spaceflight, while NASA is 50%



- U.S. is still the leader in human spaceflight.
- No discussion in Europe to send European astronauts to deep space is taking place at this time
- The ISS model of cooperation could be used for exploration of low Earth orbit but would it would have to be a very deliberate effort over time
- The development of the Vision for Space Exploration moved too quickly to permit European involvement
- The G-20 summit would be the best place to discuss such cooperation especially if new countries are sought that were previously not a part of the ISS partnership (China, India, etc.)
- The Moon as a goal would at least give creditability to U.S.
 - International Partners want stability to plan, a plan that doesn't change every 5 years
 - The fact that the Space Station was late by more than 10 years did not prevent success. From partners' perspective, it is better to be late than to change direction
 - Flexible path provides smaller steps where Europe can participate. If ESA has time and political support it can take on specific initiatives but not *anything*.
- Europe wants to build things in space, not just go there and come back.
 - Planning to build bases in space is good sign of commitment
 - Europe can contribute here.
- Sustained Policy
 - For human exploration, Augustine Report provides opportunities in its options for Europe to participate in the long-term
 - The dates that were set by the Vision for Space Exploration are not compatible with European capabilities.
 - The extension of deadlines to Moon, Mars and beyond is not seen as a catastrophe to Europe. Again, better late than to change direction.

Panel 3: Security and Commerce

MR. BRETT ALEXANDER, *Commercial Spaceflight Federation*

- Recent flight successes by ULA, Orbital Sciences, and Space X highlight the capabilities of the commercial sector
 - Displayed flights success rates for Atlas, Delta, Pegasus, Taurus
 - Space X has now had two successful flights of the Falcon I
- It's surprising that commercial space has come under such harsh scrutiny by recent House hearings.
 - NASA's confidence in the commercial sector is reflected by signed agreements for commercial services worth \$3.5 billion
- In terms of human rating commercial vehicles, NASA will be involved "every step of the way"
 - The commercial space flight sector considers safety paramount and lives by that principle; otherwise it would not be in business

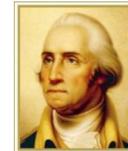


- Human space flight is not new. We have been doing it for 48 years. Technical requirements are well understood. U.S. commercial industry has been involved in human space flight from day one.
- The issue of “human-rating” expendable launch vehicles is a non-issue. Even Mike Griffin testified in 2003, the differences between relying on expendables for Mars rovers, national security payloads and safeguarding humans was ‘zero.’¹
- Furthermore, rendezvous, proximity operations and docking have been validated by US, Russia, Europe and Japan.
- Astronauts will not fly on unproven vehicles
 - The Atlas V has a long and proven track record, and the team that puts it together and launches has a demonstrated track that goes beyond the vehicle itself.
 - Falcon 9 and Taurus II will have conducted multiple cargo flights to ISS under COTS prior to being permitted to ferry human crew to LEO
 - Contrast with the fact that Ares 1X/1 will have completed two test flights prior to being permitted to carry crew to LEO
- Members of the Commercial Space Federation are not in competition with Ares I
 - All Augustine Commission options that do not extend ISS operations include Ares 1
 - It’s a choice between Ares 1 and ISS
- NASA’s current plans are to “outsource” ISS crew transport to Russia
 - This will cost \$51M/seat for 4 to 6 years using either NASA’s schedule or the Augustine Commission timeline.
 - Should we build the industry here onshore or do we send that money to Russia?
 - NASA requested \$27B more to close the gap while the Shuttle manifest was flown out while a new system was developed. That was a 33% budget increase, which was unsustainable.

MR. ERIC STERNER, George C. Marshall Institute

- Space does not appreciably affect geopolitics
 - Seeing space as a leading of political events can be likened to “It’s the tail trying to wag the dog.”
 - Space does have some impacts but it is a much lower priority in the minds of Congress
- International cooperation is useful but policy makers should be aware international partnerships have risks. You inherit or import into your program all their bureaucracy, all the budget woes. ISS proves you can do it, but it took us 25 years.
 - China is an example to consider

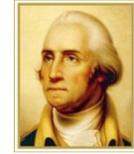
¹ Note: Mike Griffin argues that this confuses his comments on launch vehicle reliability with design changes necessary for launch vehicle safety for human missions.



- How would the U.S. deal with human rights issues if China were a partner in space exploration? It matters what values you take into space. How do you deal with proliferation issues? The Clinton administration threatened to cut off space-related payments to the Russia for its proliferation behavior with Iran
- States pursue power in zero sum games, but cynical idealists would say we can always do better
- From a space security standpoint, space is integrated with:
 - Military operations
 - Our economy
 - Our industrial base.
- Another space policy issue is ITAR.
 - ITAR has a purpose but it can have longer term unintended effects
 - What is the cost benefit of ITAR?

MR. ROBERT READ, Office of the Undersecretary of Defense (AT&L)

- NASA is the “800 lb gorilla” in the world of Solid Rocket Motors
 - One Shuttle stack is equivalent to 10 Trident II D-5 and 17 Minuteman III missiles in terms of solid propellant weight
 - The DoD is concerned over the potential loss of SRM suppliers once the Shuttle is retired
 - The DoD will be studying the issue further, given the national security implications of further decline of the SRM industrial base.
- We are married to solid rocket motors, a mature technology
 - For good reason: they’re more responsive and they require less maintenance
- Industry consolidation has occurred
 - Previously 5 U.S. firms produced solid rockets, whereas now only ATK and Aerojet exist
 - Even though there was considerable consolidation in the number of firms, there was not a corresponding consolidation in infrastructure. Hence, there is a lot of excess industrial capacity.
- Activities impacting solid rocket motor industry sector:
 - Cancellation of the Kinetic Energy Kill Vehicle halted the ground based interceptor program
 - Nuclear Posture Review
 - Ballistic Missile Defense Review
 - NASA path forward
 - Congressional House and Senate language is under development directing DOD to develop an SRM sustainability plan.
 - They are seeking to establish a working group that includes all stakeholders



MR. JOHN KARAS, Lockheed Martin

- Industrial base and work force issues transcend both civil and military space
 - The loss of both Ares I and Ares V would result in closure of Michoud
 - Budget reductions have only allowed Lockheed Martin to hire 250 staff at Michoud
 - The preferred goal was 500
 - USA and Lockheed Martin will be having layoffs later this year
 - Significant industrial base issues a result of budget cuts to Constellation to make it more efficient.
- CEV PDR was successful
 - Many subsystems are mature and closer to CDR stage
- It's important to define what constitutes "commercial" space
 - Originally the goal was not to be the cheapest or fastest developed spacecraft because Lockheed Martin was working closely with NASA, sharing processes and techniques to reinvigorate space systems engineering talent,
 - Focus could be shifted to value added capability much more like the entrepreneurial launch service providers. In effect, we can extract more value with fewer dollars than the current program.
 - Reliance on COTS companies for ISS servicing should be done carefully, and should also complement the Ares/Orion development and use
- The recent Ares test firing with no oscillation shows it to be an "exquisite LEO machine"
- The Augustine Commission is right in calling for a heavy lift vehicle
- Destinations are not as important as picking a destination and sticking with it
 - Recruitment of young talent depends on this