

NASA AEROSPACE SAFETY ADVISORY PANEL
National Aeronautics and Space Administration
Washington, DC 20546

July 29, 2009

The Honorable Gabrielle Giffords
Chairwoman
Subcommittee on Space and Aeronautics
Committee on Science and Technology
U.S. House of Representatives
Washington, DC 20515

Dear Ms. Chairwoman:

Enclosed are the responses to the written questions submitted by the Members of the Committee on Science and Technology Subcommittee on Space and Aeronautics, resulting from the June 18, 2009, hearing regarding the "External Perspectives on the FY 2010 NASA Budget Request and Related Issues."

Sincerely,



John C. Marshall
Member
Aerospace Safety Advisory Panel

Enclosure

Questions for the Record Submitted by Chairwoman Giffords

1. At the hearing, in response to a question regarding either staying on a 2-year accounting scheme or converting to a 1-year account as is being proposed by the House Appropriations Committee, you indicated that it was essential that NASA stay on the 2- year scheme. Please elaborate on why you believe this is essential, especially as it relates to safety.

Response: As noted previously, the ASAP believes that changing NASA's accounting from a 2-year scheme to a 1-year scheme has the possibility of causing financial turbulence, thereby challenging the agency's stability. Two year accounting allows for a program to have more continuity, year to year, than a one year budget cycle. Research and Development (R&D) programs need longer wavelength budget cycles in order to be effective.

In an R&D environment, requirements are not sufficiently defined at the beginning of each fiscal year to contract for all services in advance, nor are development cycles uniform or predictable across program elements. In this regard, it is critical to retain flexibility to contract for new activities only after the requirements have been fully identified and properly scoped, a process that occurs incrementally throughout the year as projects develop. More importantly, maintaining a critically robust and timely safety program necessitates sufficient budget flexibility to provide for rapid response to risks as they are identified and test failures as they occur.

Maintaining the two-year appropriations accounts provides the foundation for NASA to best manage costs, while successfully executing its programs and projects to achieve mission success.

2. Two consecutive Soyuz off-nominal reentries prompted your annual report to indicate that the Panel remains concerned about the safety of Russian Soyuz spacecraft. NASA has acknowledged that the separation failures "*are still unexplained anomalies*". Since we plan to use the Soyuz spacecraft until 2015, do we need closure on these anomalies?

Response: Even though the root cause for these anomalies cannot be proven, the Russians have instituted several changes to correct the known potential causes of the observed failures. These changes include: adding pyro wire separation; additional grounding and electromagnetic interference protection; additional instrumentation to try to isolate the failure; and installing improved pyrotechnic bolts. These new bolts are a more modern design and have improved electrical performance. Just as important, the Soyuz design is inherently stable during reentry, even with anomalies such as were experienced.

NASA has participated in many of the investigations and performed analysis that supports the general approach that the Russians are using to mitigate concerns from these anomalies. Likewise, the Russians have approached this problem in a similar manner to which NASA would approach such an unexplained anomaly. Based on NASA reports on the Russian corrective actions, the ASAP believes that the mitigation efforts, plus the robust design margins built into the Soyuz vehicle, can support safe recovery operations.

3. In his response to ASAP questions, Mr. Scolese, commented that "*ISS—NASA's best kept*

secret is just how hard it is, and will be, to keep station operating safely for the long run without a major adverse event." What, from a safety standpoint, is needed to ensure long-term safe operations and utilization of the ISS?

Response: Safety is a unique combination of good equipment, good training, and good execution. NASA and its ISS partners need to be constantly vigilant that all the equipment in the ISS works per design and any unusual incidents are investigated, studied fully, and adjustments are made quickly. The training of the ISS crews is also ongoing, and this is a strength. Lastly, it is important to never become complacent. The primary constraint for executing such a balanced approach is having sufficient budget flexibility to maintain a robust response capability.

4. The ASAP report identifies the need for NASA facility maintenance and upgrading as a critical issue for the agency. How serious is the problem of aging NASA infrastructure and what is needed to address the issue? What are the implications of not addressing these issues with NASA's infrastructure?

Response: The agenda for each ASAP meeting held at NASA Centers includes a walk-around to view first hand activities provided by the Center. During these walk-arounds we are seeing facilities of the Apollo and NACA era used in the early days of Shuttle testing again being used for Constellation projects. Evidence of years of neglect in water main breaks, burst pipes, roof leaks, HVAC system failures, electrical substation or other feeder system failures are common. There likewise is a very serious problem associated with maintenance of supporting institutional facilities and the infrastructure for utility systems, including high pressure gases, steam, water, electrical systems and high voltage, etc. The impact of such failures can range from short-term work disruption and delay to damage to flight hardware and threats to safety.

Reacting to unplanned, emergency repairs is very expensive, and further depletes NASA's ability to perform preventive maintenance and facility renewal. Direct programmatic funds are being expended to take care of major maintenance and upgrades needed in facilities where flight hardware may be at risk.

The ASAP's visit to Glenn Research Center (GRC) provides an excellent example of the implications of not addressing the maintenance and upgrading issues with NASA's infrastructure. Glenn is one of NASA's older centers, and there had been plans, not long ago, to close the facility. As a result, maintenance programs were dropped. Therefore, the challenge now is to rejuvenate aging buildings and roadways, while at the same time undertaking new construction. An example of older equipment now in need of attention and for which there are safety-of-personnel issues are pressure vessels at the Center, some of which require engineering for proper maintenance and pressure re-certification. Further complicating these efforts is that engineering documentation for a large portion of the pressure system infrastructure has been lost over the years, and it needs to be re-developed. Another example of the institutional infrastructure problem at GRC was a break in a major water main that caused the entire Center to be closed down because of the loss of fire protection systems. This shutdown resulted in

considerable loss of productivity and a significant cost to the Center.

Since most of NASA facilities are more than 40 years old, they are becoming increasingly more expensive to operate as well as maintain. Also, NASA's initiative to remove unneeded and aged facilities is one that the ASAP supports, but to reduce operating costs in the long term, incurred demolition costs can be very expensive. The result is that deferred facility maintenance associated with the institutional infrastructure continues to increase to offset increasing costs in facility operation and demolition in NASA's operating budget. In lieu of a budget increase to fund these deferred costs, NASA personnel, valued facilities, and productivity may be placed in jeopardy without careful scrutiny of the overall risks.

Significant additional resources are needed to address this serious problem. The implication of not addressing the issue is a steadily increasing risk of failure of major facility systems.

5. The FY 2010 Commerce, Justice, Science, and Related Agencies spending bill recommends the consolidation of all institutional and programmatic construction. In your opinion, is that a good idea or would it have unintended consequences. What impact would the proposed funding account consolidation have on the ability to ensure that facilities receive needed improvements in an expeditious manner? Is there a need for a targeted agency initiative on facility maintenance and modernization?

Response: The ASAP has no basis on which to provide counsel on this question as it is outside the panel's focus.

6. The Panel's annual report lists, among NASA accomplishments in 2008, *"the emergence of more cohesive and cooperative relationships among Centers"*. Was it the Panel's assessment that NASA's policy of 10 Healthy Centers is working well? Can you provide examples of such improvement and what NASA is doing to maintain that level of cooperation? Do you have any concerns that need to be addressed?

Response: It is the panel's opinion that NASA has made substantive, positive progress in the direction of 10 healthy centers. Work being performed by the NESC at Langley for all Centers and better cooperation between Marshall and Johnson are just two examples. The ongoing effort around technical authority is keeping the communication flowing, so the new NASA structure and work processes are helping to promote the "10 Healthy Center Concept."

The panel has raised the question – "Could NASA more efficiently and economically operate with fewer centers?" We appreciate the political and public challenges of rationalizing government facilities; however, fewer, stronger centers could possibly relieve ongoing funding shortfalls and ease needed improvements to infrastructure.

This said, the ASAP believes there is more work yet to be done on this, particularly in standardizing practices common among the centers, and the ASAP will be looking for continued efforts in this area. One current example is that we are asking for safety data from all centers be reviewed in public at our meetings for leanings that can be leveraged.

Questions for the Record Submitted by Ranking Member Olson

1. During our June 18 hearing, witnesses were in general agreement that converting NASA's spending authority to one-year money would create new hardships for the agency. Could you elaborate on the consequences of such a change, and perhaps provide an illustrative example?

Response: As noted in the response to Chairwoman Giffords first question, the ASAP does not agree that this proposed change helps NASA, but in fact will cause financial turbulence at a time when stability is required.

2. Reestablishing Advanced Technology Development as an independently funded and managed program has been cited as an important reform if NASA is to enhance its capability to develop new and perhaps paradigm-shifting technologies. What caused the agency to abandon this approach? Was it simply budget; was the return on investment in question? How much annual funding would be required to re-establish a credible program?

Response: The ASAP has no basis to provide counsel on this question as it is outside the panel's focus.

3. The International Space Station will, in all likelihood, be utilized by NASA for some years beyond 2015 but at present the agency appears unwilling to make such a commitment. Our international partner space-agencies have been looking for a firm signal from NASA for such a commitment, as it helps them deal with their governments to lie in long-term funding programs. What's preventing NASA from making such a commitment now?

Response: The ASAP has no basis to provide counsel on this question as it is outside the panel's focus.

4. What are your thoughts and concerns about engaging more intensively with international partners to fly joint missions? What are the primary disadvantages against joint international missions, and in your view, would US science research priorities likely be jeopardized if we were to aggressively engage in joint missions? To what degree do export control restrictions make joint missions unwieldy and difficult to manage?

Response: The ASAP has no basis to provide counsel on this question as it is outside the panel's focus.

5. Reinvigorating NASA's workforce is especially critical given the average age of the agency's employees. How would you describe the attractiveness of NASA as a prospective employer, especially from the perspective of a young 'fresh-out'? Would they tend to look at NASA as a career choice? How can NASA best ensure that the knowledge and 'lessons learned' will be passed from the current generation of scientists and engineers to the next?

Response: From all indications, NASA still is successful at attracting coop students, interns, fresh-outs, and other early-career individuals when vacancies are available. During the past year the Agency has been receiving, on average, over fifty applications for every advertised position; that number has risen to almost 120 during each of the past two months. The ASAP has thus far not heard of indications from hiring managers that sufficiently skilled candidates are missing from those applicant pools. We believe that this stems from several factors, including:

- NASA's unique programs and associated facilities that provide opportunities in aeronautics, science and engineering that are not found (or rarely found) in any other parts of the government - or even the private sector;
- The opportunity to be part of an organization that has a focus on the future, as well as contributing to improving the quality of life on our planet right now;
- Working in an agency recognized across the government as an employer-of-choice (as demonstrated in successive Federal Human Capital Surveys), with particular focus on recognizing and rewarding talent and establishing an excellent work-life balance; and, more recently,
- The security of government service during an uncertain economic period.

That said, the ASAP believes there are several factors at work that potentially discourage qualified candidates from seeking NASA positions, including: relatively few positions are available given constrained civil servant ceilings and low rates of attrition among the current workforce; concern about adequate opportunities for meaningful, hands-on work early in their careers (a combination of a relatively small number of new programs and low attrition); and uncertainty over the sustainability of major programs across multiple administrations.

We concur that passing along knowledge to the next generation of NASA employees is a critical concern. There are multiple mechanisms for doing so, and from our observations NASA is taking advantage of many of those. For example, the Agency has taken steps to increase formal and informal mentoring programs throughout the Agency. Although focused primarily on enhancing leadership skills, such programs also serve to pass along technical knowledge. A recent "career pathing" program has also been successful in capturing and documenting the developmental experiences of senior Agency personnel from multiple disciplines in order to guide newer employees along similar (or different) paths. One of the most successful mechanisms, however, is working side-by-side with more experienced personnel, and one of the objectives of the Agency's new Early Career Hiring Initiative is to bring substantial numbers of new employees into the Agency far enough in advance of anticipated retirements so that a period of overlap is available for the more experienced employees to pass along what they know before leaving.

Another NASA activity that focuses on knowledge sharing and lessons learned is the Office of the Chief Engineer's Academy for Program/Project/Engineering Leadership (APPEL) program. APPEL places a great deal of emphasis on lessons-learned and mentoring programs designed to pass knowledge to successive generations of engineers and program/project managers. This is done with two primary training activities: courses and performance enhancement. For example, APPEL has recently

added a two-day “Space Systems Development: Lessons Learned” course to the curriculum that reviews numerous NASA case studies involving designing and building space flight hardware.

6. Over the last decade, NASA has employed several different financial management schemes that directly affect managers and the manner in which they account for — and control — costs within their programs and missions. How effective, and how transparent, is the current system, especially from the perspective of program and mission managers?

Response: The ASAP has no basis to provide counsel on this question as it is outside the panel’s focus.

7. You recommend that NASA needs to take a more aggressive role articulating human rating requirements for the COTS (Commercial Orbital Transportation System) program. Could you elaborate? Has NASA not yet developed a set of specific standards for potential commercial providers? Will commercial providers be held to a lesser standard than exists today for Orion/Ares?

Response: No, NASA has not yet developed any specific information for COTS providers for human rating requirements, other than those required while delivering and docking with the ISS during cargo missions. In this regard, the ASAP believes NASA is late in developing these important requirements.

The scope of the COTS project and demonstrations involve the development and operation of an end-to-end space transportation system of services including ground operations and integration, launch, rendezvous, proximity operations, docking or berthing, orbital operations, reentry, and safe disposal or return. For the Phase 1, Technical Development/Demonstration funded Space Act Agreements (SAAs), the objective has focused on the qualification of the launch vehicle for cargo delivery and return, including rendezvous and berthing with the International Space Station (ISS). As part of these demonstrations, NASA’s approach has been to review Safety and Mission Assurance products, including the safety and mission assurance plan, hazard analysis, safety assessments, risk assessments, probabilistic risk assessments, software assurance and the human-rating plan, during partner design reviews to assure that safety is built into the design and development process – all for the cargo mission.

With respect to a set of specific NASA standards for the potential commercial providers, at the present time the agreements only impose the applicable ISS visiting vehicle requirements as a condition for using the ISS as an orbital destination and active test bed. Space Station Safety Review Panel’s (SRP) phased safety reviews will address rendezvous, approach, docking, undocking, and separation, and compliance with ISS safety requirements. The SRP’s approval will be required before being allowed to rendezvous and berth or dock with the ISS – again for the cargo mission.

Launch and reentry requirements are imposed by the Federal Aviation

Administration's Office of Commercial Space Transportation (FAA/AST), through their licensing of all of the COTS demonstration missions. The FAA/AST licensing and regulatory authority does not extend to orbital operations. FAA/AST has the authority to issue licenses for launch and reentry operations with humans aboard with the licensee responsible for crew and space flight participants' safety to assure the safety of the public and the protection of property.

The FAA licensing involving human spaceflight will proceed in a multi-step process, starting with experimental operations handled on a case-by-case basis, thus allowing for the regulation to mature as the industry gains relevant flight experience. As directed by Congress, the FAA's final rule for Human Space Flight Requirements for Crew and Space Flight Participants, which became effective on February 13, 2007 expressly addresses requirements for space flight participants (SFP) (the presumed role of a NASA astronaut) to be one of written consent and oral questioning of the operator so as to achieve some type of " - - -affirmation that the space flight participant understands what he or she is getting into before embarking on a mission." The rule indicates that the operator must inform each SFP in writing about the risks of the launch and reentry vehicle type; the known hazards and risk that could result in death, serious injury, or total or partial loss of physical or mental function; and also that there are unknown hazards. The rule indicates that an operator must inform each SFP that the "United States Government has not certified the launch vehicle and any re-entry vehicle as safe for carrying crew or space flight participant."

Therefore, in order to assure that the level of safety for the NASA astronaut on a COTS vehicle be equivalent to that for a NASA astronaut on a NASA-developed vehicle (which NASA has indicated to the ASAP to be their objective), NASA acknowledges its responsibility to define human rating requirements that are required to certify the COTS vehicle as "human-rated," but thus far NASA has not done so. Because the Phase 1 SAAs include an option for crew transportation demonstrations pending successful cargo demonstrations and additional funding, there has been no delineation of the specific human-rating requirements in the SAAs to date.

In addition, in further questioning by the ASAP, NASA had given little thought as to what their approach will be in establishing human rating requirements for the COTS program and how they will accept alternative designs, testing, or concepts of operation, etc. This then provided the rationale for the ASAP to press NASA to take a more aggressive role in articulating human rating requirements for the COTS program early on. As a minimum, the ASAP believes that NASA should begin a dialogue with the funded COTS partners now to address this issue. Further impetus for this action has been provided recently by plans to spend economic stimulus package funding for COTS D to provide, among other things, better definition of what it will take to human-rate a vehicle originally built to deliver cargo to the ISS.

The ASAP concern to some extent has been exacerbated further by media reports about the funded COTS partners' and other commercial launch providers' ease or readiness in being able to comply with the NASA human-rating requirements when the ASAP has several recommendations relating to the new standard NPR 8705.2B, Human Rating Requirements for Space Systems, issued May 2008, and our perceived

problems associated with its implementation within NASA.

8. You recommend that the Office of Personnel Management grant NASA the authority to reemploy retired NASA civil servants without penalty, and you specifically cite Marshall Space Flight Center as compelling case where such a change would be welcomed. Why Marshall, and why not other NASA centers?

Response: The ASAP believes that the ability to re-employ retired NASA civil servants would be of benefit to all NASA Centers in cases where they are experiencing difficulty with recruitment and retention, or meeting an unusual temporary hiring need.

Marshall Space Flight Center (MSFC) was used as an example only because of the large numbers of Department of Defense (DoD) components scheduled to move (or that have already moved) to the Huntsville area as a result of recent Base Realignment and Closure (BRAC) activities. The DoD currently enjoys its own specific authority to reemploy Federal retirees without penalty; the concern is that this gives them an edge over MSFC when competing for local talent. Additionally, retirement eligible NASA employees can retire and be hired by DoD without losing a significant portion of their retirement pay. This puts centers like Marshall at a disadvantage. This is especially troubling during the early stages of a new, major program.

NASA like most other Federal agencies has to seek OPM approval to waive the salary offset. Thus far, their experience has been that this is an arduous and time consuming process and puts the agency at risk of failing to obtain critical personnel on a timely basis.

NASA is using the legislative process to seek NASA-specific authority to reemploy retired NASA civil servants without penalty. If adopted, the legislation would authorize the Administrator to set the pay of reemployed annuitants throughout the agency without a reduction in their Federal salary. Such authority would provide the Administrator the ability to hire annuitants with expertise and corporate knowledge to address short-term critical program needs and mentor the next generation of NASA employees in support of the transition of the Shuttle to Constellation program. If received, such authority would be Agency-wide.

Questions for the Record Submitted by Rep. Rohrabacher

1. It is always easy to advocate for more money for NASA. Assuming however, a relatively flat budget, especially for the years following 2010, what guidance can you offer regarding areas in NASA's budget: what areas are of highest priority to you, and what areas are the lowest priorities? What can NASA or Congress do to maximize the science return on its budget? For instance, do you believe it would be prudent to consider closing one or more Centers? If so, which ones? Are there programs that need bolstering? Please offer your best guidance.

Response: The ASAP has no basis to provide counsel on this question as it is outside the panel's focus.

2. We're all familiar with the large and growing threat that orbital debris poses to our people and assets in space. This Subcommittee recently held a hearing on the topic. AIA recently hosted a briefing on this critical issue. And I think we would all agree that it is critical for us to get working on some form of remediation effort.
 - a. First - do you all agree on that?
 - b. Second - is NASA the right agency to head this up?
 - c. Third - what are the hurdles we need to overcome to create an international effort to get rid of all this debris up there?
 - d. Fourth - what are the proper roles for commercial entities to play in this?

Response: The ASAP agrees that the space debris issue is a matter of growing concern for all space-faring nations, both in terms of current space operations and future planning exercises. The threat posed by orbital debris to the reliable operation of space systems will continue to grow unless the sources of debris are mitigated. NASA clearly has a role to play in protecting its operations from orbital debris and in not contributing to the orbital debris problem. It is beyond the scope of the ASAP to evaluate the roles and missions that might be assigned to the various federal agencies involved.

3. The recent Aerospace Safety Advisory Panel (ASAP) Annual report stated: "From a safety standpoint, the ASAP strongly endorses the NASA position on not extending Shuttle operations beyond successful execution of the December 2008 manifest, completing the ISS." As you know, this leaves us with a significant gap in our domestic access to space. The ASAP report goes on to say "[we] are not convinced that the Ares I and Orion initial operating capability (IOC) date can be improved appreciably by additional resources." So if we can't extend the shuttle for safety reasons, and we can't move up the Ares I/Orion date, how could we best spend resources in trying to minimize this gap in space access?
 - a. (Follow-up): The report also states "There is no evidence that Commercial Orbital Transportation Services (COTS) vehicles will be completed in time to minimize the gap." Except for the fact that there is inadequate funding to fulfill COTS-D, is there evidence that COTS couldn't be available in time to minimize this space gap? Or reduce it? If NASA were to immediately fund these commercial efforts to modify existing launch vehicles and/or develop new ones, what is the best case scenario for their availability?

Response: The difficulty of safely and reliably placing humans into earth orbit and returning them is an immense challenge that is not fully appreciated by many. While the future is bright and our hopes are high for the potential of COTS providers, based on the data available to us at this time the ASAP believes that the chances of COTS being able to advance its own schedule, develop its methodologies, and have successful launches and missions to prove its “space worthiness” in the short time frame before shuttle shutdown are remote. Further, NASA has not yet provided COTS contractors with the requirements that must be met to enable transport of Government Astronauts.

4. There is a renewed focus on NASA looking back at planet Earth, either for climate change research, or weather patterns, or other important roles. But I have always thought NASA did its best work when it was looking outward - when it was a team of true explorers. It's impossible to go over the next hill if you refuse to leave the front porch. Isn't it time that we shifted some of these roles over to other agencies more fully so that NASA can focus on looking out, rather than looking in?

Response: The ASAP has no basis to provide counsel on this question as it is outside the panel's focus.