



If NASA is to return to the Moon, it will likely require a major overhaul of policy, plans, and budgets. (credit: NASA)

Which way is up?

by Dwayne Day
Monday, October 5, 2009

[Comments \(27\)](#)



We all knew this was going to happen. It was only the details that were unknown.

Back in January 2004, when George W. Bush announced the Vision for Space Exploration, a lot of the media reports about the plan, particularly in the trade press, pointed out that there were some major questions about it. One of those questions was the ability of a far-reaching human space exploration plan to survive multiple administrations and multiple congresses. Another was about the cost, including the claim made by the administration that the plan could be paid for without any substantial increases in the NASA budget. Closely related to this were questions about the administration's commitment to the policy, particularly in terms of budget. Could NASA craft a program for achieving the goals of the Vision if the administration was not truly committed to funding it?

Over the next several years, it became apparent to everyone watching NASA that the administration's commitment was at best lukewarm. Although it has become a cottage industry today to lay blame at the space agency itself, it is clear that Bush did not continue to publicly, politically support the plan he originally established, and over time his administration drained money from the space agency.

So here we are, with a space exploration program that cannot be executed without at least the return of the budgets that were originally promised. The recently completed [Review of Human Space Flight Plans](#)

Although it has become a cottage industry today to lay blame at the space agency itself, it is clear that Bush did not continue to publicly, politically

Committee, better known as the Augustine Committee, has thrown all of those issues, and more, into sharp relief. The Committee's work was the subject of a half-day symposium held on Monday, September 28, by the Space Policy Institute of The George Washington University. The speakers came from industry, the Department of Defense, academia, and Congress to discuss various aspects of the issues raised by the Augustine Committee. One thing that became apparent during their discussions was that the issues are much more complicated and nuanced than most Internet commentary takes into account. They include everything from industrial base and workforce considerations to procurement policy and recent government experience in other areas of space acquisition.

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Budget is policy

The introductory speaker was the Director of the Space Policy Institute, Scott Pace. (Pace's charts can be accessed [here](#).) Pace began by noting that there are currently multiple policy reviews underway within the executive branch on aspects of American space policy. Of course, the White House is, in collaboration with NASA, determining how to respond to the Augustine committee. But the National Security Council is also leading a Presidential Study Directive review of the American national space policy. In addition, the Department of Defense is also conducting a congressionally-mandated "Space Posture Review."

According to Pace, the presidential policy established in early 2004 gave nine directives to NASA. The agency has achieved, or is close to achieving, several of these. But it is clearly not going to fulfill several others unless substantial changes are made to the program, and additional money is provided.

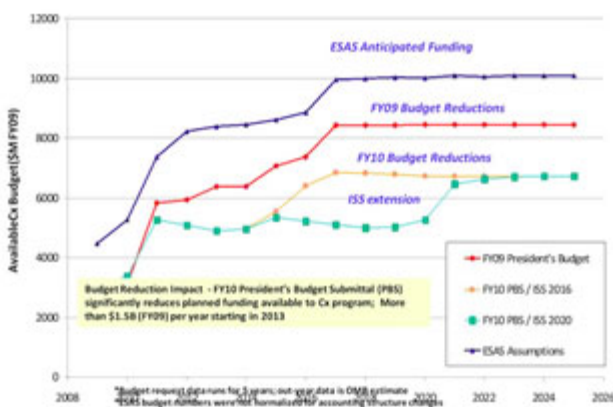
2004 National Goals to Directives to NASA

-  Complete the International Space Station
-  Safely fly the Space Shuttle until 2010
-  Develop and fly the Crew Exploration Vehicle no later 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

Pace also talked about something that he often stressed to his students: "budget is policy." Although the Bush administration had outlined a new space policy in early 2004, it had pursued what was in many ways a different policy in its subsequent budgets, which continually reduced the money available to the space agency below that which the administration had originally promised to provide. This made it impossible for NASA to plan a program based upon budget promises that were later reneged.

Pace showed a graph presented by Sally Ride at one of the committee's hearings that illustrated the different funding levels for the Constellation program that were promised to NASA over the past five years. As time went on, less and less money was made available to the program. The different levels fanned out, always curving down. He said that within NASA this was referred to as "the sea-fan of death." (Author's note: one thing that has been ignored by much of the media coverage and commentary concerning the Augustine Committee's recommendation of an additional \$3 billion per year for NASA is that this is essentially the money that was removed from the budget, combined with that required to maintain the ISS to 2020.)

Projected Constellation Program Funding has seen Significant Reductions since ESAS



Budget Reduction Impact - FY10 President's Budget Submittal (PBS) significantly reduces planned funding available to Cx program; More than \$1.5B (FY09) per year starting in 2013

*Budget request data runs for 5 years; out-year data is OMB estimate

According to Pace, the retirement of the Shuttle and the development of Constellation is being handled by NASA in a fundamentally different way than the transition from Apollo to Shuttle, when massive numbers of trained aerospace workers were fired and it was literally true that aerospace engineers were driving taxicabs. In contrast, Pace explained that this time NASA is trying "to treat the transition as an integrated whole." The agency is trying to avoid completely losing knowledge and skills in its workforce by transitioning employees from Shuttle to the new program with minimal disruption.

Pace then displayed a detailed listing of all of the budget cuts and hidden takes from NASA over the past five years. These included everything from money that was promised in the out-year budgeting plans upon which program decisions were based, to inflation and to actual cuts in the NASA budget. By his calculation, NASA had taken over \$42 billion in hits against its "nominal program."

He then outlined what he considers to be the underlying policy issues. The first question is if there needs to be government-supplied human access to space.

Another policy question is the role of NASA. Should the agency have the ability to do systems engineering itself, or should the agency rely solely on contractors to provide this capability? Pace said that the United States has "gotten comfortable" with US astronauts flying on Russian vehicles and asked what is needed for the government to get comfortable with astronauts flying on commercial vehicles.

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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.

In a partial answer to one of his questions, Pace noted that during the 1990s, the National Reconnaissance Office (NRO) leadership made a decision to lose its system engineering capabilities and rely heavily on contractors. This was “not a good experience,” Pace said. (Author's note: although he did not mention it, one well-known NRO procurement disaster that has been blamed at least partially on poor systems engineering experience and oversight within the NRO was the Future Imagery Architecture reconnaissance satellite program.)

Pace finished with what he considers to be the biggest policy question: why do we have a human space program? What are we doing this for? He said that one of the questions he poses to his students is: is there anything economically advantageous for humans to do in space? If not, is there a future for humans beyond the Earth at all?

The dangers of a camel

The next speaker was General Lester Lyles (ret.), who served as a member of the Augustine Committee. Lyles recounted that the committee had to operate under a number of limitations, including the short timeframe and the requirements of the Federal Advisory Committee Act (FACA). FACA required that the committee hold only public forums and could not deliberate behind closed doors. The committee was also not allowed to make recommendations, only to develop options.

Lyles noted that he had served on previous boards and commissions that prepared him for this and gave him insight into the committee's issues. He had chaired the NASA Advisory Council's aeronautics committee, and believed that aeronautics was still an important national priority. He had also served on a recent national security space committee, and a National Research Council study on the rationales and goals of the civilian space program. Lyles said that there were common themes relevant to all of these committees: first was “the importance of the space program to every aspect of life.” This included national security, science, economics, national prestige, and international relations. Second was a concern about the United States losing its edge in space.

According to Lyles, the charge for the committee established a number of issues that they were supposed to address. This included whether heavy-lift was necessary for human space exploration. Another issue was how to

achieve human access to low Earth orbit. They were also told to develop at least two options that stayed within the FY2010 budget out to FY2020.

Lyles said that in the course of their deliberations, the committee developed some of its own goals. “Safety and reliability was a major goal that we kept in front of us,” he said. They also were concerned with the affordability and sustainability of the overall program. When asked what he meant about sustainability, Lyles said that he was referring to political sustainability.

To tackle such a big charge, the committee members divided up their tasks and formed subcommittees based upon each member’s areas of expertise. “There’s always a risk in doing that,” Lyles said. “You might get a camel.”

Lyles said that the committee’s final report would hopefully be delivered by the end of the month (note: the final report’s release has been delayed). In response to a question he said that it would contain a lot more detailed analysis supporting the conclusions already released. He had just seen chapter 6 that morning and said that “It will be an engineer’s nightmare... or a dream.”

After numerous data-gathering sessions and deliberations, Lyles said, the committee reached a number of conclusions. One was the importance of venturing beyond low Earth orbit. Another was that heavy-lift capability is necessary for the task. He said that the committee also determined that a

separate technology development program was necessary. Currently, all of NASA’s technology development is focused towards specific missions, not for a range of possible future missions. In response to a question about how to maintain a separate technology development line—which tends to be one of the first things raided when budgets get tight—Lyles said that it would be up to Congress to protect it.

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The possibility of a horrible mistake

The next speaker was Tom Young, former CEO of Martin-Marietta and himself the chair of numerous high-level review commissions, particularly of military and intelligence space programs.

Young said that the Augustine Committee had concluded that “the current program is not executable with the current budget.” He added that this was not really a surprise. “A lot of us knew that, but we needed some group to say it,” he said. Another conclusion of the committee was that there is “no credible human exploration program executable with the current budget.”

There are two findings in the report that Young said he hopes are further developed. One concerns what to do with the International Space Station beyond 2015. He hopes that this subject is given a lot of thought. He said that right now the science conducted on ISS is not sufficient to justify the costs. The other aspect that he hopes receives greater attention is the committee’s endorsement of greater international cooperation in the program.

Young said that he thinks that the ISS should be devoted to better understanding long-duration human spaceflight, but added that “The centrifuge, that no longer exists, is critical to that effort.”

Young then turned to what he considered to be an area where he disagreed with the committee. “My personal belief is that today there is no demonstrated mature commercial human spaceflight capability.” He put emphasis on “demonstrated.” Right now, all of the efforts falling under the rubric of “commercial” were either suborbital space tourism, or cargo. Human orbital spaceflight, Young said, is a substantially more difficult proposition. “I hope it happens, I support it, I applaud it,” Young said, “but I would not build a program around it.”

Once again, NASA is trying to put ten pounds in a five-pound bag. “We’ve tried that experiment before,” he added.

Young also warned that in order for NASA to be a smart buyer and to ensure success, the agency needed in-house systems engineering talent. Echoing Scott Pace’s earlier comments, he said that during the 1990s the United States engaged in a number of “acquisition reforms,” including the Air Force’s reduction of oversight of contractor operation of launch vehicles like the Titan IV as well as some of the aspects of NASA’s “faster, better, cheaper” program. (Author’s note: Young was clear that he was not criticizing faster, better, cheaper in its entirety.) “We just fired all of the experienced people,” Young said, and adopted a policy that “government would sit in the back of the room” and let the contractors run the show. “That was a horrible mistake. The net result of that experiment was \$11.2 billion in failures. We tried that experiment, it was a horrible failure.”

Young connected those past efforts at acquisition reform to what he considers the current claims that commercial crew is the way to substantially decrease costs to the government. “There is no magic,” he warned. “When someone comes along and says ‘I’ve got this new magic solution,’ my advice is to run for the hills.”

Young took several questions that were focused upon his remarks about the lack of a credible commercial crew-to-orbit industry. How can such an industry become credible without government supporting it? “You really have to be careful about what you mean by ‘commercial,’” Young replied. “You cannot have government provide 100% of the funding and do no close monitoring.” The only way to do it is to put private money at risk. “The private sector invests in providing a service that somebody comes along and buys. I don’t see an industry that is investing the capital that is necessary, and to the extent. I’m also skeptical of providers where there is only one market.”

Young finished by saying that if he could offer any advice to the people in the White House currently considering what to do about the future American human spaceflight program, it was to “treat it as a policy issue, not a budget one.” He noted that when people look back on the twentieth century, one of the great events they see on the American scorecard is the Moon landings. That was a policy decision, not a budget one.

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Young joked that if he knew where the Obama administration officials were discussing the future of human spaceflight, he would sneak into the room and tack a sign up on the wall repeating what General Lyles had said before

him: “Great nations do great things.” Although he did not advocate a return to Apollo, Young said that addressing every question in terms of annual budget decisions was ultimately a recipe for continued failure. For future generations looking backward at this time “I think it would be a sad thing if on our scorecard was ‘we saved \$3 billion a year’ .”

Policy decisions vs. budgetary decisions

Doug Stanley is currently on the faculty of Georgia Tech, but previously worked at NASA and Orbital Sciences Corporation. (His presentation materials can be downloaded [here](#).) Stanley led NASA’s Exploration Systems Architecture Study (ESAS) that developed the agency’s plans for returning humans to the Moon.

Stanley noted that numerous policy and budget decisions had led to significant under-funding of the Constellation program. This included two continuing resolutions in Congress and other cuts. He displayed a chart indicating the budget line that ESAS had been told to plan for compared to what it was actually now going to get. He explained that buried in these budget planning charts were many assumptions about arcane subjects like the rate of inflation. Arguments over fractions of a percentage point when calculating the inflation rate over the lifetime of a program might seem trivial, but could actually mean a difference of billions of dollars.

According to Stanley, the architecture that emerged from ESAS was the result of a number of assumptions they made when they started their evaluation. Had some of those assumptions been different, their architectural design would have been substantially different. As an example, if the Crew Exploration Vehicle (CEV, now named Orion) had not been required to go to the International Space Station, then they would have produced a requirement for only a single launch vehicle rather than the Ares 1 and Ares 5 combination that they ultimately produced. On the other hand, if the requirement had *only* been for the CEV to go to the International Space Station, they would have selected an EELV (i.e. the Atlas or Delta). Stanley said that now that the assumptions have changed, it was entirely legitimate to question if NASA was developing the right architecture.

Stanley said that there are now some major questions that have to be answered about the human spaceflight program. The first is whether or not ISS should be extended to 2020. The second is if shuttle should be extended into 2011, as now seems likely, or beyond 2011. Another major question is whether or not the United States will pursue beyond-LEO missions and in what timeframe and what budget profile. Another question is the government’s policy toward commercial crew.

This last issue, Stanley said, “is more of a policy decision than a budgetary one.” The reason is that the marginal costs of flying additional Ares I rockets is not significantly greater than developing and maintaining two commercial providers. If the Obama administration chooses to do this, it will have to be for reasons other than saving money—i.e. a policy decision, echoing Tom Young’s closing comments.

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The view from the Hill

After Stanley, the discussion turned to Capitol Hill and the next speaker was J.T. Jezerski, the legislative director for Republican congressman Pete Olson of Texas. He joked that “In my NASA days, I was a ‘One-NASA, ten-healthy-

centers' guy, but now I'm here to talk about the Johnson Space Center."

Jezerski said that Washington is "not unwilling to spend money" at the current time. He noted that NASA has bipartisan support in the Congress, but added that NASA also has bipartisan opposition. He noted that both liberals like Barney Frank and conservative Republicans view NASA as a luxury.

The value of the Augustine Committee, according to Jezerski, was that it focused attention. "The best contribution has been to provide a number that we can all hang our hat on."

Jezerski referred to the rather hostile reception that the committee report received during a recent hearing in front of the House Science and Technology Committee. He said that there was a great deal of frustration in Congress because they did not see a strong Augustine Committee endorsement of a program that Congress itself had already endorsed.

Jezerski also explained some of the changes in the political terrain as it pertains to NASA. The recent turnover during last year's election had not been good to the agency. He noted that the agency's three main centers are now represented by four freshmen congressmen whereas previously they had experienced legislators. In addition, they also lost important appropriator seats. All of this undercuts the agency's ability to get a sympathetic audience on the Hill.

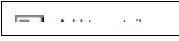







He finished by mentioning a recent editorial titled "[U.S. Cannot Responsibly Avoid a Significant Investment in its Space Program](#)" that appeared in the *Cleveland Plain Dealer*. He suggested that supporters send that editorial to the White House.

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[Paul Spudis](#) · *4 weeks ago*

Spudis said that "all four heresies" are in the Augustine report.

Actually, I said that the four "canons of the faith" are in the Augustine Committee report. I'm the heretic; their report is the orthodoxy.

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P. Remac · *4 weeks ago*

It's so easy... When something seems not to have a way out then look it from another totally different point of view. _Keep the shuttle alive. Turn it into a space liner by designing a cargo module for, let's say, twelve tourist passangers. You will get money to keep it working. In the mean time develop a reentry vehicle and use the shuttle to launch it. You will get incomes with shuttle from both business. _Risky? Be sure. But far less risky that Apollo program. Does life worth much more now? _Ask for american people what do they think about this risk_

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[7 replies](#) · *active 3 weeks ago*



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CharlesHouston 47p · *4 weeks ago*

There is a lot to say about several parts of this but let me restrict myself right now to asking another question. Referring to JT Jzerski's notes, is it political theater alone that had the Congress asking the kind of questions that they asked? It seems that they revealed their ignorance in part and were supporting narrow parochial interests. How could they have been the last people in America that had realized that Constellation was in big trouble??

Certainly they are not technical experts but it they must have known about problems that people had pointed out! Just the fact that a Commission (of such well qualified experts) was formed should have told the Congress that the money flowing to their districts was not being spent well.

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Donald F. Robertson · *4 weeks ago*

Thank you Mr. Day for this extensive summary. It's excellent, as usual.

I've just belatedly read the collection of commentaries on the Augustine report in the 24th August *Space News*. The interesting thing to me is that there is almost no agreement on much of anything, and your summary reinforces that impression in my mind. This is not the way to build a political constituency.

Whatever one thinks of ESAS (and I was opposed to it long before it was fashionable), abandoning it now cannot be good news. The critical need if we are really going to send humans out to explore is "sticktoitness" for long enough to accomplish something. Whatever replaces ESAS is just as likely to be reconsidered in four or eight years.

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Donald F. Robertson · *4 weeks ago*

Part 2

Two thoughts on that. First, it was the international component that politically saved the ISS. In executing ESAS or whatever replaces it, we should take a lesson from that. Having other countries involved exacts a heavy political price

for abandoning a project, or even changing course. If "sticktoitness" is really what we need -- and I think it is -- than our vision should be made as international as possible.

Second, It is vital that all the bits of the human spaceflight community find something to agree on. Surely, those who want to go to Mars, Mars' moons, asteroids, Earth's moon, continue to maintain the ISS, build spaceplanes and fuel depots, can find some technology and some facility that is vital to any of those, and that all can gather around and support. I would suggest commercial transportation to the ISS, long-term near-closed life support, and development of techniques for living off the land on regolith-dominated objects are common to everyone. Maybe these, in some form both research and applied, should be our next set of goals in space.

-- Donald

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[1 reply](#) · *active less than 1 minute ago*

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[Donald F. Robertson](#) · *4 weeks ago*

Common Sense. I don't disagree with you, unfortunately. Since there is no likely consensus, I suspect there is no likelihood of significant progress.

If so, what now? Try to make use of what is already built (ISS, comsats, civil application satellites, and military satellites, and yes orbital tourism, to cobble together enough of a market to let outfits like SpaceX succeed. Once we have a real commercial space transportation industry, the game just may change a little. But, getting into the Solar System this way is going to be a long and winding -- and very difficult -- road. . . .

-- Donald

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[4 replies](#) · *active 4 weeks ago*

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[Danny Deger](#) · *4 weeks ago*

NASA needs a good conceptual design capability, not the same as systems engineering.

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[1 reply](#) · *active less than 1 minute ago*



-1 [Vote up](#) [Vote down](#)



[Daniel Sample 21p](#) · *4 weeks ago*

The Augustine Committee appears to be "much ado about nothing". President Obama charged NASA with setting up the Augustine. NASA went one step further and totally dominated the Augustine. Not one genuinely new or creative idea was presented before the Augustine and that suited NASA just fine. There were a few new ideas buried in the "Emails to the Committee" on the NASA.gov site, but few of them reached the Augustine Committee.

I would like to know what General Bolden, the new head of NASA thinks about all of this. He may still be in Russia, but did anyone think to ask him about the Augustine?

Should the GAO and the U. S. Attorney General be invited to look at NASA's books for the past 30+ years, particularly at expenditures on the SPACE SHUTTLE before Congress spends another nickel on space exploration? NASA

still spends more money, fact, than all of the other space agencies in the world combined. All that money and NASA still can't get its act together and wants more? It is very clear to me that NASA has been lacking in any serious oversight for 30+ years. <http://www.cyrus-space-system.com> Daniel Sterling Sample Space Designs in Los Angeles

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[Don Page](#) · *4 weeks ago*

Has anyone taken another look at the the Shuttle-C study? As the KSC Rep to the study team in the mid 80s, many thought it was a good replacement for the Space Shuttle, max use of existing infrastructure, returnable, cost effective, even unmanned, etc. A lot of time and money went into developing this concept (and others). But it was not "Single stage to orbit" as was dictated by Dan Golden, so it was scrapped. Then came X33. So much for following a good conceptual design approach. You are right, Common Sense

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[1 reply](#) · *active 4 weeks ago*

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[Bob Mahoney](#) · *3 weeks ago*

The Augustine II panel has been just another exercise in standard govt committee operations (someone wrote an article about this process ages ago; the only difference is that Ted Hesburgh isn't the chairperson): study a festering problem that seems to have no easy solution and come to the final, authoritative conclusion that "something needs to be done."

The final report is turning out to be any politician's perfect tool (granted, its charter was crafted to carefully make it just that): a whole lot of mix-and-match options with no concrete recommendations or specified course of action. The politicians can (and are) make(ing) of it anything they so desire, all the while leaving the vital underlying questions unanswered...while most of the country pays it no attention at all.

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[Trent Waddington](#) · *3 weeks ago*

wow, now that was a long article.

Quick question: what's with all these boneheads saying that the only customer of human access to LEO is government? Are they completely unaware that there is over 100 people in line to ride on Russian rockets are \$30M for a 9 day stay at the ISS? It's been this way for about 8 years now, get with the program.

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[krispace 49p](#) · *3 weeks ago*

Part 1_Whew! I've finished! I'm rather surprised that in the interim so many people STILL think the Augustine Committee was there to provide a singular direction for Manned Space. A plethora of Options was always on the cards – as illustrated by the DIRECT people actually being given the time of day! My main

beef is with the inflated budget that went along with the report: produced by a barely competent "Aerospace Company" sponsored by the USAF. I'm really perturbed by all these supposed budget shortfalls/cancellations/diversions which apparently constitute almost a full 3 years of NASA's annual budget. The budget cuts/overruns I've seen don't add up to anything like said figure and furthermore are actually manifestations of NASA's normal "and add another 50% after contract award" cost estimation process which puts every Space project routinely in danger of cancellation. VSE was supposed to address that problem and incorporate the residuals from "faster, cheaper, better" days

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[krispace](#) 49p · *3 weeks ago*

Part 2

If the EELV's were marginal (but no more than ARES 1) per dual mission requirements, why was there no attempt on the part of both NASA and relevant contractors to produce updated concepts as competition to the (virtually) completely new ARES 1 LV which still requires full qualification? Had they not gone completely with ATK's proposals – and in so doing slamming the door on the others – the downgrading of Orion would not have been necessary. Thus we would have been able to take the step-by-step route originally envisaged without huge gobs of money: the perennial problem...

This is what happens when people impose their own personal agenda upon a national situation/scenario and tailor it accordingly. If Obama chooses Option 4B for example it'll be interesting to see if the sabotage crew get busy and screw that up too.....!

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