Horizons

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Accelerating the Crew Exploration Vehicle

STEVE KING, AIAA HOUSTON CHAIR

AIAA HOUSTON

American Institute of Aeronautics and Astronautics

Image at right: Initial Crew Exploration Vehicle concept from Lockheed Martin - Crew Vehicle (top) with the mission module (center) and the Trans-Earth Injection Module (bottom). The Trans-Earth Injection Module would be used to return the CEV from lunar missions back to Earth. [Northrop/Boeing has not released any concept art at this time.] Image courtesy of Lockheed Martin.

Contents

Almost everyone is in agreement that the United States needs a new means to safely and effectively put humans into low-Earth orbit (LEO) and the space beyond – this being recently reinforced by the suspension of Shuttle flights as a result of debris shedding on STS-114. The development of the Crew Exploration Vehicle (CEV) is envisioned as our follow-on vehicle for human space transportation. The question now is: when can we realistically expect to see the first crewed flight of the CEV? From approval to proceed (ATP) to Gemini's first crewed flight, Gemini 3, was 40 months. Apollo 7, the first crewed flight of Apollo, flew 84 months after ATP and includes the setback of Apollo 1. If the Apollo 1 fire had not occurred and the mission launched as planned, the duration would have been 64 months. Many challenges must be addressed before this new spacecraft takes flight.

On January 14, 2004 the official clock on CEV started when President George W. Bush announced the CEV as part of the Vision for Space Exploration (VSE):

> *"Our second goal is to develop and test a new spacecraft, the Crew Exploration Vehicle, by 2008, and to conduct the first manned mission no later than 2014. The Crew Exploration Vehicle will be capable of ferrying astronauts and scientists to the Space Station after the shuttle is retired. But the main purpose of this spacecraft will be to carry astronauts beyond our orbit to other worlds. This will be the first spacecraft of its kind since the Apollo Command Module."*

Initial NASA plans called for the first, "boilerplate" flight tests of the CEV to occur in 2008. They were to be followed by more capable, uncrewed flight tests in 2011 which would lead to an operational, crewed capability in 2014. This plan unnerved many lawmakers who do not want the United States to have to rely on other countries to catch a ride to the International Space Station (ISS) after Shuttle retirement in 2010. In April 2005 during his Senate confirmation hearing, new NASA Administrator Dr. Mike Griffin called for accelerating the CEV program to bring it into service as soon as possible. He established an Exploration Systems Architecture Study team two-weeks later which included as part of its charter these words:

> *Assessing the top-level CEV requirements and plans to enable CEV to provide crew transport to ISS, and accelerate the development of the CEV and crew-launch system to reduce the gap between Shuttle orbiter retirement and CEV initial operational capability (IOC).*

As of this writing the official results of this team study will not be released until August or September 2005. It is generally believed that their assessment will call for an IOC to transport crews to ISS and back again to be available by no later than mid 2011. This is roughly 89 months from the President's CEV announcement. Later versions of the CEV will still need to operate for extended duration in close proximity to or on the surface of the Moon and Mars.

While accelerating CEV to minimize the gap between Shuttle retirement and CEV IOC is a great idea, many programmatic - not necessarily technical challenges - must be dealt with. These include:

Budget: CEV must be adequately funded to have any likelihood of meeting a shortened schedule. This may result in

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Chair's Corner

STEVE KING, AIAA HOUSTON CHAIR

Happy New Year! No, you haven't picked up an old issue of the newsletter. Each July the Houston Section kicks off a new administrative year, and this one promises to offer a lot of content and variety as a service to our membership and community. Our technical committees will be hosting a diverse selection of lunch n' learns and we are working to secure dinner meeting speakers to discuss topics ranging from non-traditional space to the restoration of JSC's Saturn V. Plus throw in a "space trivia" night to determine who has local bragging rights. All of this will be complemented by outings, socials, tours, a kid's balsa glider workshop, a Student Paper Conference, our Annual Technical Symposium, and much more. Stay tuned in for details.

Making all this possible comes from the teamwork and volunteer time of members serving on the Section's Executive Council and its committees. Lance Armstrong could not have won his 7th consecutive Tour de France without the help of his teammates and other riders in the peloton. The Houston Section is fortunate to have teammates that give of their time and can be counted upon in turning our plans into reality. We are always looking to add to our team and get more members involved. Whether your interest is in technical exchange, professional development, community outreach, public policy or networking, there is a place for you. Ever wonder what's happening outside of your local work organization? Getting involved can open up a whole new world of interaction with others regardless if they are competitors, executives, elected officials, educators or students. In addition, you might not be aware that some employers will cover all or part of your AIAA membership based on your level of involvement. Another benefit to consider.

These are exciting and dynamic times for all of us in the business of human spaceflight with many new begins – Shuttle Return to Flight, the start of Crew Exploration Vehicle Phase 1, new NASA top leadership, commercial bidding for Space Station cargo services, the X-PRIZE Cup, etc. May your association with AIAA serve you well as we seek to explore. Let's continue the journey…

-SK

From the Editor

JON S. BERNDT, EDITOR, "HORIZONS"

We've finally seen the return to flight of the space shuttle, and a successful landing. Some have referred to this mission as a very successful test flight (it was an acknowledged test flight) – even among the more successful missions of the shuttle program. Yet, we also witnessed a couple of unexpected events. The press seized on the loss of some foam on the ET – a significant event, to be sure. In the media frenzy that followed, The New York Times labeled the shuttle as an old jalopy. Some are asking if it's ready for retirement (if not for ISS and our international obligations, the decision on whether to retire the shuttle program before 2010 would of course be a lot more clear-cut). Some opinion writers have even called the return to flight a failure, viewing the entire flight in narrower terms.

According to a recent CBS poll (8/3), public support for the shuttle program is at its lowest point in the past 20 years. These figures beg the answer to the question: what information do American citizens draw from to form their opinions? From respected space industry publications? From network news coverage? From publications that write of space events only when there is a sensational event that can be spun to sell as many issues as possible?

Words matter. People can be misled. Bad information sticks around for a long time. Here's a specific example: In 1980, sometimes-sports-writer and avowed shuttle critic Gregg Easterbrook wrote what could be viewed as the journalistic equivalent of shooting fish in a barrel. In "*Beam Me Out Of This Death Trap, Scotty*", Mr. Easterbrook wrote of the engineering hurdles the shuttle program was overcoming at the time. Some of what he wrote was on target, some was misleading, some was sensationalized, and some was incorrect. For instance, of the solid rocket boosters, he wrote: "*Solid rockets can fail in two ways. They can explode; enough said. Or they can shut down spontaneously. If a booster shuts down, there will be 2.5 million pounds of thrust on one side battling zero pounds on the other.*" Solid rockets in general can (and have) exploded, but according to ATK Thiokol, the STS SRB propellant cannot detonate. And I'm not aware of any solid rocket booster that has spontaneously shut down. Neither of Mr. Easterbrook's "two ways" was *the* way that Challenger's SRB failed. In addition, he stated in no uncertain terms, "*You've probably heard, for instance, that the space shuttle will retrieve damaged satellites and return them to earth for*

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(Editorial, continued from page 2)

repair. Not so. It can't. Simply and flatly, can't." That was proven incorrect when, in November of 1984 during the STS-51A (Discovery) mission, two satellites were deployed (Anik and Syncom) and two were retrieved (Palapa B2 and Westar 6). The retrieved satellites were later refurbished and relaunched.

Fast forward two decades. Within 24 hours of the loss of the STS-107 crew and Columbia, Mr. Easterbrook had another article published – this one in Time magazine - entitled, "*The Space Shuttle Must be Stopped*". That article was also rife with error. For example, Mr. Easterbrook claimed that after Challenger, "*the Rogers Commission, ordered to get to the bottom of things, essentially recommended that nothing change."*, as well as *"... no safety systems were added to the solid rocket boosters whose explosion destroyed Challenger."* In at least one other editorial by a different writer, and elsewhere online, Mr. Easterbrook's new article was receiving lots of attention, with some claiming in reference to his 1980 article that he had *predicted* the Challenger disaster. This lent undeserved status to the insight portrayed in his Columbia column. And so, incorrect information was disseminated. That's the way that trillion dollar Mars program costs get legs. In fact, Mr. Easterbrook had a hand in that one, too (see James Oberg's article, "*Bringing space costs back down to Earth*").

Back to the present. Frustration at some of the coverage in the first few days of the STS-114 mission drew a response from Gene Kranz (New York Times):

> *To read and listen to the coverage about the space shuttle, you would think NASA's mission team has taken careless risks with the lives of the seven astronauts who went into space on the Discovery last Tuesday. During the launching, foam fell off the external tank. For the risk averse, the only acceptable thing to do now is retire the shuttle program immediately and wait for the divine arrival of the next generation of spacecraft. I am disgusted at the lack of courage and common sense this attitude shows.*
> ...
> *The technical response to the Columbia accident led to a significant reduction in the amount of debris striking this shuttle during launching. Mission managers have said that the external tank shed 80 percent less foam this time than on previous launchings. Only in the news media, apparently, is an 80 percent improvement considered a failure. Rather than quit, we must now try to reduce even more the amount of foam that comes off the tank.*

Risk and exploration is a hot topic. Today, we stand on the shoulders of those who were willing to take calculated and managed risks in the past. Remember the X-15? [Note: the "X" in X-15 is acknowledged.] Pete Knight, one of the X-15 pilots, recalled: "*I can probably count on one hand the number of flights we made where nothing happened in terms of an emergency, regardless of how big or small the emergency."* The three X-15s made a total of 199 flights. The vehicles, on various occasions, suffered mishaps including: rolling over and over down the lakebed when a strut failed at landing, breaking in half on landing with a heavy load of fuel, having the engine blow up while the vehicle was in a test stand (with a pilot in the cockpit), having the engine blow up while in the air, and a fatal in-flight break-up. Except for the last accident, the vehicles involved were all repaired and flown again. Has the risk aversion "climate" changed since the early years of human spaceflight?

A few days ago on August 17, the Return to Flight Task Group issued its final report. What made the news was not so much the entire report of the 25 member group, but one section (referred to as the "minority report") of Annex A in which seven of the Task Group members present in frank detail their observations of serious problems they felt remained in place at NASA (for instance: not learning from their own mistakes, and reliance on past success as a substitute for the use of sound engineering analysis). A New York Times editorial ("*Mismanaging the Shuttle Fixes*") described some of the concerns conveyed in the minority report, and lists the high qualifications of its seven authors. Other editorials are also critical.

In the RTF TG Final Report itself, there are some positive statements. For instance, in the executive summary of the report:

> *Relative to the 15 specific recommendations that the CAIB indicated should be implemented prior to returning to flight, NASA has met or exceeded most of them – the Task Group believes that NASA met the intent of the CAIB for 12 of these recommendations. The remaining three recommendations were so challenging that NASA could not comply completely with the intent of the CAIB, but conducted extensive study, analyses, and hardware modifications that resulted in substantive progress toward making the vehicle safer. It must be emphasized, however, that, the inability to fully comply with all of the CAIB recommendations does not imply that the Space Shuttle is unsafe.*

From the "minority report" itself:

> *We agree that the improvements to the Space Shuttle and its organization are real, a tribute to the dedicated efforts of many people working hard at all levels and in all parts of the Agency. At the same time, we believe that the leadership and management climate that governed NASA's return-to-flight effort was weak in some important ways that bear discussion. While we explicitly address the Space Shuttle return-to-flight effort, we believe these organizational and behavioral concerns are still pervasive throughout the human spaceflight programs.*
>
> *These observations are not intended as criticism of the entire NASA workforce. We have stated several times – in this report and elsewhere – that within the "working levels," much of the NASA and contractor workforce "got it" and we believe at least some have always gotten it. And, indeed, there are some capable leaders at NASA who also "get it."*

Over the past few weeks, with respect to both the STS-114 mission and the release of the RTF TG Final Report, has the press been accurate? Fair and balanced? Overly risk-averse? Send comments to: editor@aiaa-houston.org.

- JSB

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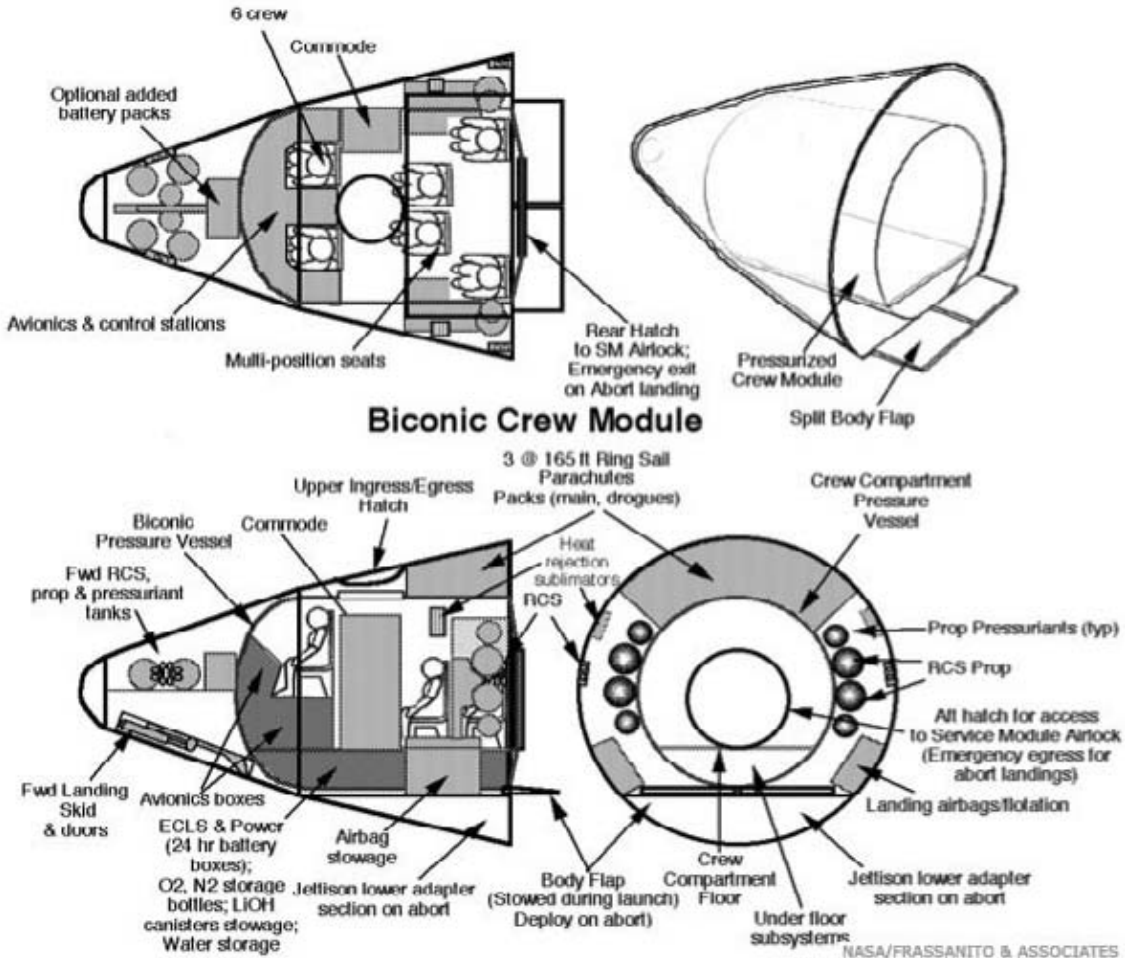
some tough budget decisions within NASA as it attempts to accomplish so much over the next five or so years. Recent fallout from freeing up funding for VSE has resulted in the reduction or elimination of several ISS science and NASA aeronautics projects. NASA's overall budget has little margin for error since it must still compete with other agencies for its budget in the annual appropriations process. NASA's budget at the same time must also deal with realities and dynamics such as a possible redesign of some External Tank components as a result of STS-114's debris shedding. Events like this have an adverse effect on the phased spending plan to safety retire the Shuttle, and complete and operate ISS. Another possible wild card in the mix is the development of possible two Shuttle Derived Launch Vehicles (SDLVs) over the same period. Even though these SDLVs use many existing Shuttle components, they should be looked at as new vehicles. They will require the design of new hardware and software, modification of ground systems, testing, extensive analysis, etc. All of this combined will have a large price tag.



Industry Capacity: Bringing a new human rated spacecraft online in roughly six years is possible, but is still a tremendous task. Consideration must be given to all the support elements for CEV including the launch vehicle (likely the SDLV "stick" configuration), ground systems, simulators, trainers, test equipment, facility modifications, etc. In all, a lot of work that needs to be done. One thing to keep in mind is that the aerospace workforce is much smaller today than it was when Apollo (and even the Space Shuttle) were developed. There is also competition within the aerospace industry for many critical skills. Portions of the workforce are already committed on other long-term programs outside of NASA such as the F/A-22, Joint Strike Fighter, and 787. Others are becoming involved in projects of national importance such as homeland security, and some are drawn to small space startups such as t/Space and Bigelow Aerospace. The creation of the proposed

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United Launch Alliance will likely make other technical skills unavailable. NASA will also be adding a new demand on industry with the need for developing commercial cargo services for ISS. CEV will gain personnel from the Shuttle and ISS workforce; however, their critical skills won't be readily available since they will be needed to ensure safe operations on those programs. Others from this workforce becoming available might require retraining at an expense. As with the availability of enough technical and leadership talent, so exists limits on the supply chain for CEV. Some long-lead components and raw material stock might also be in demand by other programs.

Requirements Creep: The Shuttle is a magnificent and versatile flying machine, but CEV is not intended to replace all of its capabilities. Too often aerospace projects have suffered costly delays and overruns as a result of changing requirements. Past history tells us that CEV cannot be all things to all people. The CEV Program must be vigilant in fending off "requirements creep" while maintaining focus on its top-level mission requirements. There is also a need for requirements "push back" where it makes sense so no obsolete legacy or "nicety" requirements are imposed. There will also be a delicate balancing act between keeping the initial CEV LEO vehicle simple and reliable vs. including extensibility for future Moon and Mars missions.

Launch Vehicle: As previously mentioned NASA will likely push forward with developing a SDLV "stick" configuration for launching the CEV. If so, the certification of this booster will be on CEV's critical path for first flight. Particularly if NASA does not elect to human-rate other boosters as a means of operational redundancy.

National Priorities: There exists a family of other risks to accelerating CEV development which are beyond the control of the CEV Program. National priorities could change in the event of another major terrorist strike within the United States, the loss of another Orbiter and crew before its planned retirement, or with the change in administrations in essentially three and a half years. Dr. Griffin acknowledged that progress must be demonstrated to keep such a long-term program alive. On typical programs tangible results must be shown within five years, but in this case they will be expected by the end of President Bush's second term. Lawmakers and the public must sense real progress and not see just the latest offering in a series of go-nowhere paper studies and PowerPoint presentations. Failure to perform would leave the program vulnerable, and open to renewed debate about spending billions to go to Mars at the expense of other important programs. But for the moment, the VSE and its CEV have strong Congressional backing. Sen. Hutchison (Chairman of the Senate Commerce Subcommittee on Science and Space) was recently quoted saying "At a time when space is becoming increasingly important and relevant to commerce, national security and international affairs, it is crucial that we recognize and acknowledge the importance of our current human space flight activities."

Accelerating the schedule for first crewed flight of the CEV is possible; however, it will take strong leadership on all fronts. Thorough planning and execution is paramount. Execution must be carried out with a realistic assessment and plan to deal with the numerous risks the program may face. Planning cannot become reliant on a success-oriented mindset. Dr. Robert H. Goddard once said "It is difficult to say what is impossible, for the dream of yesterday is the hope of today and the reality of tomorrow." I look forward to the day when a "Go" for flight is given to a brand new CEV sitting primed and ready in the Florida sunshine. Let's make it happen!

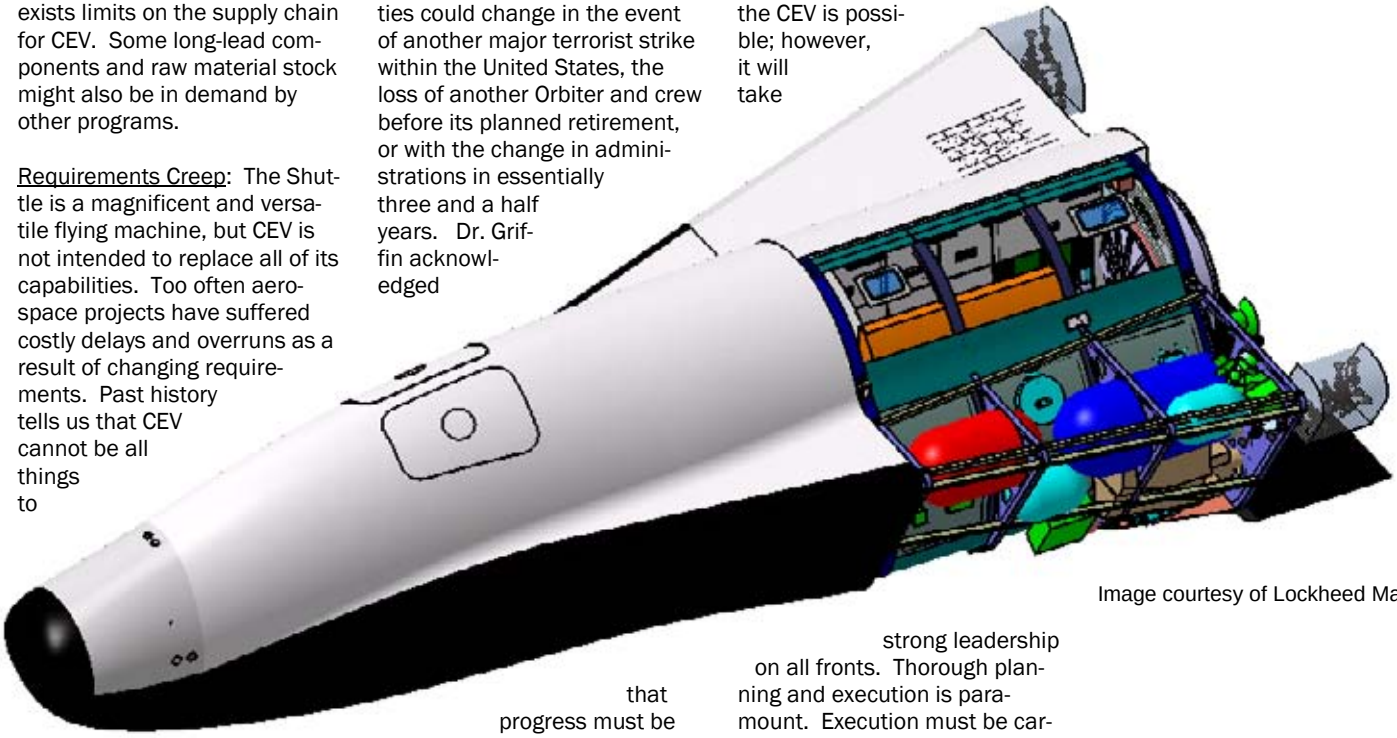

Image courtesy of Lockheed Martin

Letters to the editor@aiaa-houston.org

AIAA HOUSTON

Digital Decay of Documents

To the Editor,

Over recent months I had the opportunity to try out the on-line AIAA journal archive and I come away from it wondering whether our nation's knowledge base for heading into deep space is dissolving into a digitized fog.

My experience and concerns result from working with the NASA Johnson Space Center library system to research papers and issues related to lunar flight dynamics. To formulate new plans for lunar exploration, it makes sense to check how far theory and planning had already gone in the 60s and 70s efforts at solving astrodynamics problems. Obviously stacks of research papers were published in that period and the material was archived in many research libraries (state universities, NASA centers, etc.) for many years. Of course, these institutions experience both budgetary and modernization pressures. As a result, many document collections are disappearing off library floors. Substituting for back volumes of the AIAA Journal, Journal of Spacecraft and Rockets, Journal of Guidance and Control are on line services such as the one I used at the Johnson Space Center to locate a number of papers regarding lunar mission trajectory design and solutions to three body problems in celestial mechanics.

At first I was pleased how easy it was to locate these papers, but then when I began to read them carefully, I noticed many more typographical errors than I had come to expect in such publications. In some instances, I had looked at these papers before and I was certain that the errors were new. Greek symbols were now appeared as Roman alphabet characters; for example, gamma or alpha would become "y" or "n"). The letter "n" sometimes turned into two letters "i". Subscripts for 1 and 2 turned into commas. In other cases I had no idea what the original letter or symbol must have been. In some instances denominators simply dropped out of equations. They weren't cancelled by algebraic division; they were deleted.

Some of the papers I am referring to are the following as particular evidence, but I suspect that this is only a sampling:

1. "*Traveling between the Lagrange Points and the Moon*", R. Broucke, JG&C, Vol 2. No. 4, Article No. 79-4087, July-August 1979, pp. 257-263.
2. "*Stability of Periodic Orbits in the Elliptic, Restricted Three Body Problem*", R. Broucke, AIAA Journal, Vol. 7, No. 6, June 1969, pp.1003-1009.
3. "*Rapid Analysis of Moon-to-Earth Trajectories*", J. E. Lancaster, J. C. Walker & F. I. Mann, AIAA Journal, Vol. 7, No. 6, June 1969, pp. 1017-1023.
4. *"Apollo Lunar Rendezvous"*, K. A. Young, J. D. Alexander, J. of Spacecraft & Rockets, Vol. 7, No. 9., pp. 1083-1086.

This is a serious problem for papers with dozens and dozens of detailed, yet abbreviated mathematical equations. It creates further gaps in understanding of an argument's logic, if it is difficult, concise and refined to essentials already. Engaging in a guessing game adds to the odds of incomprehension or drawing the wrong conclusions.

It is suspected that this problem disappears in recent journal articles, probably electronically submitted in the first place. Cases such as I describe, in all likelihood, were papers which were SCANNED into an electronic medium at a later date after original publication. It was assumed that text errors were absent or negligible, but this has proved not to be the case.

I hope that good hard copies of many of these 1960s and 70s journal volumes still remain at headquarters; otherwise serious losses of data will result if this process of folding up libraries and trusting to electronic archiving continues. Possibly scanner technology will increase the accuracy of the copy if the papers are read in a second time. But if this problem is not addressed, we are going to lose a lot of research and technology that Americans paid a high price for.

And, oh yes, remember all those old journals and clippings you were going to throw away? Think again.

Best regards,

Wes Kelly

[Editor: AIAA has responded, below.]

The AIAA has spent more then two years developing a complete online archive of its journals. In this process, we had to use compression technology to reduce the size of the pdf files for online transmission. In comparing the online files with the hardcopy, we have also noted the discrepancies to which your writer refers. After a fair amount of research and testing, we have identified another compression tool that renders graphics accurately. We are now in the process of replacing the existing files with files processed through this new tool. We

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anticipate that we will be able to replace all files within the next several months.

AIAA is fully committed to creating an online archive that is faithful to the hardcopy and can serve as a durable, permanent record of the enormous research and insights that are conveyed through the more then 50,000 articles published in the AIAA journals.

Thank you again for allowing us to respond (and hopefully to clarify the situation).

Sincerely,
Norma Brennan
–
AIAA Publications
E-mail: normab@aiaa.org

Cost of Education

As Candide said, "In the land of the blind, the one-eyed man is king".

The fact is, a university education in the United States now costs between three and ten times as much for this generation as it did 20 years ago, while the cost of higher education in the other G8 nations is nothing. Zip, zilch, nada, nix. $0.00. That means, Germans and Frenchmen and Japanese come out of college interested in teaching, or science, or social work, or law, and enter into those professions, while Americans come out of college — whatever their *interests* – with a crippling six-figure debt that for all practical purposes restricts their career options to those that are lucrative enough to pay off their loans. Even the Indians are pretty well subsidized for their higher education.

We have somehow managed to set our next generation up to be as NON-competitive in the world market as possible, starting out with a massive handicap compared with their counterparts elsewhere, and as many disincentives as we can muster against choosing a career in education. Why would anyone with a first-rate education run themselves into the poorhouse for the dubious pleasure of teaching the next generation of Americans how to read, write, decline, integrate or mix NaCl?

It means, one-eyed Americans today should probably try to get citizenship somewhere else for their children's sake.

And that is a pretty depressing thought.

Constance Adams

[Editor: Readers may recall that the previous (May/June) issue of Horizons featured an article entitled, "Education and the Future Workforce". Coincidentally, the current issue of Aerospace America features a roundtable discussion, "Examining the U.S. Aerospace Workforce". The specific concern expressed by Ms. Adams is not addressed in the article. The roundtable discussion is good reading, though. Here's an excerpt:

"... intellectual capital is the highest asset this country has. So, the management of that intellectual capital, the knowledge management has got to be number one, because that affects everything else. No matter what you want to do, you've got to have the right people to do it.

... We ought to be in-service training the math and science and other types of teachers so that they heighten the students' appreciation, whether they're going to go into that area or not.

We need comprehensive career planning, so that students have the information to make a learned decision in selecting their career, not driving someone because we need more people in an area.]

"The fact is, a university education in the United States now costs between three and ten times as much for this generation as it did 20 years ago …"

Letter to Editor

Horizons

Horizons is a bi-monthly publication of the Houston section of the American Institute of Aeronautics and Astronautics.

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Legislation

National Aeronautics and Space Administration Act of 2005

Policy Watch at AIAA:

http://www.aiaa.org/content.cfm?pageid=128

Guidelines for writing your representative:

http://www.aiaa.org/content.cfm?pageid=147

June 23, 2005 — The U.S. Senate Committee on Commerce, Science, and Transportation today approved S. 1281, the National Aeronautics and Space Administration Act of 2005 by a unanimous vote. Senator Kay Bailey Hutchison (R-Tex.), Chairman of the Senate Commerce Subcommittee on Science and Space, introduced the legislation, which was co-sponsored by the subcommittee's Ranking Member Bill Nelson (D-Fla.). Commerce Committee Chairman Ted Stevens (R-Alaska) and Co-Chairman Daniel Inouye (D-Hawaii) also co-sponsored the bill.

The legislation authorizes funding for NASA's programs for Fiscal Years 2006-2010. The authorization for FY 2006 and 2007 is consistent with the President's budget request, with the exception of an additional $100 million in fiscal year 2006 for International Space Station research. The authorization includes a NASA budget increase at the level of inflation for FY 2008-2010.

The bill addresses concerns about NASA's capability to launch humans into space once the space shuttle is retired. NASA is directed not to plan on or allow for a gap in human space flight without Congressional approval. In order to achieve this direction, NASA is authorized to conduct the Space Shuttle transition in a manner that uses the personnel, capabilities and infrastructure of the current Shuttle program. The NASA Administrator must report to Congress with an overall Shuttle transition plan, after completion of an overall assessment of space transportation requirements.

The bill directs NASA to implement a science program that extends human knowledge and understanding of the Earth, Sun, solar system and the universe. The National Aeronautics and Space Administration Act of 2005 instructs NASA, as well, to develop an expanded permanent human presence on the Moon, and then extending from the Moon to Mars.

The National Aeronautics and Space Administration Act of 2005 establishes criteria for the development, capabilities and support of the International Space Station (ISS). Additionally, NASA is directed to ensure diverse and growing utilization of and benefits from the ISS.

The bill also requires NASA to conduct a balanced and broad science program, including the development of a plan for a Shuttle servicing mission to Hubble after completion of the first two "return-to-flight" Shuttle missions, unless such a mission would compromise astronaut safety or the integrity of NASA's other missions.

(Source: http://commerce.senate.gov/newsroom/printable.cfm?id=239450)

"The space shuttle propulsion systems are the most reliable systems in the world. The Reusable Solid Rocket Motors used in the space shuttle launch phase have flown 226 times with significant engineering, inspection, and testing supporting well understood operational margins; the Space Shuttle Main Engines have flown 339 times and have over a million seconds of testing!"

- Dr. Scott Horowitz
DIRECTOR OF SPACE TRANSPORTATION AND EXPLORATION, ATK THIOKOL
Human Spaceflight: The Space Shuttle and Beyond, Science and Space Hearing

Staying Informed

COMPILED BY JON S. BERNDT, EDITOR "HORIZONS"

This column points out useful web sites, documents, policy papers, periodicals, etc.

Return to Flight Task Group Final Report
http://returntoflight.org/reports/final_report.asp

Aerospace America: Examining the U.S. Aerospace Workforce
http://www.aiaa.org/aerospace/images/articleimages/pdf/AA_Aug05_RT.pdf

Human Spaceflight: The Space Shuttle and Beyond
Science and Space Hearing (May 18, 2005)
U.S. Senate Committee on Commerce, Science, and Transportation
http://commerce.senate.gov/hearings/witnesslist.cfm?id=1509

NASA Authorization Act of 2005
Report of the Committee on Commerce, Science, and Transportation
http://thomas.loc.gov/cgi-bin/cpquery/T?&report=sr108&dbname=cp109&

Proceedings from the NASA Administrator's Symposium:
"Risk and Exploration: Earth, Sea and the Stars"
http://history.nasa.gov/SP-4701/frontmatter.pdf

New Members

ELIZABETH BLOME, MEMBERSHIP

The Houston Section has several new and transferred-in members. If you see one of these folks at the next section event, please give them a hearty welcome:

Alexandrea Anderson
Nick Baker
Nazareth Bedrossian
Farokh Bharucha
Kyle Brewer
Dennis Carroll
Joseph Coddou
William Davidson
Monica Dubois
Karen Faubion
David Fleeger
Matthew Geistweidt
John Gowan
Sarah Graybeal
Robert Hall
Neal Hammond
Brian Handley
Dallas Hopper
Daniel Houy
Brent Hughes
Myung-Hee Kim
Ying-Ming Kuo
Jessica LoPresti
Michael Machula
Mark Mangieri
Gavin Mendeck
Richard Mrozinski
Khoi Nguyen
Patricia Nesrsta
Brian Payne
Artem Pomnomarev
Gregory Prichard
Faheem Qazi
Leslie Quiocho
Marc Reagan
George Robinson
Jerry Sanders
Mark Schrock
Laura Slovey
Jeremy Steinshnider
Glenn Stromme
Stephen Walker
Michael Weeks

Important notes:

- Not a member? See the end page.

Help AIAA Help You - Update Your Membership Records

ELIZABETH BLOME, MEMBERSHIP

It is often said that the aerospace industry is the only place where you can have the same job for five years and work for five different companies. That is especially true given the industry wide consolidation that has happened in the last few years. As companies have changed so have the building signs and the business cards.

With all of these potential changes have you verified if your AIAA member record is up to date? Knowing where our members are working is vital to the Houston Section in obtaining corporate support for local AIAA activities (such as our monthly dinner meeting, workshops, etc.). Please take a few minutes and visit the AIAA website to update your member information or call customer service at 1-800-NEW-AIAA (639-2422). Feel free to also contact me at 281-244-7121.

The AIAA-Houston section is currently missing information for the following members. If you know where they are, please let them know their contact information is not up to date for AIAA. Or, if you prefer, email me, Elizabeth.c.blome@nasa.gov with any contact information you have.

Missing in action:

Jeff Donoughue
Jeffrey Marshall
Justin Doyle
Henry Hoang
Keun Joo Park
Jeff Phillips
Gable Rhodes
Matthew Schudder
James Watts
Sean Welch

Membership Upgrades

You are eligible for Senior Member status if you have over eight years of professional practice in the arts, sciences, or technology of aeronautics or astronautics. You may be nominated for Associate Fellow status if you have over 12 years of professional practice in the arts, sciences, or technology of aeronautics or astronautics and are currently a Senior Member. You may be nominated for Fellow if you have personally made notable and valuable contributions in the field of aeronautics or astronautics and are currently an Associate Fellow. You may be nominated for Honorary Fellow if you are a person of eminence in aeronautics or astronautics, recognized by a long and highly contributive career in the arts, sciences, or technology of these fields, and are a current Fellow.

AIAA does not charge a fee to upgrade your membership. Your dues only increase when you are elected to Fellow grade.

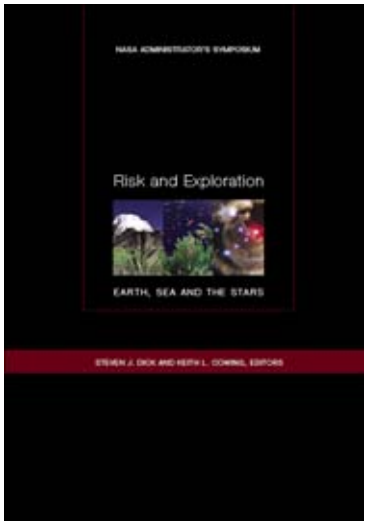
Senior Member applications are accepted and processed each month. Associate Fellow nomination forms are due by 15 April of each year, and references are then due by 15 May. Fellow and Honorary Fellow nomination forms are due by 15 June of each year, and reference forms are then due 15 July.

To receive AIAA membership upgrade information, simply call AIAA Customer Service at 800/639-AIAA. Outside the United States, call 703/264-7500. The Customer Service representatives will be glad to forward membership upgrade information to you. ▲

Books

Proceedings from the NASA Administrator's Symposium: "Risk and Exploration: Earth, Sea and the Stars"

RISK AND EXPLORATION: EARTH, SEA AND THE STARS



The issue of risk and exploration has been forefront in the news again, recently. As the Acknowledgement in "Proceedings ..." points out, it really has been since Columbia was lost. In September of 2004, then NASA Administrator Sean O'Keefe sponsored a Symposium on Risk and Exploration—the idea of NASA Watch Editor Keith Cowing, and NASA astronaut (and then Chief Scientist) John Grunsfeld. The aim of the meeting was to offer "*insights on why we explore, how to balance risk and exploration, how different groups define and perceive risk differently, and the importance of exploration to a creative society.*"

The chapters in the book are made up of the transcripts of speakers' presentations. Groups of speakers are set off into sessions addressing various destinations: Earth, Sea, Stars.

In the session entitled Stars, movie writer/director Graham Yost relates the feelings he has developed about risk in exploration, given his unique experiences. A portion of his presentation is reprinted, below:

▼

In the writing of this episode, "Apollo 1," I decided very early on that I wanted to focus on Frank Borman, who was part of the Apollo 1—it was actually, technically, called the Apollo 204 Review Board. We're going to show a clip from the episode. So this is Frank Borman. It's later on in the episode and it's Frank Borman, played by David Andrews, who's testifying in front of a Senate committee. And I made Walter Mondale the bad guy, but that's a whole other story.

[Dialogue from video clip is indented.]

Senator Mondale: Colonel Borman, would you have entered the spacecraft on the morning of the accident if your turn had been called?
Frank Borman: Yes, sir.
Senator Mondale: Would you have had any hesitancy?
Frank Borman: No, sir.
Senator Mondale: Were there defects in workmanship?
Frank Borman: There were.
Senator Mondale: And did these defects go beyond workmanship?
Frank Borman: Yes, sir, there were defects in design.
Senator Mondale: If you had entered that spacecraft on that morning, would you have been motivated by a desire to take risks?
Frank Borman: No, sir. Sometimes there are romantic, silk-scarf notions attributed to this business, but we're professionals. We will accept it, certainly, but not undue risks.
Senator Mondale: Let me rephrase the question. Knowing what you know now, would you have entered that spacecraft?
Frank Borman: No, sir.
Senator Mondale: Colonel Borman, how did Commander Grissom and his crew feel about the readiness of the vehicle?
Frank Borman: I talked to Ed White shortly before the accident. He thought they were over most of their problems and were on their way . . .
Senator Mondale: Didn't Commander Grissom once hang a lemon on the simulator?
Frank Borman: You had to know Gus.
Senator Mondale: Did Commander Grissom hang a lemon on the simulator?
Frank Borman: Yes, sir.
Second Senator: [interrupts Mondale] Tell us about him, Colonel. Sorry, Senator, I just have a couple of quick questions. Would you yield for a minute or two?
Senator Mondale: Actually, Mr. Chairman, I—
Second Senator: Thanks. Colonel Borman, you just said, "You had to know Gus." And I think that that's been missing in here the past few days. I'd like the record to contain just a little about the men who perished in that fire. Colonel, could you do that for us?
Frank Borman: Gus Grissom was the first astronaut to be asked to fl y three times. Mercury, Gemini, and Apollo. He loved being an astronaut, except for the publicity and display that comes with the job. There are no front windows on the house he built for Betty in Timber Cove because he didn't want people looking in. If that gives you the impression that Gus was a cranky SOB, well, he was, at times. But I would have trusted him with my life.
Ed White was a big man for an astronaut, a shade under six feet. As you well know, Ed was the first American to walk in space. There's a story going around that when he was on his spacewalk, he stayed out after he had been ordered in because he was having such a good time. Funny story, but it would have meant Ed White disobeyed an order. Not going to happen. Ed was a West

(Continued on page 11)

"After working on Earth to the Moon, I was looked at in Hollywood as the guy who, if NASA ever had a problem, would write the thing about it. So I became the disaster guy. This was also incredibly tough. I wrote a screenplay in '99 on Challenger. That has never been produced. Partly because, I think—it was for 20th Century Fox—they were looking for white hats and black hats, and what I found was human beings."

Graham Yost
Writer/Director

(continued from page 10)

Point man. Duty, honor, country were not just words to him. He was one of my closest friends.

Roger Chaffee, I didn't know that well. He was one of the new guys, very energetic, very excited. I heard a story about him, though. He was out on Long Island visiting the Grumman facility where they were building the descent stage of the lunar module. He saw a group of men standing in the corner. He found out these were the fellows that make the tools that make the machines. None of the big wigs that were escorted through there ever talked to these guys. But Roger went over and made them feel like they were the most important part of the program.

Second Senator: Colonel, this isn't a court of law, so I can ask you something that's completely hypothetical. If you could somehow reach beyond the wall of death and talk to Grissom, White, and Chaffee, what do you imagine they would say about the fire?

Frank Borman: I was—I was hoping that someone would ask that. I don't know what Roger or Ed would say, but I can let Gus speak for himself. Back in January, he talked to a group of reporters. They asked him about the dangers involved in going to the Moon.

[Additional indentation to set off reminiscence of Grissom speaking.]

Gus Grissom: We're in a risky business, and we hope if anything happens to us, it will not delay the program. The conquest of space is worth the risk of life. Our God-given curiosity will force us to go there ourselves, because in the final analysis, only man can fully evaluate the Moon in terms understandable to other men.

Second Senator: Colonel, at the risk of being gruesome, we've heard about the fire from everyone who was there, everyone except the astronauts themselves, of course. Can you tell me what they went through? What it was like for them?

Frank Borman: I can only tell you what we know or, at least, what we think we know. When it happened, they were just waiting for the test to resume.

[Additional indentation to set off flashbacks to astronauts caught in Apollo I fire.]

Gus Grissom: How are we going to get to the Moon if we can't talk between three buildings? I can't hear a thing you're saying. Jesus Christ, I said, how are we going to get to the Moon if we can't talk between two or three buildings?

Frank Borman: They didn't see the spark that caused the fire because it was behind the panel door, down below Gus's feet. Because of the oxygen, the spark was able to jump out into the netting under the seats. Gus probably saw it first because it was closest to him.

Astronaut: Fire! We have fire!

Frank Borman: Procedure would have had Gus push down Ed's headrest so that Ed could have started turning the latches.

Frank Borman: Now, it just took me a minute or more to tell you all that. In actuality, from the first mention of the fire to the rupture of the hull only 15 seconds went by.

Second Senator: Colonel, what caused the fire? I'm not talking about wires and oxygen. It seems that some people think that NASA pressured North American to meet unrealistic and arbitrary deadlines and that in turn North American allowed safety to be compromised.

Frank Borman: I won't deny that there's been pressure to meet deadlines but safety has never been intentionally compromised.

Second Senator: Then what caused the fire?

Frank Borman: A failure of imagination. We've always known there was the possibility of a fire in a spacecraft. But the fear was always that it would happen in space when you were 180 miles from terra firma and the nearest fire station. That was the worry. No one ever imagined that it would happen on the ground. If anyone had thought of it, the test would have been classified as hazardous. But it wasn't. We just didn't think of it. Now whose fault is that? Well, it's North American's fault. It's NASA's fault. It's the fault of every person who ever worked on Apollo. It's my fault. I didn't think the test was hazardous. No one did. I wish to God we had.

Second Senator: Now before we all go home, is there any statement you personally would like to make?

Frank Borman: I think I'm safe in speaking for all the astronauts when I say that we are confident in our management. We're confident in our training, in our engineering, and in ourselves. The real question is, are you confident in us?

Second Senator: What do you think we should do Colonel?

Frank Borman: I think you should stop this witch-hunt and let us go to the Moon.

▲

For more information about the book, and about ordering a hardcopy, see the NASA History web site:

http://history.nasa.gov/what.html

"Risk and Exploration" is available online at the NASA History web site:

http://history.nasa.gov

2005 Annual Technical Symposium

TIM PROPP, VICE-CHAIR, TECHNICAL

Liz Zapata, Padraig Moloney, and Norman Chaffee working the registration

Michaela Benda of EADS/ Astrium North America presents "Development and Testing of Sails for Solar Sail Spacecraft"

Jeffery Morris, Texas A&M Aerospace Engineering Graduate Student, presents "Vision-Based Relative Navigation System for Autonomous Space Craft Docking Operations"

Standing room only.

The 2005 AIAA Annual Technical Symposium (ATS) was held on Friday, May 6th at the JSC Gilruth Center. This all-day event was open to NASA civil servants, NASA contractors, industry, and academia.

This year's theme was Space Exploration Initiative. In all, 200 people attended the symposium throughout the day, representing over 25 different NASA and contractor organizations. Attendees enjoyed 47 20-minute presentations made by 43 separate speakers. Some presentations were made to standing room only crowds. The event began at 7:45 a.m. with registration. A minimal fee of $5 was charged for all who participated in the symposium. Breakfast items were provided compliments of Atec, Inc., a local aerospace firm who sponsored a booth at the ATS. Atec specializes in the design and production of quality critical components and test systems for the aerospace and energy markets.

Paul Hill, Lead Flight Director for STS-114 (Return to Flight) kicked off the symposium at 8:15 a.m. Mr. Hill reviewed the Columbia early debris recovery efforts and preparations for return to flight.

The morning sessions began promptly at 9:00 a.m. and consisted of the following topics: Crew Exploration Vehicle (1 session), Robotics (1 session), Future Space Suit Development (1 session), Space Exploration (3 sessions), Simulation and Modeling (1 session), and Aerospace Technology (2 sessions).

Lunch was served at noon in the Gilruth Alamo Ballroom, and was followed by a keynote speech by JSC Deputy Director Colonel Robert Cabana. Col. Cabana discussed the state of the center, the new vision for space exploration, and how the new vision might affect the JSC community. Col. Cabana then led a question and answer session in which he fielded several questions from the audience on the new exploration initiative.

The afternoon sessions began at 1:30 p.m. Afternoon topics included: Space Operations (3 sessions), Space Exploration (1 session), Space Exploration (1 session), Safety (2 sessions), Aerospace Technology (3 sessions). The day concluded with a drawing for a free Space Shuttle model, provided compliments of Atec, Inc. The winner of the drawing was Roy Harris from Honeywell Technology Solutions. Congratulations Roy!

The evening reception featured free hors d'oeuvres and a cash bar. The symposium concluded with a tribute to the late Max Faget, hosted by AIAA Associate Fellow Chet Vaughan. Mr. Vaughan reviewed the fascinating career of Dr. Faget, including a summary of the numerous patents he was awarded during his career at NASA.

The symposium was organized by the ATS Planning Committee: Tim Propp (General Chair), Douglas Yazell (Operations Chair), Norm Chaffee (NASA Interface), Murugan Subramanium (Webmaster), and Ellen Gillespie. The planning committee wishes to thank all those who contributed to the success of the 2005 ATS, particularly the JSC Center Director's Office, the JSC Print Shop, the three keynote speakers, 16 session chairs, 43 speakers, and finally Atec, Inc.

A copy of the 2005 ATS program can be found online at www.aiaa-houston.org/cy0405/event-06may05/ats05_program.doc. Presentations from authors/speakers who have agreed to post their materials on our local website can be obtained at www.aiaa-houston.org/cy0405/event-06may05/program.

Advent Launch Services Soliciting Volunteers

JIM AKKERMAN, PRESIDENT, ADVENT LAUNCH SERVICES

Advent Launch Services is seeking volunteer help.

Advent Launch Services (ALS) is an employee-owned corporation established to provide reliable earth-to-orbit payload deliveries at a small fraction of today's costs and to establish a fully-commercial space program. ALS is a group of NASA retirees having extensive experience with space vehicle development. The Advent concept has been developed using a cost/performance modeling technique which allows the vehicle to be optimized for cost. The proposed Advent fleet consists of a group of vehicles with the same design differing only in size. All the development is performed on the first vehicle, which is the smallest, and is used as the initial orbiter. Successive vehicles are each about 2.5 times larger than the previous vehicle, and can be used as boosters or orbiters.

More than a hundred individuals and three business organizations have supported the Advent design and development activities over the last 15 years. Some individuals have provided technical and analytical support for each and every aspect of the concept.

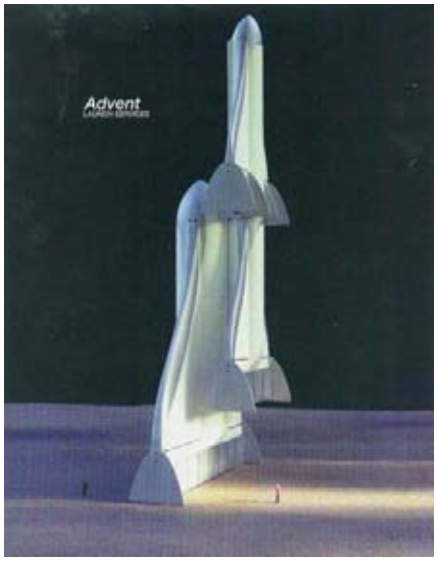
The current effort to raise capital to advance the system development requires current support of several qualified individuals. Hopefully we will be able to have a representative for each of the 15 subsystems (subsystem managers). The System Accounting Model (SAM) documents the concept. It employs the following categories:

1. Wing
2. Fuel Tank
3. Oxygen Tank
4. Engine
5. Orbit Maneuvering System/Reaction Control System
6. Power/Distribution
7. Steering
8. Guidance/Navigation/Control
9. Fairings
10. Thermal Protection System
11. Vehicle Assembly & Verification
12. Payload
13. Payload Ground Service Equipment
14. Vehicle Operations Ground Service Equipment
15. Maintenance Ground Service Equipment

The launch system employs two stages that differ only in size and basic function: orbiter and booster. The same categories (1 through 11) are involved with both stages and they are to be worked on in sequence. Ideally, the same subsystem managers will be available to help with both stages.

The Advent Launch System concept is the product of about 15 years of design and analysis effort. The primary responsibility of each subsystem manager is to review the work already done and provide a response, improvement, refinement, cost reduction, schedule improvement, or other appropriate input. A change in one of the systems will likely have “ripple effects” into the other systems. Each system manager will need to respond to those effects.

Interested parties should contract Jim Akkerman at jimakkerman@houston.rr.com.



A Lunch and Learn Summary Report

In Pursuit of the ISS Phantom Torque

TIM PROPP, VICE-CHAIR, TECHNICAL

The AIAA Houston Section's Guidance, Navigation, and Control Technical Committee hosted a Lunch and Learn seminar on July 26, 2005, in the JSC Building 30 Auditorium. Dr. Jack Bacon, lead of the NASA Mission Analysis & Integration team in the VIPER group, attracted a crowd of 78 to hear the story of the ISS "phantom torque". Over the past 18 months, ISS crewmembers have abandoned the Station to conduct a handful of EVAs on the Russian Segment. Several of the EVA tasks were executed on the aft end of the Service Module, outfitting it for the future arrival of ESA's Automated Transfer Vehicle. It was during these EVAs that GN&C personnel observed unexpected saturation of the US control moment gyroscopes, occasionally causing the ISS to lose control of its attitude, then drift in unpredictable ways. The phenomenon soon became known as the "phantom torque" in the ISS community because its cause was unknown. The ISS Mission Evaluation Room managers assembled a team of experts, including Dr. Bacon, to troubleshoot the problem. One of the early theories was that outgassing from the Docking Compartment-1 was creating the unexpected torque. To test this theory, the starboard Service Module solar array was feathered to an edge-on position with respect to the DC-1 EVA hatch during RS EVA #10 in early August 2004. This theory was quickly discarded as the US CMG's saturated at 92% momentum within 40 minutes. Here's where the story gets interesting. A member of the troubleshooting team hypothesized that the sublimators on the Russian Orlan EVA suits was the cause of the "phantom torque". The sublimator does not have a diffuser, so it is possible to get a directional thrust from the Orlan suit. Many laughed at the concept. How could emissions from an Orlan suit exert a force large enough to have such drastic effects on a 195 ton spacecraft? To attempt to prove this hypothesis, experts used a combination of basic physics and an impressive set of flight data analyses. First, the team derived the force expected from the Orlan sublimator. Their conclusion was that thrust levels of about 0.05 Newtons (0.011 lbf) could be expected from each sublimator. Second, the GN&C team developed a means of extracting the total disturbance torque from the flight telemetry. This technique was used on flight data from RS EVA #11, which occurred on September 3, 2004. The US CMG's saturated 4.5 hours into the EVA, at which point the ISS entered into a loss of attitude control. The reconstructed disturbance torque was injected into a time domain simulation with initial conditions similar to RS EVA #11. The simulation response to the reconstructed disturbance torque compared very well with the actual EVA #11 flight telemetry. To further test the sublimator theory, a disturbance measurement test was conducted in the early stages of RS EVA #11 by positioning the EVA crew face down on the zenith face of the FGB and remaining motionless. With both Orlan sublimators pointed zenith, a positive ISS pitch torque was expected and observed. This data was used by the GN&C team to estimate the magnitude of the thrust vector from the two sublimators as 0.025 lbf. Finally, a reconstruction of the torque throughout RS EVA #11 based solely on crew orientation, crew position, and expected sublimator force was performed. Fourteen distinct periods of the EVA were identified, and torque predictions were generated for each period. The correlation between the GN&C torque backed out from flight data and the computed torque estimates was good: 0.838 in yaw, 0.747 in pitch, and 0.689 in roll. With all of this data in hand, the team of experts was ready to conclude that the Russian Orlan sublimator was indeed the primary source of the ISS "phantom torque". Mr. Bacon concluded his presentation by proudly displaying the US currency he collected from those who were willing to bet against the sublimator hypothesis. If anyone is interested in obtaining a copy of the videotaped presentation, please contact Douglas Yazell at douglas.yazell@honeywell.com.

Image courtesy of NASA

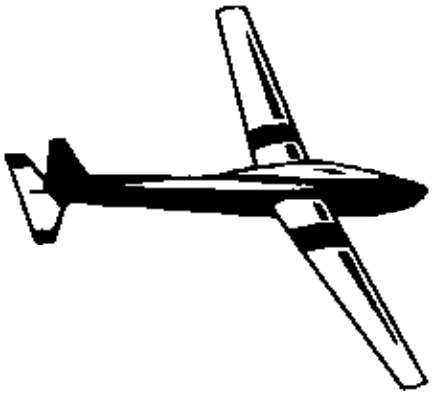
Outreach and Education

Free Glider Workshop

JOY CONRAD KING, PRE-COLLEGE

Who: 100 students (grades K – 8)
What: Hear pilots talk, then build your own balsa glider
When: Saturday, October 22, 2005 9 am – 12 noon
Where: NASA Johnson Space Center Gilruth Center

The workshop is FREE but you must pre-register. Registration starts September 1st at *www.aiaa-houston.org*. Anyone interested in volunteering can e-mail *precollege@aiaa-houston.org*.



The 2005-2006 Mars Rover Model Competition

Date: January 21, 2005
Time: 12:00-5:00 pm
Where: Houston Room, University Center, University of Houston

Primary (Grades 3-5) and middle school (Grades 6-8) students interested in science and engineering will compete in the design and construction of a model of a Mars Rover to carry out a specific science mission on the surface of Mars. The model will be mostly a mock-up, constructed at a minimal cost (estimated cost of less than $10-$25) of mostly found objects and simple art supplies. If desired, teachers may supply students with a low cost ($10) solar powered car kit or a low cost RC car to serve as the chassis. Solar powered RC and free-form models will compete separately. The students will build the models as part of a 6-week fall semester classroom-learning or homework project on Mars. The students will be given design criteria for a rover, and be required to do basic research on Mars that will determine the operational objectives and structural features of their rover. This module may be used as part of a class studying general science, earth science, solar system astronomy or robotics or as a multi-disciplinary unit for a gifted and talented program. Entries will be limited to the first 50 schools to enter. Home school students and organized youth groups are also encouraged to enter. Schools are encouraged to have entire grades participate. Participation in the finals on January 21 may be limited to the best 3 teams of 4 students from each school depending on total number of entries. A $25 entry deposit is required. Deposit will only be refunded when you show up for the contest.

Questions and Teacher Workshops

Contact Prof. Edgar Bering at ebering@mail.uh.edu or Prof. John Ramsey at jramsey@uh.edu for more information.

Entries

Submit no later than Nov. 15, 2005 to Prof. Bering by e-mail.

Section Announcements

AIAA HOUSTON EXECUTIVE COUNCIL

New Young Professionals Chair

The Houston Section welcomes Laura Slovey of United Space Alliance who will be servings as Young Professionals Chair. She will be planning a variety of YP outings, socials, etc. Please contact her at: laura.slovey1@jsc.nasa.gov or 281-483-1685 if you have questions or want to find out more about the YP committee.

Assistant Newsletter Editor Needed

The Houston section is looking for some help in producing the newsletter. The assistant editor would be responsible for helping to collect articles for the upcoming issue, proofread, etc. Interested parties should have a deep interest in aerospace current events and history. Please contact Jon Berndt for more information at editor@aiaa-houston.org.

Student Paper Conference

The 2006 AIAA Region IV Student Paper Conference will be held in April, exact date to be decided, on the campus of Texas A&M University. The Houston Section and the Texas A&M Student Chapter will be the hosts. More details will be forthcoming in future editions of the newsletter.

CALENDAR

August	
26-28	Outing: Ballunar Liftoff Festival (JSC)
September	
12	Executive Council Meeting (Gilruth)
15	Lunch n' Learn: "Business School Admissions Seminar" by Kaplan (JSC Bldg 16 Rm 111/113)
16	Workshop on Automation & Robotics (WAR) 2005, and Innovation 2005 (Gilruth)
29	Lunch n' Learn: "Small Business Innovative Research, Small Business Technology Transfer" by Dr. Kumar Krishen/NASA-JSC (JSC) at Gilruth
TBD	Dinner Meeting (Gilruth)
TBD	Apache helicopter demo (JSC or Ellington)
TBD	Public astronomical observing activity (likely UHCL)
October	
3	Executive Council Meeting (Gilruth)
8-9	Outing: "Wings Over Houston" Airshow (Ellington)
22	Kid's Balsawood Glider Workshop (Gilruth) 9 am to 12:00 noon, JSC Gilruth Live Oak Pavilion Middle school students listen to pilots then build their own balsa wood glider. If you would like more information or to volunteer at the event contact Joy Conrad King at aiaa_houston@yahoo.com.
TBD	Lunch n' Learn: "Advent Launch System" by Jim Akkerman/Advent Launch Services (JSC)
November	
7	Executive Council Meeting (Gilruth)
15-16	American Astronautical Society (AAS) National Conference (South Shore Harbour)
TBD	AIAA Aerospace Historical Site Dedication at JSC
TBD	Lunch n' Learn
TBD	Dinner Meeting (Gilruth)
December	
5	Executive Council Meeting (Gilruth)
TBD	Lunch n' Learn

Cranium Cruncher

BILL MILLER, SENIOR MEMBER

Last Issue

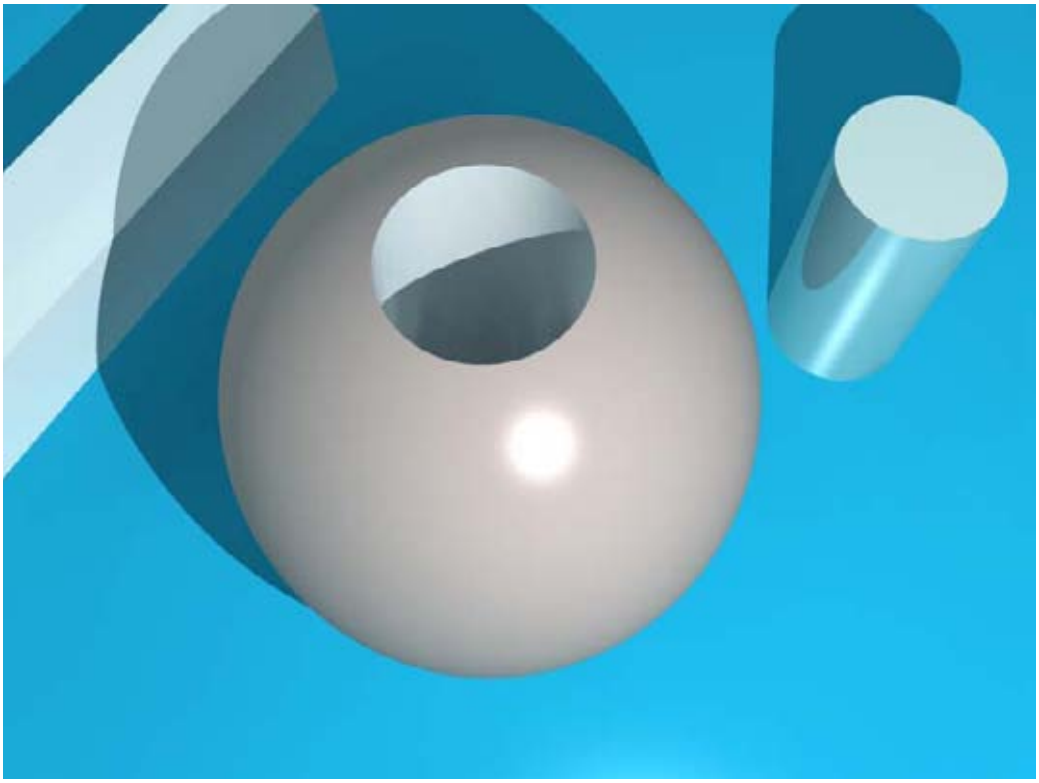
Last month's sphere problem came (once again) from Chapter 12 of Martin Gardner's book Hexaflexagons and Other Mathematical Diversions (1959).

The surprising thing about this problem is that the radius of the sphere drops out of the solution. There are at least two ways to solve it – I think this is the most elegant:

If the problem has a unique solution, the volume must be a constant which holds even when the hole is reduced to zero radius. Therefore the "residue" must be equal to the volume of a sphere with a diameter of six inches - 36p.

Correct solutions were received from:

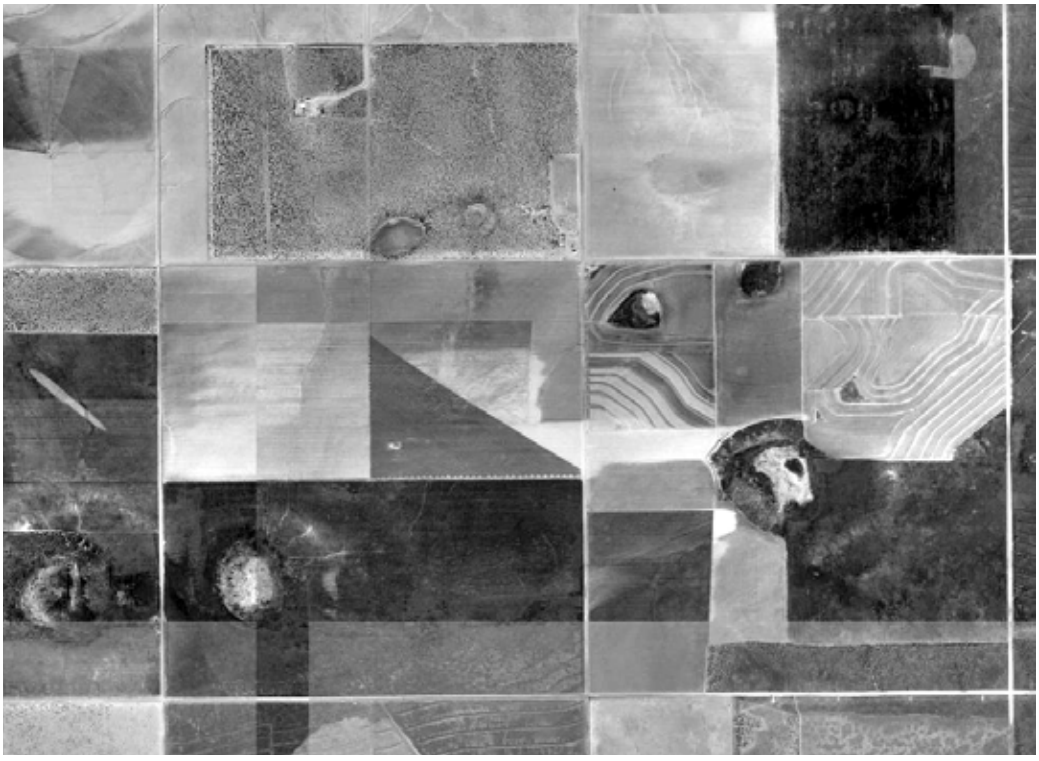
Wendell Mendell
Brian Johnson
Joshua Gibson
Jeff Hagen



Current Cruncher

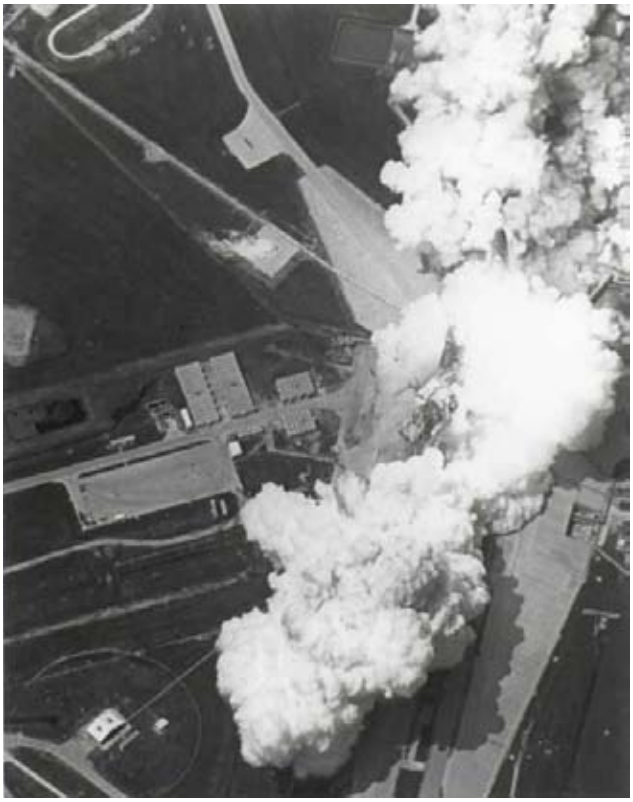
A Texas wildcatter is drilling an oil well somewhere in a flat rectangular lot. His GPS is failed so in order to re-locate a promising spot he measures distances to the spot from the corners of the lot, which are marked by stakes. The spot is 21,000 feet from one corner of the lot, 18,000 feet from the opposite corner, and 6,000 feet from a third corner. How far is the spot from the remaining corner of the lot?

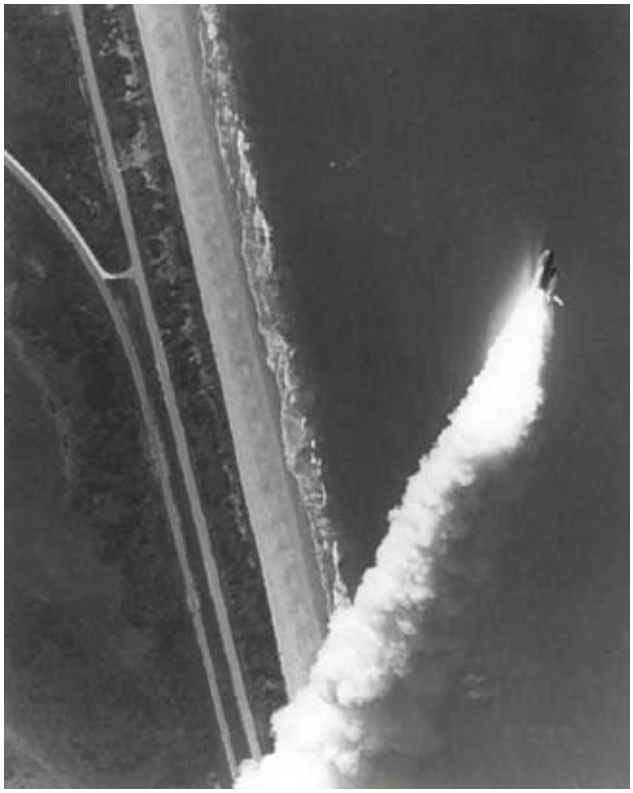
Send solutions to Bill Miller at wbmiller3@houston.rr.com. The answer, along with credits, references, and names of the solvers, will be provided next time.



Odds and Ends

SPECIAL EVENTS, PICTORIALS, ETC.





These are three of a sequence of aerial U-2 photos showing the May 4, 1989 STS-30 launch of the Space Shuttle Atlantis. These were among those taken by a U-2 reconnaissance aircraft flying a race track pattern above the Kennedy Space Center. The unique bird's eye views show the Space Shuttle Atlantis during the first seconds after liftoff during STS-30 on May 4, 1989. Why were these photos taken?

The orbiter Atlantis, upon its return after the successful DoD STS-27 mission in December 1988, was peppered with some 707 hits on the tiles. When the orbiter landed, engineers were amazed to find seven times the normal number of hits. Because of the unusual number of hits received, engineers wanted to know if the damage was unique to Atlantis or was part of a trend that began with STS-27. They wanted to "see" the damage as it was happening to help answer such questions as where did the debris sources originate since damage could have been caused by ice, insulation from the external tank or ablative material falling off of the solid rocket boosters. In addition, they wanted to know how much material was lost and at what point in time during the flight (pre-Mach, transition or post-Mach) did the damage occur. Upon closer examination of the orbiter tiles from STS-27, engineers found 16 damage sites with residual material that could be sampled. The results of the sampling revealed traces of MSA-1 (the ablator) and Hypalon paint (the white topcoat) from the SRB forward assemblies. Since the forward skirts and frustrums showed very little loss of material, a process of elimination suggested the damage might have originated from the unrecovered SRB nose caps. Most of the orbiter lower surface damage was on the right side; the left was virtually undamaged. Hence, the source of the damage seemed to lean toward the right SRB nose cap. Eventually, it was determined that the tile damage was caused by booster ablative material falling off of the right SRB nose cap due to a bonding problem. Once the bonding problem was fixed, that type of damage was not seen on subsequent missions. (From BlackBirds.net)

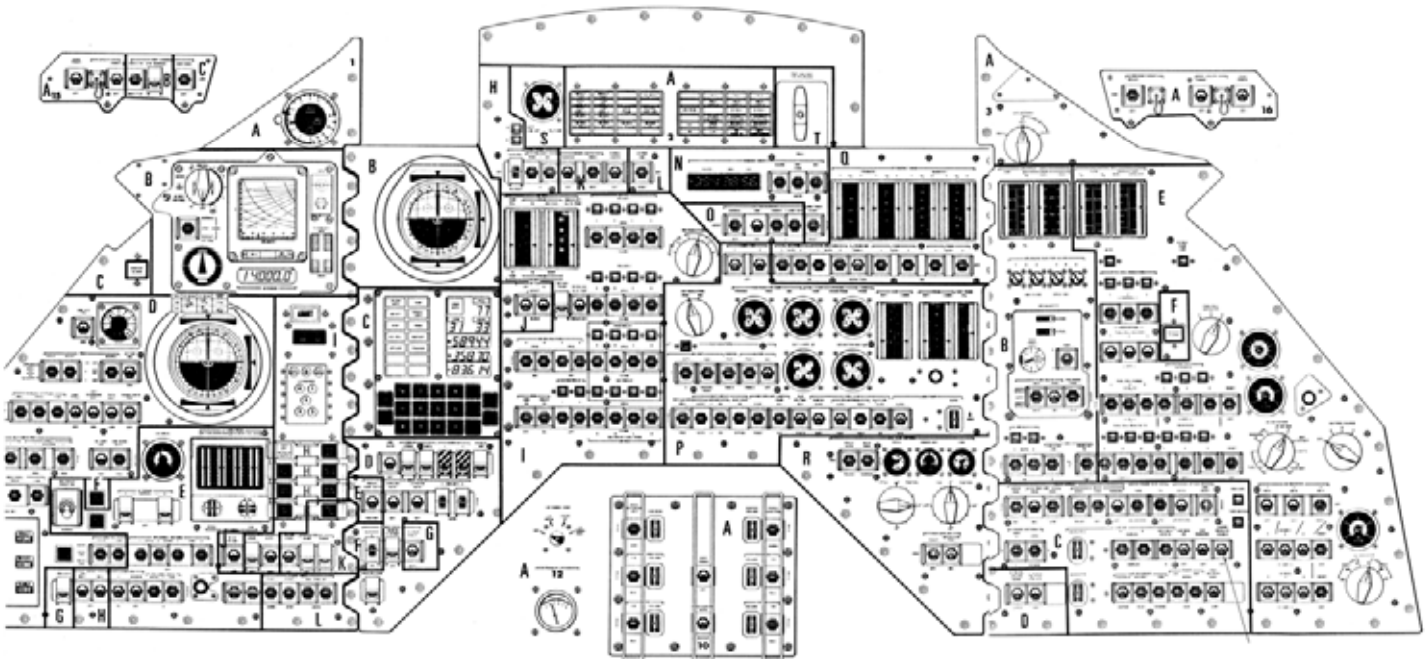
Odds and Ends (Page 2)

SPECIAL EVENTS, PICTORIALS, ETC.

Someone got the idea that a documentary about a small airport would be a great idea. Surprisingly, he (producer/director/pilot Brian J. Terwilliger) appears to be right. From the web site: "*One Six Right* is an aviation documentary about the passion for flying centered around the life and history of an airport icon, Southern California's Van Nuys airport. The film illuminates an appreciation for small airplanes and community airports everywhere."

Visit the web site at http://www.onesixright.com for more information. For those with a broadband Internet connection, you can watch a high quality preview of the DVD of the movie, which they offer for sale. It's a beautifully filmed excerpt. The full length documentary (over one hour) is planned for completion in November 2005.

Image at left courtesy of VNY Documentary, LLC.



APOLLO CM CONTROL PANEL—Flight controls are located on the left-center and left side of the main display console, opposite the commander. These include controls for such subsystems as stabilization and control, propulsion, crew safety, earth landing, and emergency detection. One of two guidance and navigation computer panels also is located here, as are velocity, attitude, and altitude indicators. The astronaut in the center couch (CM pilot) faces the center of the console, and thus can reach many of the flight controls, as well as the system controls on the right side of the console. Displays and controls directly opposite him include reaction control propellant management, caution and warning, environmental control and cryogenic storage subsystems. The right-hand (LM pilot's) couch faces the right- center and right side of the console. Communications, electrical control, data storage, and fuel cell subsystem components are located here, as well as service propulsion of subsystem propellant management. All controls have been designed so they can be operated by astronauts wearing gloves. The controls are predominantly of four basic types: toggle switches, rotary switches with click-stops (detents), thumbwheels, and push buttons. Critical switches are guarded so that they cannot be thrown inadvertently. In addition, some critical controls have locks that must be released before they can be operated. (Image: NASA History Web Site; Text: Apollo Spacecraft News Reference, ApolloSaturn.com)

Upcoming Conference Presentations by Houston Members

COMPILED BY THE EDITOR FROM AIAA AGENDAS

Information here is taken from AIAA conference agendas. As such, it is subject to change. AIAA-Houston members can also inform the editor of any upcoming presentations at any conference (AIAA or other) via email at: editor@aiaa-houston.org.

Space 2005
30 Aug - 1 Sep 2005
Long Beach Convention Center
Long Beach, California

"Sustainable, Reliable Mission- Systems Architecture"
G. O'Neil, J. Orr and S. Watson, United Space Alliance LLC, Houston, TX

"ARED Flight Software - A Unique Approach to Exercise in Long Duration Habitats"
M. Mangieri, NASA Johnson Space Center, Houston, TX

"Developing and Verifying Requirements for Extravehicular Activity (EVA) Worksites"
D. Coan, Barrios Technology, Houston, TX; and J. Kagey, United Space Alliance LLC, Houston, TX

"Space Flight Resource Management: Mitigating Human Error in Human Space Flight"
S. Dillon, United Space Alliance LLC, Houston, TX

"Knowledge Capture and Management - Key to Ensuring Flight Safety and Mission Success"
J. Goodman, United Space Alliance LLC, Houston, TX

"Health Management and Automation for Future Space Systems"
C. Garcia-Galan and G. Aaseng, Honeywell Inc., Cocoa Beach, FL; A. Crocker, NASA Mission Operations Directorate, Houston, TX

"Spacecraft Design Considerations for Human Radiation Shielding and Protection Issues"
W. Atwell, The Boeing Company, Houston, TX

"Effect of Shielding Materials from SPEs on the Lunar and Mars Surface"
M. Kim, Wyle Laboratories, Houston, TX; X. Hu and F. Cucinotta, NASA Johnson Space Center, Houston, TX

"Tethered Lander for Planetary Applications"
O. Bannova, Sasakawa International Center for Space Architecture, Houston, TX

"Lessons Learned in Simulation Development for Space Systems"
W. Davidson, G. O'Neil and S. Watson, United Space Alliance LLC, Houston, TX

"An Overview of Shuttle Derived Launch Vehicle Concepts"
W. Rothschild and D. Boyd, The Boeing Company, Houston, TX; E. Henderson, NASA Johnson Space Center, Houston, TX

"Shuttle- Derived Side- Mount Heavy Launch Vehicle"
D. Boyd and A. Gale, The Boeing Company, Houston , TX; E. Enright, Lockheed Martin, New Orleans, LA

"Lunar Post Solar Power System Configuration and Location Trade Study"
A. Leskin and G. Trobaugh, Raytheon, Houston, TX; R. Lenard, Desert Fox Engineering Services, Edgewood, NM

"Automating Space Exploration Software Verification and Testing"
G. O'Neil and S. Watson, United Space Alliance LLC, Houston, TX

"A Computational Study of Explosive Hazard Potential for Reusable Launch Vehicles"
C. Freitas and S. Chocron, Southwest Research Institute, San Antonio, TX; D. Palmer and P. Langley, Lockheed Martin Space Systems, Denver, CO; M. Kipp, Sandia National Laboratories, Albuquerque, NM; L. Langston, NASA Johnson Space Center, Houston, TX; and W. Saul, Sandia National Laboratories, Albuquerque, NM

"Automation Scripting for Manned Spaceflight"
Z. Parer, United Space Alliance LLC, Houston, TX; T. Eckert, Barrios Technology, Houston, TX

"EVA Inspection of Space Shuttle Thermal Protection System"
Z. Scoville and S. Rajula, NASA Johnson Space Center, Houston, TX

"The NEEMO Undersea Analog: Another Type of Deep Space Exploration"
W. Todd, United Space Alliance, LLC., Houston, TX; and M. Reagan, NASA Johnson Space Center, Houston, TX

"NASA Radiation Track Image GUI for Assessing Space Radiation Biological Effects"
A. Ponomarev and H. Nikjoo, Universities Space Research Association, Houston, TX; and F. Cucinotta, NASA Johnson Space Center, Houston, TX

"Cooperative Education: A Proven Cornerstone for Developing Tomorrow's Space Workforce"
B. Dansberry, University of Cincinnati, Cincinnati, OH; D. Pearson, Georgia Institute of Technology, Atlanta, GA; and R. Musgrove, NASA Johnson Space Center, Houston, TX

"Analysis of Planetary Surface Module Options"
L. Bell, University of Houston, Houston, TX

"Planetary Surface Transportation and Site Development"
L. Bell, University of Houston, Houston, TX

"The Peer- to- Peer Human- Robot Interaction Project"
T. Fong, I. Nourbakhsh, C. Kunz, L. Fluckiger and J. Schreiner, NASA Ames Research Center, Moffett Field, CA; R. Ambrose, NASA Johnson Space Center, Houston, TX

"Human- Automation Partnering for Onboard Mission Management: Human Factors Challenges"
R. McCann, NASA Ames Research Center, Moffett Field, CA; J. McCandless, NASA, Moffett Field, CA; B. Hilty, NASA Johnson Space Center, Houston, TX

Upcoming Conference Presentations by Houston Members

CONTINUED …

"RASC- AL 2005: SelenAres"
B. Bodrero, J. Gregory, A. Johnes, J. Salmon, E. Siggard, J. Stromsdorfer, and T. Mosher, RASC-AL / Utah State University, Logan, UT; and S. Skillern, Universities Space Research Association, Houston, TX

"Early Lunar and Planetary Outpost Design and Requirements"
G. Kitmacher, NASA Johnson Space Center, Houston, TX

"RASC- AL 2005: Advanced Space Health Maintenance System: Technology Enabling Extending Manned Space Exploration"
A. Elam, C. Gibson, Z. Metwalli, R. Robb, T. Rooney, and M. Liebschner, RASC-AL / Rice University, Houston, TX; and S. Skillern, Universities Space Research Association, Houston, TX

"Optimal Design Solutions for Crew Exploration Vehicle"
T. Kulkarni and S. Suh, Texas A&M University, College Station, TX

"Interplanetary Communication Network for Outer Planets of Solar System"
T. Kulkarni and A. Dharne, Texas A&M University, College Station, TX

"Proton Flux at Mars: Assessment with the MARIE Data"
E. Towns and P. Saganti, Prairie View A&M University, Prairie View, TX

"Radiation Particle Flux Assessment with ACE / CRIS Data"
T. Calvin, P. Saganti, R. Wilkins and K. Kirby, Prairie View A&M University, Prairie View, TX

AIAA 5th Aviation, Technology, Integration, and Operations Conference (ATIO)
16th Lighter-than-Air and Balloon Systems Conference
26 - 28 Sep 2005
Hyatt Regency Crystal City
Arlington, Virginia

"Flight Segment Identification as a Basis for Pilot Advisory Systems (Invited)"
W. Kelly, Blue Rock Research, Apex, NC; and J. Painter, Texas A&M University, College Station, TX

"Small Aircraft Pilot Assistant: Onboard Decision Support System for SATS Aircraft"
J. Rong, T. Spaeth and J. Valasek, Texas A&M University, College Station, TX

"Improving Aircraft Sequencing and Separation at a Small Aircraft Transportation System Airport"
K. Helbing, T. Spaeth and J. Valasek, Texas A&M University, College Station, TX

Infotech@Aerospace
26 - 29 Sep 2005
Hyatt Regency Crystal City
Arlington, Virginia

"Autonomous Walking Inspection and Maintenance Robot (AWIMR)"
H. Lane, Northrop Grumman Corporation, Redondo Beach, CA; B. Kennedy, Jet Propulsion Laboratory, Pasadena, CA; D. Apostolopoulos, Carnegie Mellon University, Pittsburgh, PA; and M. Diflter, NASA Johnson Space Center, Houston, TX

"Understanding the Application of Knowledge Management in a Technology Driven Industry"
D. DeLoach and G. Lowe, NASA Langley Research Center, Hampton, VA; B. Anderson, The Boeing Company, Houston, TX; L. Long, Penn State University, University Park, PA; R. Aggarwal, Rockwell Collins, Cedar Rapids, IA; M. Bailey, GE Aircraft Engines, Cincinnati, OH

"An Architecture for Intelligent Management of Aerial Observation Missions"
M. Freed, NASA Ames Research Center, Moffett Field, CA; P. Bonasso, NASA Johnson Space Center, Houston, TX; W. Fitzgerald and C. Frost, NASA Ames Research Center, Moffett Field, CA

"Comparison of In Depth and Critical Few System Models"
D. Bradt, NASA Johnson Space Center, Houston, TX

"FLOAAT, A Tool for Determining Levels of Autonomy and Automation, Applied to Human-Rated Space Systems [invited]"
R. Proud and J. Hart, NASA Johnson Space Center, Houston, TX

"Autonomous Mission Management for Spacecraft Rendezvous Using an Agent Hierarchy"
M. Jackson, Charles Stark Draper Laboratory, Inc., Houston, TX

"Application of Model- Based Technology Systems for Autonomous Systems"
D. Cooke, M. Gelfond, and N. Rushton, Texas Tech University, Lubbock, TX; and H. Hu, NASA Johnson Space Center, Houston, TX

"Improved Adaptive- Reinforcement Learning Control for Morphing Unmanned Air Vehicles"
M. Tandale, J. Valasek and J. Doebbler, Texas A&M University, College Station, TX; A. Meade, Rice University, Houston, TX

"Scattered Data Approximation of Weapons Bay Flow Classification"
J. Yoo and A. Meade, Rice University, Houston, TX

"Characterization of Shape Memory Alloy Behavior and Position Control Using Reinforcement Learning"
C. Haag, M. Tandale and J. Valasek, Texas A&M University, College Station, TX

AAS Conference Highlights Role of ISS in Achieving *Vision for Space Exploration* Goals

The American Astronautical Society's Annual Conference (Nov 15-16, 2005 at South Shore Harbour Resort) will bring together senior-level technical and public policy experts from NASA, industry and the International Partners, as well as university student participants, in a wide-ranging review of International Space Station as a means to achieve the Vision for Space Exploration. An overview of the Conference agenda is included below. Updates and registration information can be found at the AAS's Houston Chapter's web site: http://www.aashouston.org The AAS is the premier independent scientific and technical group in the United States exclusively dedicated to the advancement of space science and exploration. It is also committed to strengthening the global space program through cooperation with international space organizations.

AAS & AIAA jointly sponsor several national conferences throughout the year. Both organizations believe in collaboration that brings a mutual benefit to each other's membership.

Building Bridges to Exploration: The Role of the International Space Station

AMERICAN ASTRONAUTICAL SOCIETY
National Conference and 52nd Annual Meeting
South Shore Harbour Resort
November 15-16, 2005

Draft Agenda

Day 1

Welcome: Jonathan T. Malay, AAS President and Director, Civil Space Programs, Lockheed Martin Corporation
Jefferson Howell, Director, Johnson Space Center

Keynote Speaker: Carl Sagan award winner [chosen by AAS and Planetary Society]

Session 1: Realizing the Promise of International Space Station

Theme: Status of ISS program, discussion of its challenges and its achievements to date, challenges ahead after Shuttle is retired.
Session Chairman: ISS Program Manager/Bill Gerstenmaier (confirmed)
Deputy Chairman: NASA/G. Kitmacher

Lunch Speaker: Kay Bailey Hutchinson (proposed)

Session 2: Focus on International Space Station Research

Theme: International discussion on each partners' plans with respect to ISS research
Session Chairman: ISS Program Scientist/ Don Thomas (confirmed)
Deputy Chairman: Julie Robinson/NASA
Speakers/Panelists: NASA, CSA, JAXA, Russia, ESA

Session 3: International Space Station Challenges Enabling Exploration Risk Reductions

Theme: Discussion of ISS systems/operations/etc that have contributed directly to Exploration risk reduction. Ideas include: EMU on-orbit maintenance and certification, advanced life support, advanced power systems, etc.
Session Chairman: Boeing/John Elbon (confirmed)
Deputy Chairman: Boeing/Rich Clifford
Speakers/Panelists:

Session 4: Roundtable on Integration Challenges of Large Scale Programs (ISS Program SSCB to be held in Houston during this timeframe)

Moderator: Stephen Johnson (confirmed)
Panelists: NASA/Gerstenmaier, Russia/Representative, ESA/Thirkettle, JAXA/K. Shiraki, CSA/B. Marcotte, Boeing/J. Elbon

Dinner Speaker: TBD

Day 2

Keynote Speaker: Mike Griffin (proposed)

Session 5: Common Challenges: Human and Robot Exploration

Theme: This session is dedicated to the "outbrief" of the JSC/JPL Personnel Bridges session. What challenges and risks exist within manned and robotic spacecraft missions? What can we learn from each other to reduce risks? How can we work together to reduce risks? Each JSC/JPL team will review their results/ ideas/etc.
Session Chairman: Gen. Howell/C. Elachi/ TBD
Deputy Chairman: David Korth/Troy Leblanc/Andy Miskin

Lunch Speaker: TBD

Session 6: Roundtable on Commercial Opportunities in Human Spaceflight

Theme: This session will be a lively discussion on the possibilities and policies associated with commercial opportunities for human spaceflight, such as human transportation, cargo transportation to the ISS, and other possibilities for in orbit infrastructures operated on a commercial basis.

Session 7: The Future of International Cooperation

Theme: This session will explore the impact of current events and policies on the future of international cooperation on human spaceflight projects. Invited presentations include ESA/Russia cooperation on Soyuz in Kourou and the Clipper development, The Global Impact of International Space University, and an examination of cooperation when managed at the intergovernmental level vs. industrial level

Session 8: ISS as a Mars Mission Testbed

Theme: Ideas for using the ISS in mission simulations or other operational risk reductions in support of the exploration spirals. Include presentations on activities around the agency/outside the agency. Also include presentations by student session leads – idea discussed separately.
Chairman: NASA/HQ Mike Foale (confirmed)
Deputy Chairman: Paul Brower

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