Horizons

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Heavy Lift: Big Lever or Large Diameter Pipe Dream?

JON BERNDT, EDITOR

AIAA HOUSTON
American Institute of Aeronautics and Astronautics

There is one thing that can be said for sure about the discussion of heavy lift: there are at least as many opinions about it as there are people who debate the subject, and as many motivations. One favorite debate about heavy lift regards logistics. For example, a recent issue of Aviation Week and Space Technology contained a letter from a reader who expressed the sentiment: "*People have forgotten the lessons container ships, the A380, and the C-5A, have taught us: size does matter.*" It's not hard to support an opposing view: container ships have no shortage in the continuous supply of cargo to pay for the investment in huge ships, the A380 is facing large cost overruns and has not yet (at the time of this writing) received the number of firm orders needed to reach the break even point, and the C-5 was built to fill a projected *military* need. Note, too, the growing importance of smaller, regional jets in air transportation, which would argue the opposite point to the one the reader expressed.

At the Space Exploration Conference in Florida earlier this year, outgoing NASA Administrator Sean O'Keefe said, "We cannot return to the days of Saturn V, when we put all of our eggs in a basket with a few huge, expensive fire-belching rockets".

Contrasting the sentiments expressed by the outgoing NASA administrator, his successor, Michael Griffin, has a very different view about heavy lift. In March 2004 in Testimony to the Committee on Science for the "Hearing on Perspectives on the President's Vision for Space Exploration", Mr. Griffin stated:

- NASA should initiate development of a heavy lift launch vehicle having a payload capacity of at least 100 metric tons to low Earth orbit (LEO). Such a vehicle is the single most important physical asset enabling human exploration of the solar system. The use of shuttle-derived systems offers what is quite likely to be the most cost effective near-term approach.
- Much cargo (including humans) does not need to be launched in very large packages. We desperately need much more cost effective Earth-to-LEO transportation for payloads in the size range from a few thousand to a few tens of thousands of pounds. In my judgment, this is our most pressing need, for it controls a major portion of the cost of everything else that we do in space. Yet, no active U.S. government program of which I am aware has this as its goal. Again, shuttle-derived systems, particularly emphasizing use of the RSRB, may offer a useful approach.

"NASA should initiate development of a heavy lift launch vehicle having a payload capacity of at least 100 metric tons to low Earth orbit (LEO). Such a vehicle is the single most important physical asset enabling human exploration of the solar system."

- Michael Griffin

Official Policy

There are at least two official policy reports that address heavy lift. The "Report of The President's Commission on Implementation of United States Space Exploration Policy" (a.k.a. "The Aldridge Report") recognizes the importance of a decision regarding heavy lift: "*Decisions about heavy lift will guide fundamental options about how to design and implement the early stages of the space exploration architecture, and will have long-lasting impacts upon future development costs and capabilities.*" The Aldridge Report lists heavy lift among 17 "focus areas" that need to be addressed:

- Affordable heavy lift capability – technologies to allow robust affordable access of cargo, particularly to low-Earth orbit.
- Transformational spaceport and range technologies – launch site infrastructure and range capabilities for the crew exploration vehicle and advanced heavy lift vehicles.

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Chair's Corner

T. SOPHIA BRIGHT, CHAIRPERSON, AIAA HOUSTON

This is a pivotal time in AIAA as we continue to embrace the new Strategic Plan set forth last year by our Board of Directors. As AIAA President Don Richardson indicated in his visit to the Houston area last fall, AIAA is doing what it can to bolster membership services and to align itself better with the core missions of the Aerospace Industry:

- Enabling the global movement of people and goods
- Leading the global acquisition and dissemination of information and data
- Advancing national security interests
- Providing a source of scientific progress and inspiration by pushing the boundaries of exploration and innovation

By now many of you should have received your 2005 Board of Directors Nomination Package and Ballot. We hope that you had a chance to review the candidate bios and have selected the candidate that you feel best reflects the goals of the Strategic Plan. Those goals are:

Goal 1 – Focus AIAA Activities on Critical and Emerging Technologies, Capabilities, and Programs
Goal 2 – Strengthen Internal and External Communications
Goal 3 – Improve and Expand Services and Benefits to Our Members
Goal 4 – Increase the Depth and Breadth of Our Membership
Goal 5 – Establish AIAA as the Voice and Advocate of/for the Profession
Goal 6 – Stimulate Workforce Development and Retention
Goal 7 – Fully Utilize Information Technology
Goal 8 – Communicate and Involve our Stakeholders in the Implementation of the Strategic Plan

Not only is it election time on the National level it is also election time for the Houston Section. In the next month or so many of you will receive a letter or postcard directing you to the Houston Section nomination package and ballot to select the 2005/2006 term's Executive Council. If you are interested in becoming more involved in the Houston Section please do not hesitate to let any member of the Executive Council know.

In addition to the nomination package information, you will also receive information regarding a survey to help us determine how we are doing. It is our hope that we have been able to give our members the type of service that they expect from an organization such as AIAA. Of course, our only way to really gauge this is to hear from you – the members. However, do not feel that you have to wait to fill out a survey to let us know how we are doing. Please feel free to send me an email at chair@aiaa-houston.org with any thoughts you might have. ▲

From the Editor

JON S. BERNDT, EDITOR, "HORIZONS"

There's a lot of good debate going on right now in blogs, Usenet, and in various restaurants along NASA Parkway in Clear Lake during lunchtime. One of the topics I've found most captivating is the concept of "heavy lift". As I was researching for and writing this article I found myself starting with one position, then taking a slightly different one. It became clear that one reason for the mix of opinions being fielded now is that there isn't enough information to draw a firm conclusion on what kind of payload lofting capabilities are going to be needed to implement the President's Vision for Space Exploration. There are good arguments made for and against shuttle derived solutions.

The lack of prior clarity on the subject may be changing, however, as the new NASA administrator has taken office and made his position clear: that heavy lift on the order of 100 tons to LEO is needed.

The issue could have implications for commercial space services. Does this statement look familiar: "*These [specific actions in supporting commercial development of the space industry] should be aimed at removing present barriers to commercialization (such as Government competition), reducing the cost of space operations, and encouraging the future provision of launch services by the private sector.*"

This issue's main article will hopefully help in bringing some of the broader issues together. I'm sure it will stimulate some spirited discussions. We'd like to hear your opinions (you may remain anonymous). Send comments to the editor at:

editor@aiaa-houston.org

Comments may be edited for space limitations.

By the way, the space commercialization statement [above] was issued by the Reagan Administration, in 1984. ▲

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The report continues by adding that the "*missions to be undertaken as part of the exploration vision will likely require a lift capability beyond today's Space Shuttle and EELVs. There are numerous technologies and sub-technologies that need to be developed, matured, and demonstrated to achieve the desired goals of future heavy lift launch vehicles.*"

Likewise, The U.S. Space Transportation Policy urges that NASA develop, "*in cooperation with the Secretary of Defense as appropriate, options to meet potential exploration-unique requirements for heavy lift beyond the capabilities of the existing Evolved Expendable Launch Vehicles.*" Specifically,

- These options will emphasize the potential for using derivatives of the Evolved Expendable Launch Vehicles to meet space exploration requirements. In addition, the Administrator shall evaluate the comparative costs and benefits of a new dedicated heavy-lift launch vehicle or options based on the use of Shuttle-derived systems.
- The Administrator and the Secretary shall jointly submit to the President a recommendation regarding the preferred option to meet future heavy-lift requirements. This recommendation will include an assessment of the impact on national security, civil, and commercial launch activities and the space transportation industrial base.

Through its various Technical Committees (TC), AIAA has presented position papers and recommendations based on the experience of its members (see http://www.aiaa.org/content.cfm?pageid=127). One such group is the Space Logistics TC (http://www.aiaa.org/tc/sl/), which was formed "*to provide a conduit for the exploration and communication of innovative space logistics architectures and systems that will support a broad expansion of human and robotic space operations throughout the central solar system.*" The SLTC has issued an Information Paper, "*Recommended Government Actions to Address Critical U.S. Space Logistics Needs*". The information paper states: "*The expansion of human space-faring activities, including human space exploration and space science programs, will require the ability to build new and substantially larger facilities and systems in space. Previous Government and contractor studies have identified several design approaches for transforming the current Space Shuttle into a Saturn-V class, unmanned space launch system. Such a Shuttle-derived heavy space-lifter, brought into operation in 2012, would complement the two-stage Reusable Launch Vehicles (RLVs) and provide an integrated space transportation capability for launching payloads of virtually any desired size into Earth orbit.*"

Is there a real need?

Most of the preliminary exploration architecture concepts show modular vehicles which could be connected in a number of ways to achieve a particular objective. The military will be busy keeping two EELV manufacturers in business, and the hibernating commercial satellite market won't support the development of a new "status quo" launcher.

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AIAA
American Institute of Aeronautics and Astronautics

Horizons

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Shuttle-C Photo credit: ATK Thiokol

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Yet, it is generally believed that – at least at some point – the ability to launch very heavy monolithic payloads (say, greater than 30 tons) will be required, particularly for eventually going to Mars. But, that will come at a cost. T/Space, in their architecture study report, recommends using EELVs as long as possible for heavy lift: *"… compensate for modest lift via assembly in space. Not spending $18-$20 billion in 2010-2020 on invisible-to-the-public heavy lift development means $18 billion more will be available for actual operations in space that the public can see and understand."* [The $18 billion figure surely refers to a clean-sheet booster development program, but the origin of that figure is unknown.] The idea of developing a clean-sheet heavy lift launch vehicle (HLLV) has been all but ruled out.

There continues to be talk in aerospace circles (official or not) about using shuttle components in a variety of ways. But, depending on the option being discussed, that could be quite expensive, as well. Every three months that the shuttle remains in operation costs roughly $1 billion whether there are flights or not. That cost includes support for maintaining the infrastructure, paying the workforce to process the vehicle, etc. How much of the "standing army" would be required to support a heavy lift vehicle based on STS components? How much cheaper would it be without orbiter processing?

Self-described "recovering aerospace engineer" Rand Simberg wrote in his "Transterrestrial Musings" blog: *"A heavy-lift vehicle, even a shuttle-derived one, will cost a lot to develop, and unless it flies enough, it will be difficult to amortize those development costs. Smaller vehicles, flown more often, will be more likely to reduce launch costs in the near term."*

Smaller vehicles and more launches infers more on-orbit assembly, more integration, which carries its own problems and risks.

In the February 2005 issue of AIAA's *Aerospace America*, Admiral Craig Steidle, Associate Administrator for the Exploration Systems Mission Directorate was interviewed by Frank Sietzen, and he answered questions about heavy lift:

FS: *What about heavy-lift solutions?*
CS: *We're looking at cargo and human-rating pieces. They don't necessarily have to be the same, don't necessarily have to be the same family [of boosters]. In the vision statement, we said, to the extent possible, separate cargo from human. The contractors are good at providing us with families of lifting capabilities. We have the shuttle-derived piece to be considered.*

FS: *Isn't there a certain logic to the shuttle-derived solution? You've got the flight history, the infrastructure there, the trained workforce there. Doesn't that make a good case for that vehicle?*
CS: *We're doing these particular trade studies on that, looking at the infrastructure costs, what has to be changed. What are the reliability levels that we need right now, what makes sense for growth capability. And what can we use to meet our vision capability, eventually get to Mars. But we won't have anything more until the March timeframe.*

It will be interesting to see where that ends up. It has been said that anything that launches from LC-39 can't be cheap. In his book "Space Shuttle", Dennis Jenkins lists the historical Shuttle-C program costs. In 2005 dollars, the estimate of the cost to complete Shuttle-C development is about $2.8 billion, with a per launch cost of $780 million, based on 10 launches per year, and the use of new GPCs and SSMEs (assumes the supply of used items have been exhausted). At the time the estimate was made 15 years ago, alternatives to the use of the SSME were not considered.

The "fire-belching" rockets that former NASA administrator O'Keefe referred to were not cheap, either. One estimate (perhaps too high) puts the launch cost of a Saturn V at over $2 billion, and the development cost at over $40 billion (both figures in 2005 dollars, adjusted simply for inflation).

It's not clear at this point how many launches per year NASA will need in fulfilling the Vision, nor exactly at what point the first heavy lift launchers would be needed. In the NASA Exploration Systems Mission Directorate *Analysis of Alternatives* Overview given in February 2005, it is pointed out that, *"Cost effectiveness and reliability of [a] launch system can be optimized by higher flight rates (multiple customers – e.g. NASA, AF, NRO, etc.)"* This characteristic could be addressed by the use of existing EELVs, and might serve to accelerate the development of growth versions of those launchers. It is also a valid question to ask what could be done with $2.8 billion (presumed Shuttle-C development completion costs) to enhance the capabilities of the current fleet of EELVs.

<u>*Standing at the brink*</u>

Is there another angle on this debate that is being overlooked? The Vision for Space Exploration uses the word "*commercial*" many times. It is a stated goal to use commercial services where possible, "*For cargo transport to the Space*

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Station after 2010, NASA will rely on existing or new commercial cargo transport systems, as well as international partner cargo transport systems. NASA does not plan to develop new launch vehicle capabilities except where critical NASA needs—such as heavy lift—are not met by commercial or military systems. Depending on future human mission designs, NASA could decide to develop or acquire a heavy lift vehicle later this decade. Such a vehicle could be derived from elements of the Space Shuttle, existing commercial launch vehicles, or new designs."

This is where the varied opinions about "heavy lift" (which is, in truth, a somewhat vague term with more than one interpretation) get more ... interesting. We are seeing the emergence of new players, with fresh ideas, and bold proclamations – yet often with very little real hardware. Sean O'Keefe addressed this vexing stumbling block in relation to the supply of ISS after STS is retired: *"There are plenty of bold, confident purveyors of future capability who firmly assert they can support the logistics requirements on station through commercial services contracts if just given the chance. ... This is a chicken and egg thing. If we planned on retaining shuttle until commercial services could be proven, how enthusiastic do you think anybody would be about getting on with the alternative?"*

Others have been even more emphatic:

David Gump (t/Space): "*We are very hopeful that NASA does not develop a heavy-lift launch vehicle. With propellant being one the biggest things NASA can buy in orbit, it provides a tremendous lever to NASA to create innovation in new launch vehicles. NASA can do a pay-on-delivery contract for liquid oxygen in LEO, and not care if the launch vehicle fails.*"

Greg Allison (National Space Society) is concerned about the NASA bureaucracy, "*We don't need another bureaucratic program like the shuttle that keeps commercial ventures from developing launch services.*"

Andrew Beal (Beal Aerospace), during an effort to build a Titan-class launcher, in 2000 test fired the largest rocket engine ever privately financed and built. At 810,000 lbs. vacuum thrust it was second only in size to the F-1 engine. He closed the doors on Beal Aerospace later that year, and explained in a letter: "*NASA has embarked on a plan to develop a "second generation" launch system that will be subsidized by U.S. taxpayers and that will compete directly with the private sector. In my capacity as founder and chairman of Beal Aerospace, I previously testified to a congressional subcommittee that government subsidies to competing launch providers constituted the private sectors biggest business risk.*"

The U.S. Space Transportation Policy directly addresses this kind of concern in one of it's tenets: "*Refrain from conducting activities with commercial applications that preclude, deter, or compete with U.S. commercial space transportation activities, unless required by national security.*"

The new NASA Administrator has touched on this subject in the past, as well: "*...the development of space launch vehicles has been almost exclusively a government enterprise, and because the few and only competitors have been other governments, normal market mechanisms are absent, and we continue to muddle along.*"

Perhaps most eloquently - and most controversially - XCOR President and CEO Jeff Greason, in his testimony for the Presidential Commission on Moon, Mars and Beyond, stated: "*NASA can position itself to grow with the private sector very simply – by buying space transportation services available on the open market. That is a simple rule with profound implications – for I mean that NASA should use commercial providers as its sole means of transportation to Earth orbit. That means that if they cannot find a commercial provider for a given launch capability, THEY MUST DO WITHOUT IT. Off-the-shelf transportation settled the New World, explored the American West, and built the Antarctic stations. Surely, it can carry us into the future. Almost every bridge and building in the world was built with parts that come on trucks in 25 ton pieces. The Space Station is built from 25 ton pieces. The South Pole station is built from 20 ton pieces that fit into an airplane. We can go to the Moon and Mars this way.*" (http://www.xcor.com/jeff-aldridge-full.html)

The U.S. Space Transportation Policy can be read to be nearly as emphatic in these statements:

- Purchase commercially available U.S. space transportation products and services to the maximum extent possible, consistent with mission requirements and applicable law.
- Involve the U.S. private sector in the design and development of space transportation capabilities to meet United States Government needs.

We stand at the brink of a new space endeavor, one that can and should help fuel the growth of a nascent - but primed and ready - crop of aerospace enterprises. The *lever* is the power that NASA has at this point in time to undertake an affordable exploration program while fostering the creation of innovative ways of implementing the Vision for Space Exploration. ▲

> *"NASA should use commercial providers as its sole means of transportation to Earth orbit. That means that if they cannot find a commercial provider for a given launch capability, they must do without it."*
>
> Jeff Greason
> President and CEO,
> XCOR

Sources:

- Aviation Week & Space Technology
- The Space Review
- U.S. Space Transportation Space Policy
- Aerospace America
- *Space Shuttle, The History of the National Space Transportation System*, Dennis Jenkins
- The Aldridge Report

Call for Nominations for National Awards

DR. RAKESH BHARGAVA, CHAIR HONORS & AWARDS

As you know, honoring and recognizing AIAA members who have advanced the quality and depth of the aerospace profession is an important AIAA tradition. Listed below are various national awards, with brief description for each award, for which nominations are due on July 1. If you would like to be nominated or you know someone who deserves to be recognized for his contributions, please contact me or the Section Chair. Additional information and a list of past recipients may be found at www.aiaa.org, "Inside AIAA," "Honors & Awards".

My contact information - Tel: 281-776-3515, rkbhargava@earthlink.net

Aerospace Contribution to Society Award is presented for a notable contribution to society through the application of aerospace technology to societal needs.

Aerospace Software Engineering Award is presented for outstanding technical and/or management contributions to aeronautical or astronautical software engineering. (Presented odd-years)

Computer-Aided Engineering and Manufacturing Award presented in 1988 to an individual who has conceived, defined, or developed an original concept leading to a significant advancement in the use of interactive computer graphics for conceptual design, computer imagery, or computer-aided design and computer-manufacturing. (Presented odd years)

Digital Avionics Award is presented to recognize outstanding achievement in technical management and/or implementation of digital avionics in space or aeronautical systems, including system analysis, design, development or application. (Presented odd-years)

Excellence in Aerospace Standardization Award is presented to recognize contributions by individuals that advance the health of the aerospace community by enabling cooperation, competition, and growth through the standardization process.

F. E. Newbold V/STOL Award is presented to recognize outstanding creative contributions to the advancement and realization of powered lift flight in one or more of the following areas: initiation, definition and/or management of key V/STOL programs; development of enabling technologies including critical methodology; program engineering and design; and/or other relevant related activities or combinations thereof which have advanced the science of powered lift flight.

Faculty Advisor Award is presented to the faculty advisor of a chartered AIAA Student Branch, who in the opinion of student branch members, and the AIAA Student Activities Committee, has made outstanding contributions as a student branch faculty advisor, as evidenced by the record of his/her student branch in local, regional, and national activities.

Gardner-Lasser History Literature Award is presented for the best original contribution to the field of aeronautical or astronautical historical non-fiction literature published in the last five years dealing with the science, technology, and/or impact of aeronautics and astronautics on society.

Haley Space Flight Award is presented for outstanding contributions by an astronaut or flight test personnel to the advancement of the art, science or technology of astronautics. (Presented odd years)

History Manuscript Award is presented for the best historical manuscript dealing with the science, technology, and/or impact of aeronautics and astronautics on society.

Information Systems Award is presented for technical and/or management contributions in space and aeronautics computer and sensing aspects of information technology and science. (Presented odd years)

Lawrence Sperry Award is presented for a notable contribution made by a young person to the advancement of aeronautics or astronautics. *The nominee must be under 35 years of age on December 31 of the year preceding the presentation.*

Losey Atmospheric Sciences Award is presented for recognition of outstanding contributions to the atmospheric sciences as applied to the advancement of aeronautics and astronautics.

Pendray Aerospace Literature Award is presented for an outstanding contribution or contributions to aeronautical and astronautical literature in the relatively recent past. The emphasis should be upon the high quality or major influence of the piece rather than, for example, the importance of the underlying technological contribution. The award is an incentive for aerospace professionals to write eloquently and persuasively about their field and should encompass editorials as well as papers or books.

Space Processing Award is presented for significant contributions in space processing or in

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Kalpana Chawla Memorial Foundation

DR. RAKESH BHARGAVA, CHAIR HONORS & AWARDS

Last month we remembered crew members of Columbia on their second death anniversary. To pay homage to the first Indian American Astronaut Kalpana Chawla, students of her college (at Chandigarh, India, where she completed her Bachelor degree in Aeronautics) and many others living in India and abroad have joined hands and established Kalpana Chawla Memorial Foundation (KCMF) to fulfill the dreams (of reaching to stars) initiated by her and encourage students to pursue career in science and engineering, particularly in the field of aerospace engineering. Kalpana initiated to sponsor high school students from India to visit NASA. The KCMF will continue efforts initiated by her. Some of the objectives of this Foundation include: to promote exchange programs for teachers, scientists and researchers in the areas of aeronautics and aerospace; to set-up Entrepreneur Development Institute for creating more jobs; and provide financial support to underprivileged students. To initiate activities of the newly established Foundation, I was given privilege to give the first Memorial Lecture in October last year. For me this was a great honor which I accepted without any hesitation. In addition, this gave me an opportunity to visit my college from where I completed my undergraduate degree (Kalpana and myself both graduated from the same department).

During my trip in October, I also had an opportunity to visit the school where Kalpana had completed her secondary education and met her Principal and other teachers. On behalf of the AIAA Houston Section, I presented the aviation poster, developed as a part of the Centennial of Flight celebration, to her high school and college. With this distribution, the poster developed by the AIAA Houston Section has been shared internationally. ▲

Astronaut Kalpana Chawla

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furthering the use of microgravity for space processing, (Presented even years)

Summerfield Book Award is named in honor of Dr. Martin Summerfield, founder and initial editor of the Progress in Astronautics and Aeronautics Series of books published by the AIAA. The award is presented to the author of the best book recently published by AIAA. Criteria for the selection include quality and professional acceptance as evidenced by impact on the field, citations, classroom adoptions and sales.

System Effectiveness and Safety Award is presented for outstanding contributions to the field of system effectiveness and safety or its related disciplines.

Wright Brothers Memorial Trophy Award, sponsored by the Aero Club of Washington, is presented for significant public service of enduring value to aviation in the United States and was established to honor the Wright Brothers annually. ▲

2005 Annual Technical Symposium

TIM PROPP, VICE CHAIR, TECHNICAL

The 2005 Annual Technical Symposium is scheduled for May 6th at the Gilruth Center. This year's theme is Space Exploration Initiative, with several topics slated for discussion:
The New Space Race
Crew Exploration Vehicle
Return to the Moon
Robotic Missions
Space Operations
Aerospace Technology

The ATS planning committee has been hard at work developing an outstanding program. This year's program will include a keynote speech by STS-114 Lead Flight Director Paul Hill, a luncheon speech by JSC Deputy Director, Col. Bob Cabana, and an evening reception which will feature a tribute to the late Max Faget.

Some key dates to remember:

Speaker Registration and Abstract Deadline
Monday April 18

Reservation Deadline for Lunch
Wednesday April 27

The symposium provides local engineers/scientists/etc... the opportunity to showcase their work to the JSC community. The symposium also presents an opportunity for licensed professional engineers to earn continuing education credits. AIAA membership or JSC badging is not required. A $5 registration fee will be charged to attendees and presenters. Please visit the 2005 ATS website @ www.aiaa-houston.org/ats2005 for more information. ▲

Staying Informed

COMPILED BY JON S. BERNDT, EDITOR "HORIZONS"

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

Preliminary Concept Studies for the Vision for Space Exploration
http://www.nasa.gov/missions/solarsystem/vision_concepts.html

t/Space Mid-Term Architecture Briefing
http://www.transformspace.com/Background.htm

Human Rating Requirements and Guidelines for Space Flight Systems
http://www.aoe.vt.edu/~cdhall/courses/aoe4065/NASADesignSPs/N_PG_8705_0002_.pdf

AIAA Space Logistics Technical Committee
http://www.aiaa.org/tc/sl/

James Oberg
http://www.jamesoberg.com

Federation of American Scientists
http://www.fas.org/

Klabs.org: NASA Office of Logic Design
http://www.klabs.org

Apollo Guidance Computer and Other Computer History
http://klabs.org/richcontent/Misc_Content/AGC_And_History/AGC_History.htm

Great Images in NASA (GRIN — highly recommended site)
http://grin.hq.nasa.gov/

NASA History Division
http://history.nasa.gov

NASA Lessons Learned Information System
http://llis.nasa.gov

For example, the large number of expected launch operations in the ETO mission represent fundamentally different risks than conducting the first BEO mission to Mars. Single mission risk on the order of 0.99 for a BEO mission may be acceptable, while considerably better performance, on the order of 0.9999, is expected for a reusable ETO design that will fly 100 or more flights.

- Human Rating Requirements and Guidelines for Space Flight Systems

New Members

ELIZABETH BLOME, MEMBERSHIP CHAIRPERSON

If you see one of the folks at the next section event, please give them a hearty welcome!

Laurie Aubin
John Birdsong
Julia Bodenhamer, League Cty Elem
Dennis Chim
Samuel Collis, Sandia National Labs
Bill Decker
Peggy Eddy
Mandakh Enkh
Mary Fallon
Susan Fontanilla
James Fisher
Natalie Goldberger
Addie Gollette
Sarah Graham
Sid Hamid
Nathaniel Harris
Tara Inscore, Hirsch Elementary
Salma Issa
Zina Karimi
Melissa Larsen
Nghia Le, Westbury High School
Thomas Miller
Kassie Moore, Seabrook Intermdt.
Anastasica Muliana, Texas A & M
Jennifer Needham
David Peters
Matthew Posey
Helen Reed
Wilma Robinson, Houston Gardens
Gopal Salvady
Bambi Spurgeon, Huntington ISD
Kristie Staas
Brian Tnady
Myesha Thomas, USA
Rouyana Vekilov
Liz Warren
Stephanie Witherspoon

Important notes:

- Not a member? See the end page.

Help AIAA Help You - Update Your Membership Records

ELIZABETH BLOME, MEMBERSHIP CHAIRPERSON

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.

- Scott Bourgeois
- Amanda Collins
- Justin Doyle
- David Keef
- David King
- Kyle Kraft
- Steve Lee
- Kwang Paick
- Brent Schultz
- Chaine Selig
- Nicholas Tyler
- Emily Unbehaun
- Timothy Welsh

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. ▲

New NASA Administrator Michael Griffin was three weeks away from becoming the next AIAA President at the time of his confirmation on April 14.

AIAA Houston Nominates Johnson Space Center …

AARON MORRIS, HISTORY

The "AIAA Historic Aerospace Sites Program" was started in 2000 to recognize sites in our history that contributed to the advancement of the aerospace field. Examples of sites already designated include the Boeing Red Barn, the site of Robert Goddard's first rocket launch, NASA Marshall Space Flight Center, NASA Langley, First Balloon Launch Site Annonay France, Kitty Hawk, and Tranquility Base. This year a team of AIAA Houston members and members of the NASA public affairs office are working to recognize The National Aeronautics and Space Administration Lyndon B. Johnson Space Center as a Historic Aerospace Site.

The primary motivation of this team has been the fact that the Lyndon B. Johnson Space Center (JSC) has played a vital role in all human space exploration programs from Gemini, Apollo, Skylab, Space Shuttle, through the International Space Station; and is at the forefront in making future expeditions to the Moon, Mars, and beyond a reality.

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The AIAA Houston team has submitted a nomination packet to the AIAA national office in Reston, Virginia. This packet has been reviewed and accepted. In the coming months the AIAA Houston team is working to produce a brochure and a plaque honoring the Center. This plaque will be dedicated at Rocket Park during a ceremony in the coming months. The wording of the plaque is as follows:

American Institute of Aeronautics and Astronautics
Historic Aerospace Site
NASA Johnson Space Center
(Houston, Texas)

Since its establishment in 1961 the Johnson Space Center (formerly the Manned Spacecraft Center) has led America's efforts in human space exploration. The numerous contributions of this site include advances in spacecraft development and life and space sciences – as well as for hosting Mission Control and the Astronaut Corps. The Johnson Space Center has played a vital role in all human space exploration programs from Gemini, Apollo, Skylab, and the Space Shuttle, through the International Space Station, and it is at the forefront in making future expeditions to the Moon, Mars, and beyond a reality. ▲

A celebration erupts in Mission Control at the Johnson Space Center at the successful conclusion of the Apollo 11 mission.

Dinner Meeting Reports

DANIEL NOBLES, PROGRAMS

In the month of February, the Houston Section hosted two dinner meetings. On Wednesday, February 16th Bill Chana discussed the development of a triphibian aircraft, a high technology research and development project for Rohr Industries, best known for its aircraft engines. The triphibian aircraft could land on water, snow, or land. An advanced concept prototype was designed, built, and flight-tested. The aircraft had a ducted fan propulsion system, a delta wing, all-composite structure, and a combination landing gear and water skis. Hydrodynamic tests were conducted with small and large scale models. The small scale model was even pulled behind a boat to test drag on the skis. There were many lessons learned in this development program. We saw slides that covered the construction, propulsion installation, taxi tests and flight tests, with a video that showed the taxi and hydrodynamic tests. For it's time, 1973-1975, this was quite an advanced aircraft. It pushed the cutting edge to its limits. It was approximately the size of a small car, and could fit into a normal garage with quick disassembly of a few parts. The Houston section thanks Bill for flying in from San Diego to give this interesting presentation.

General Jefferson Howell addressed the Houston Section with a "State of the Center" Address, conducted on Thursday, February 24th. He joked that the state of the center is Texas, and gave a quick off the cuff presentation about "Things that are on (his) mind". To summarize briefly, Return to Flight of the Shuttle is of great importance. Johnson Space Center has been given presidential orders to return the shuttle to flight, construct the international space station, and build a Crew Exploration Vehicle, which is a replacement for the space shuttle, 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. After completing these tasks, we'll look beyond our own planet, and look towards the Moon and Mars. These are frightening times for NASA; there is a great amount of pressure on us to perform, but success builds success, and we will pull through and comply with the tasks given to us by presidential orders. Budget is a concern to everyone, but we will find the money and do what we have been instructed to do. Many thanks go out to General Howell for taking the time to share his vision and the president's vision with us of the year to come at Johnson Space Center. ▲

What's Your Next Step?

ELIZABETH ZAPATA, PROFESSIONAL DEVELOPMENT

During Engineers week the Professional Development and Career Enhancement Committee held a Lunch & Learn on February 23 concerning career tracks. The Lunch & Learn was organized so that the community would have a chance to ask their peers how the panelists arrived at their present careers. The 6 panelist that the audience addressed their questions too included Brett Anderson, Robert Fisher, Albert Gonzales, Larry Tucker, Chet Vaughan, and Cynthia Wells. A couple of the questions asked of these panelists are paraphrased in the following list: "How do I get my manager to recognize that I am ready for more responsibility or more in depth tasks?", "As a hiring manager do you look at whether the candidate has a masters degree and in what field?", "How has professional organizations helped your career?", "Why did you pursue a masters degree or Professional Engineers License?" For more information on these topics visit the following websites to see what they have to offer for career development.

Texas Board of Professional Engineers
http://www.tbpe.state.tx.us/

AIAA
http://www.aiaa.org/

Snacks and drinks were provided and the final head count was approximately 30+ attendees. Many thanks to our wonderful panelists, as they did a great job providing helpful responses to tough questions. ▲

Technology and the History of Aeronautics: An Essay

DR. JAMES R. HANSEN, PROFESSOR OF HISTORY, AUBURN UNIVERSITY

The history of flight technology is just as much a story of people and ideas as are histories dealing with any other topic related to society and culture.

The history of aeronautical technology concerns much more than just the nuts and bolts of airplanes and spacecraft. It involves much more than just the history of propellers and wings, more than the history of landing gear and jet engines, more than the ornithology of P-51s and F-22s, or the genealogy of X-planes. The history of flight technology is just as much a story of people and ideas as are histories dealing with any other topic related to society and culture. Without question, scholars who write about the history of flight technology have a lot to say about the research, design, building, flying, maintaining, and utilizing of aerospace vehicles, but their studies are no less human, no less connected to social or political or aesthetic forces, because they deal with technical things.

The history of aeronautical technology tells us a lot about our existence as a thinking, dreaming, planning, scheming, aspiring, and playful species. As aerospace industry analysts William D. Siuru and John D. Busick have noted in relation to their study of the evolution of modern aircraft technology, humankind's journey through the ages has been not only eased and accelerated, but also *complicated* by our unique and irrepressible knack for technology and invention. From the stone ax and clay pot of prehistory to the electron microscope, computer, and spacecraft of the 20th century, our technological creations have been ingenious, phenomenal, and occasionally—for good and for ill—of world shaking significance.

This is, by all means, true for the airplane, one of the most ingenious and phenomenal—if slow-to-come—inventions in our history, and surely one of the most world-shaking. In how many ways has the flying machine changed society? As Antoine de Saint Exupery wrote in 1939, it has "unveiled for us the true face of the Earth." It has brought people together. It has changed our economy. It has added an unprecedented new dimension to warfare. It has affected such things as government, public administration, international relations, international policies, manufacturing, marketing, mining, cities, real estate, media, railroads, ocean shipping, agriculture, forestry, and much more. It has affected population, the family, religion, health, recreation, education, crime, even sex.

And it has not been all for the good, of course. What ever *is* "all good"? In the 90 years from the tragic death of Lt. Thomas Selfridge in Orville Wright's airplane at Fort Myers, Virginia, in 1908 to the Swissair disaster off Nova Scotia in summer of 1998, there has never been a time when aviation did not know terrible accidents. Aviation has also raised human conflict to new heights (or depths) of destruction. Despite this, the flying machine has always inspired "great expectations"—perhaps too great given that it is, after all, just one of our *many* machines. Orville Wright himself summed up our loftiest ambitions for aviation when he said that it had been his hope (and that of brother Wilbur) that they were giving the world "an invention which would make further wars practically impossible." Unfortunately, history proved them wrong, and it did not take long to do it. As much as we admire the "Bishop's Boys" for their dream of a benevolent instrument of global peace, we are equally astonished by how such extraordinarily clear and logical thinkers could have been so ordinarily naive about the forces in the world around them. Maybe someday their vision will be proved right, and the world will discover, as the Wrights did, that peace, like flight, requires not brute power, but control and balance.

Contrary to what many engineers, most technocrats, and the great majority of industrial entrepreneurs seem to believe; contrary to people who use the internet to read the morning paper, or to golfers who cannot enjoy a round of golf without riding in an electric golf cart and swinging a $500 titanium-headed driver; contrary to what many people in modern consumer society seem to believe, *technology is not inherently good*. In the words of one of the founding fathers of the history of technology as a discipline, Melvin C. Kranzberg, "technology is [actually] neither good, nor bad, nor is it neutral." Kranzberg called this "The First Law of the History of Technology."

No technology is absolutely, by-its-very nature "good." And none is bad. But neither is technology ever *neutral*. Depending on how we design the technology, and even more on how we *use* the technology, it will affect us, it will change us, in some way. Whether the effects and changes turn out to be good or bad, or both inseparably together, is not predestined in the inherent qualities of the technology itself (as the Wright brothers seemed to have thought about the airplane) but rather it depends on the broader context and values within which we live our lives. The human consequences of the airplane have gone far beyond what the Wrights or any-

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one else imagined in 1903. If it had been invented at a different time, or if it had been introduced into a different context or under different circumstances, the invention of the airplane might have led to quite different results. In this case, as in others, "The river of history could have cut a different canyon." Kranzberg's first law reminds us to "compare short-term versus long-term results, the utopian hopes versus the spotted actuality, the what-might-have-been against what actually happened, and the trade-offs among various 'goods' and possible 'bads'". All of these comparisons can be made "by seeing how technology interacts in different ways with different values and institutions, indeed, with the entire sociocultural milieu."

But Kranzberg's first law is not the only "law" apropos to consideration of the history of flight technology. Another basic insight comes not from historians, but from those who work in the aerospace industry. There is a saying in the aerospace industry: 'Requirements push and technology pulls." What this means, in a nutshell, is that the requirements of new missions, or even the need to do current jobs better, are often what is driving engineers and scientists to work on the leading edge of technology. They are being "pushed" by ever more demanding requirements to find solutions to problems through the invention of new ideas. Technology then "pulls" by attracting those whose job it is to find a way to meet the requirements to the newest concepts germinating in university, government, and commercial laboratories. For the "push and pull" to work together effectively, it then takes a forward-thinking planner smart enough to envision a way to use the new technology successfully in the design of a brand new aircraft.

This sequence of developments—requirements (or needs), technology, concepts—has been, and still is, basic to the technological progress of most modern aircraft—and perhaps *all* military aircraft. "Requirements push and technology pulls" may be just a more complicated way of the old saying: "Necessity is the mother of invention." There is a lot of common sense, and quite a bit of historical validity, to this ancient aphorism, but it is also true that it is not always the case—or always that illuminating of what is going on. Sometimes "Necessity is *not* the mother of invention," but just the opposite: "*Invention* is the mother of necessity." This is in fact Melvin Kranzberg's second law of the history of technology—and it makes us think about aerospace technology in some very important ways.

Once the Wrights invented the airplane, all sorts of things then really needed to happen. Over the course of the next 30 some years, the airplane was in a sense *reinvented* as the Wrights' achievement was completely rethought and reworked by emerging groups of professionals dedicated to the airplane's improvement and greater practicality. What Kranzberg's second law tells us is that "Every technical innovation seems to require additional technical advances in order to make it fully effective." In the case of the airplane, the invention quickly necessitated all sorts of auxiliary technologies: advanced structures and materials, new wing shapes, streamlined aerodynamics, retractable landing gear, efficient low-drag engine cowlings, variable-pitch propellers, and much more. But perhaps even more importantly, it also necessitated new social forms and organizations (like military air services, airlines, airports, government bureaus, research laboratories, engineering curricula, and much else) in order to make the airplane more fully practicable. "While it might be said that each of these other developments occurred in a response to a specific need," Kranzberg claimed "it was the original invention that mothered the necessity."

It is important to underscore one last, essential point. Just because the history of technology involves technology, it does not mean that technical factors always take precedence. In the real world, so-called "soft" and "mushy" things like politics and culture, like what bankers think can make them money or what activists say may harm the environment, often override good technical or engineering logic. *And they should.* Some might say that is why an American SST has never flown. That is why in the history of the American space program, all the thoughtful and well intentioned talk about "the next logical step" has almost never led to it. After launching a man into space via Project Mercury, NASA said that the next logical step was to establish a permanent manned presence in low earth orbit, but instead the country landed men on the Moon. After going to the Moon via Project Apollo, the next logical step was to build an earth-orbiting space station along with a space shuttle to service it, but instead the Nixon Administration decided that the country could not afford both and could manage temporarily with just the shuttle, even though the space station had always been the shuttle's main reason for existing. After the shuttle, surely the next logical step was to build a space station, but once again the country found reasons to postpone building one.

Clearly, logic does not determine the history of technology; and technologically "sweet" solutions do not always triumph over political and social forces. Historical logic, if we even want to use that phrase, is not the

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Sometimes "Necessity is not the mother of invention," but just the opposite: "Invention is the mother of necessity."

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logic of engineers and scientists; it is the logic of Lewis Carroll's *Through the Looking Glass*. In that all-too-real fantasy land, Tweedledee explains logic to Alice: "Contrariwise, if it was so, it might be; and if it were so, it would be; but as it isn't, it ain't. That's logic." Tweedledee's logic is the only kind the American space program has ever known, or probably ever will.

So, if you stumble across a book on a topic in the history of aerospace technology, do not be put off because you might think its author's brain is full of just engineering tables and equations. That will not prove to be the case. There is a lot of "soft and mushy stuff" up there also. It is what makes our species human; it is part of what makes us brilliant, and a large part of what drives us nuts. It is what makes the history of technology one of the most complex and fascinating subjects one can possibly study.

There may be a bigger message here as well. In 1998 Microsoft's Bill Gates said about the Wright brothers' invention in a speech he gave at *Time Magazine*'s 75th anniversary celebration of the airplane that "We have to understand that engineering breakthroughs are not just mechanical or scientific, they are liberating forces that can continually improve people's lives."

Let us hope that the flying machine, in the 21st century, does "free" us, in *more positive* ways, than it has been able to do in the century just passed. There is no guarantee that it will. But like our dear Wright brothers gazing into their future that is our present, let us proceed into this new millennium with optimism that our globe's political environment will improve so that our future generations can enjoy our technical advances and not be destroyed by them. It is something in which the Wrights would want us not only to apply our best problem-solving and inventive skills, but also in which to invest our limitless capacity to hope and to trust. ▲

[Thanks to Dr. Hansen for allowing us to reprint this article.]

A Lunch and Learn Summary Report

Network Centric Computing for Aerospace Applications

TIM PROPP, VICE-CHAIR, TECHNICAL

The Extra-Vehicular Activities Technical Committee hosted a Lunch and Learn seminar on January 20, 2005. Nazareth Bedrossian of the Charles Stark Draper Laboratory gave a very popular technical briefing on Network Centric Computing for Aerospace Applications to 16 members of the JSC community.

Network Centric Computing (NCC) describes a set of networked computers that are used for resource sharing and coordinated problem solving. Two categories of NCC, internet computing, and distributed simulation, were described with example applications. Internet computing describes centralized applications accessed by geographically distributed users. In this category, two internally developed software products were reviewed; eSim and VSSim. eSim is web server software that enables multiple users to access any simulation via the Web. The current version runs under the Unix OS. An interactive version of eSim has also been developed. Examples of eSim developed by Draper include the Draper Station Analysis Tool (DSAT), Draper Station Simulation (DSS) for Mathworks, and Shuttle Interactive On-Orbit Simulation (IOS). VSSim is a Virtual System Simulation framework that provides a geographically dispersed user community the capability to share models without revealing source code, and create simulations from them on a central computer. The software features a subsystem “model repository” that can be populated with models from a variety of languages/tools, and provides model migration pathways to hardware-in-the-loop simulation environments.

Distributed simulation involves geographically distributed software subsystems, which are assembled into complete simulations over a network by geographically distributed users. In this category, an internally developed software product, XNsim, was reviewed. XNsim (eXtensible Network simulation) provides the capability to assemble simulations from remotely shared models without revealing model source code. Dr. Bedrossian reviewed an XNsim demo developed for the 2002 AIAA GN&C Conference. A simulation was assembled in Monterey, California from subsystem models executing on nodes in Houston, Texas and Munich, Germany. Additional examples are available at http://www.jsc.draper.com/ncc.

Naz Bedrossian has been involved in spacecraft simulation development, control system design and verification for over 15 years. He is the group leader for aerospace systems at The Charles Stark Draper Laboratory, Inc. He holds a PhD from MIT. ▲

Graphical Object Simulation Tools & Techniques

TIM PROPP, VICE-CHAIR, TECHNICAL

A Lunch and Learn Summary Report

The International Space Activities Technical Committee hosted a Lunch and Learn seminar on January 17, 2005. Draper Laboratory's Mark Jackson gave a very popular technical briefing on Graphical Object Simulation Tools & Techniques to 35 members of the JSC community. The lecture focused on the latest technology for space vehicle mission and guidance simulations. Mr. Jackson reviewed various applications developed by the JSC-based Draper team for the space flight community.

The core functionality of the program builds upon the inherent strengths of graphical depiction and data flow in Matlab Simulink, but using an object-oriented approach. This approach, although common in the software industry in general, is not widely used by the space flight simulation and controls community. It improves the usability and extendibility of the Simulink package, making it more suitable for complex space simulations. Mr. Jackson emphasized the value of a hierarchical decomposition of simulation data objects through the use of common "masks" or abstraction layers. The effectiveness of his team's development was demonstrated in a live demo. Mr. Jackson designed and built a multi-body satellite demonstration "on-the-fly" and clearly showed the ease of data building and organization. The flexibility introduced by his team's approach was also shown, as the demonstration included replication of a many-vehicle simulation for a mission using entirely different parameters.

Mark Jackson has been involved in spacecraft simulation development, control system design, and verification for 10 years. He is a Principal Member of the Technical Staff at The Charles Stark Draper Laboratory, Inc. He holds an MS from MIT. ▲

Outreach and Education

JOY CONRAD KING, PRE-COLLEGE OUTREACH CHAIR

AIAA Chooses Science Fair Winners

The 46th annual Science and Engineering Fair of Houston was held March 17-19 at the George R. Brown Convention Center. This fair is one of the largest of its kind and draws regional winners from the 16 county area. Each year there are approximately 1200 entries spanning grades 7-12. The fair also has by far the most special awarding agencies that give out their own award at the fair.

Once again the AIAA Houston section was one of those special awarding agencies and gave out prizes to the best aerospace project in the Junior, Ninth Grade, and Senior divisions. The award this year was a book about how things work signed by NASA astronaut John Phillips. The winners also received a balsa wood glider, a toy shuttle, and some other goodies.

This year the winners are:

Junior Division
Ben Moras, *Paper Airplanes – The Real Story*
8th Grade, St. Thomas More Catholic School, Houston

Ninth Grade Division
Tiffany Pham, *Airfoils: Camber and Angle of Attack*
9th Grade, Clements High School, Sugar Land

Senior Division
Joash Cantu, *1, 2, 3 Blast Off*
11th Grade, Waltrip High School, Houston

Congratulations to all the students who made it to this level and especially to the AIAA winners. It's great to see such an enthusiastic bunch of possible future engineers and scientists. ▲

Outreach and Education

2005 AIAA Region IV Student Paper Conference

Dr. John Valasek, College and Co-op Chair

The 2005 AIAA Region IV Student Paper Conference was held on 8-9 April, and hosted by the University of New Mexico Student Branch and the Albuquerque Section. A total of 40 students and faculty advisors from the University of New Mexico (Albuquerque Section), University of Texas-Arlington (North Texas Section), and Texas A&M University (Houston Section) attended. The First Place students in the Undergraduate Technical Division and the Graduate Technical Division will compete in the National Student Paper Competition at the 2006 AIAA Aerospace Sciences Conference in Reno, NV.

Texas A & M student branch officers. Merri Sanchez receives award.

Undergrad Technical first thru third place winners

Conference attendees were treated to tours of the National Atomic Museum, and Eclipse Aviation, home of the revolutionary Eclipse Jet for General Aviation. A Young Professional Seminar was also held so that student attendees could interface with young professionals and garner career advice.

The students and faculty from Texas A&M University who attended the conference wish to express their appreciation for the generous support provided by the Houston Section, which made their attendance at this conference possible.

Here are all of the results from the conference:

Outstanding Student Branch in Region IV

Texas A&M University

Aerospace History Division
(Freshmen and Sophomores)

1st Place: Jose Rodriguez, Texas A&M University, "An Analytical Approach to the Development of Sputnik in Soviet Russia"

2nd Place: University of Texas-Arlington student

Team Design Division

1st Place: Shane Schouten, Michael Albright, Randi Florey, Chris Haag, Guadalupe Perez, and Ben Riley, Texas A&M University, "The 'Revenant' Advanced Gunship Design"

2nd Place: Brandon Ray, Timothy Thornton, T.J. Fuller, Kyle Helbing, and Alexandrea Anderson, Texas A&M University, "Design of the DA-222 Negotiator Advanced Gunship"

3rd Place: University of Texas-Arlington team

Undergrad Technical Division

1st Place: Zach Reeder, Texas A&M University, "Marathon Long Endurance UAV Development"

2nd Place: Kyle Helbing, Texas A&M University, "Improving Sequencing and Separation at a SATS Airport Including Human Factors Considerations'

3rd Place: (TIE)
Amanda Lampton, Texas A&M University, "Prediction of Icing Effects on the Stability and Control of Light Airplanes"

Chris Haag, Texas A&M University, "Characterization of Shape Memory Alloy Behavior and Position Control Using Reinforcement Learning"

Graduate Technical Division

1st Place: University of New Mexico student

2nd Place: University of Texas-Arlington student

3rd Place: Tapan Kulkarni, Texas A&M University, "Crew Exploration Vehicle: Optimal Design Solutions and Configuration" ▲

Cranium Cruncher

BILL MILLER, JON BERNDT

Last Issue Solution

The ferry problem comes from the puzzle master himself, Martin Gardner, from his book Hexaflexagons and Other Mathematical Diversions (1959). It's in Chapter 12.

I have seen about as many ways to solve this as solvers. I like this one the best. Let w = the width of the river. On the first crossing the ratio of distances traveled by the ferryboats is (w-720)/(720). On the next trip it's (2w-400)/(w+400). You can set these two ratios equal and solve for w. It comes out to 1760 yards, or one mile. The speed of the boats can't be found, but the ratio of the speeds is 13/9.

Correct solutions were received from:

Douglas Yazell
Frank Baiamonte
Darrin Leleux (extra credit for showing all his work!)
Ed Smythe

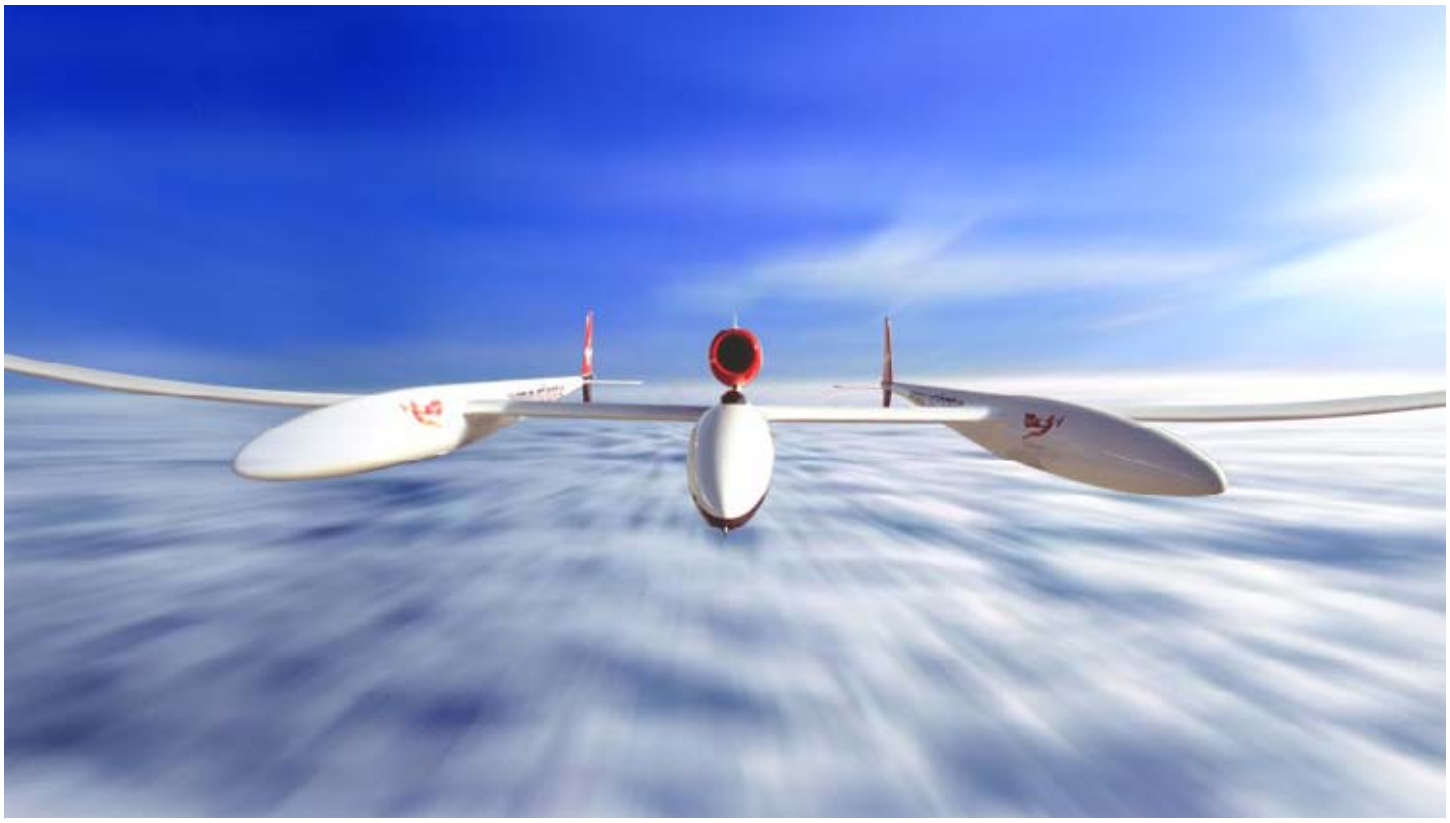
March April Puzzle: Flight Around the World

A group of airplanes is based on an island. The tank of each plane holds just enough fuel to take it halfway around the world. Any desired amount of fuel can be transferred from the tank of one aircraft to the tank of another while the aircraft are in flight. The only source of fuel is on the island, and for the purposes of the problem it is assumed there is no time lost in refueling either in the air or on the ground.

What is the smallest number of aircraft that will ensure the flight of one aircraft around the world on a great circle , assuming that the aircraft have the same constant ground speed, the same rate of fuel consumption, and that all aircraft return safely to their island base?

Please send your answers to Jon at editor@aiaa-houston.org.

Names of winners will be published in the next issue. ▲



Hint: None of the aircraft in this issue's puzzle are Scaled Composites designs!

CALENDAR

April
4 Executive Committee Meeting
14 Social
15 Election Ballots sent out
15 Associate Fellow Nominations due
23 Spirit of Flight Airshow - Lone Star Flight Museum
23 JSC Open House

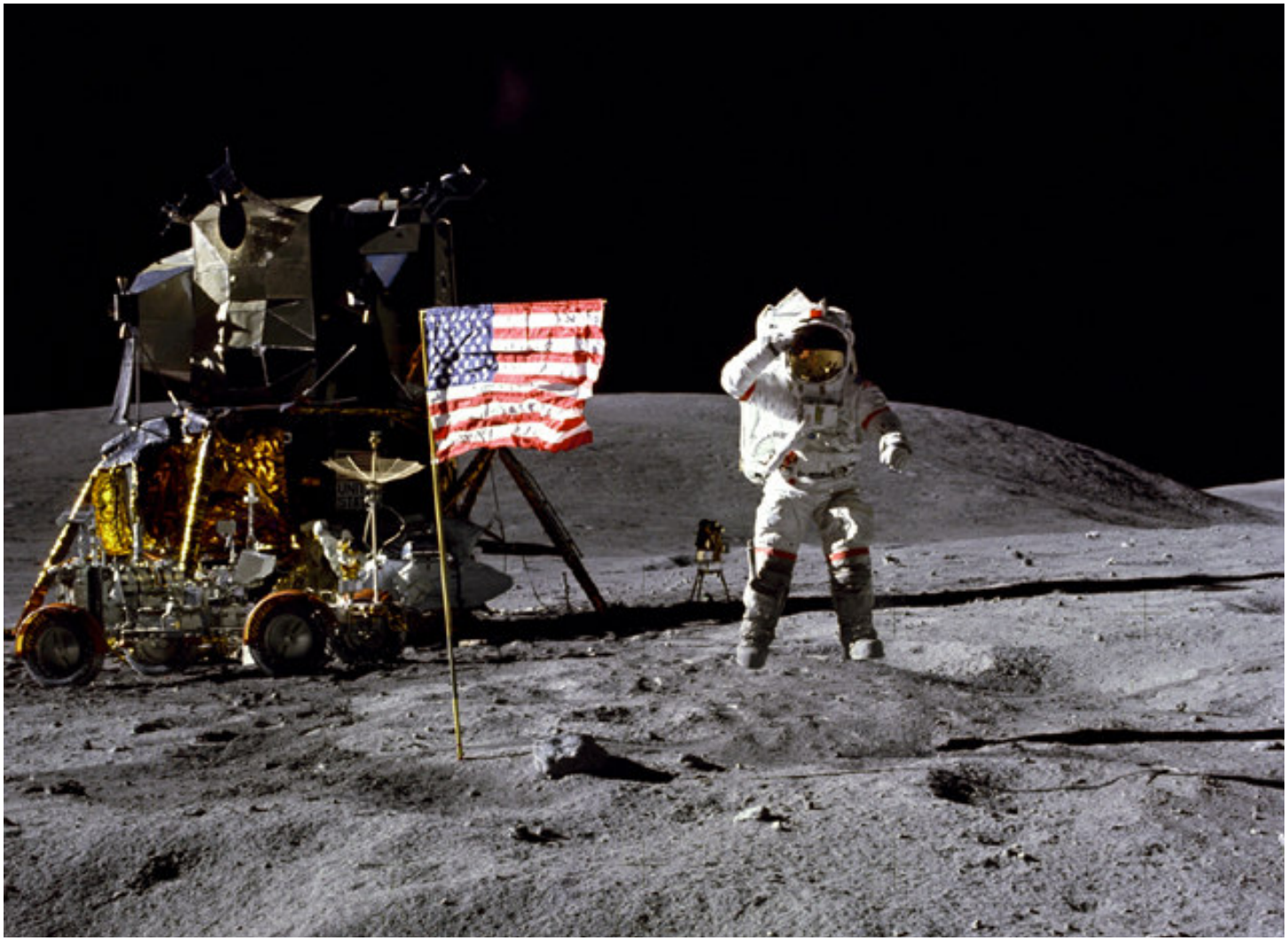
May
2 Executive Committee Meeting (Gilruth)
4-5 11th Annual Workshop on "Enhancing Space Operations" Gilruth
6 Annual Technical Symposium at Gilruth
Facility Tour (TBD)
15 Ballots should be tallied by May 15th
Compile and submit awards for banquet
Finish nomination packages for Fellows
?? Apache helicopter demo JSC or Ellington
?? Public astronomical observing activity UH-Clear Lake

June
2 "Risk Management" by David Fuller/Boeing
6 Executive Council meeting
16 "The Search for Extraterrestrials" by Seth Shostak (AIAA Distinguished Lecturer); Annual Honors & Awards Banquet

July
1 "ISS Phantom Torque" by Dr. Jack Bacon/NASA-JSC
14-15 Region Leadership Conference in Tucson, AZ

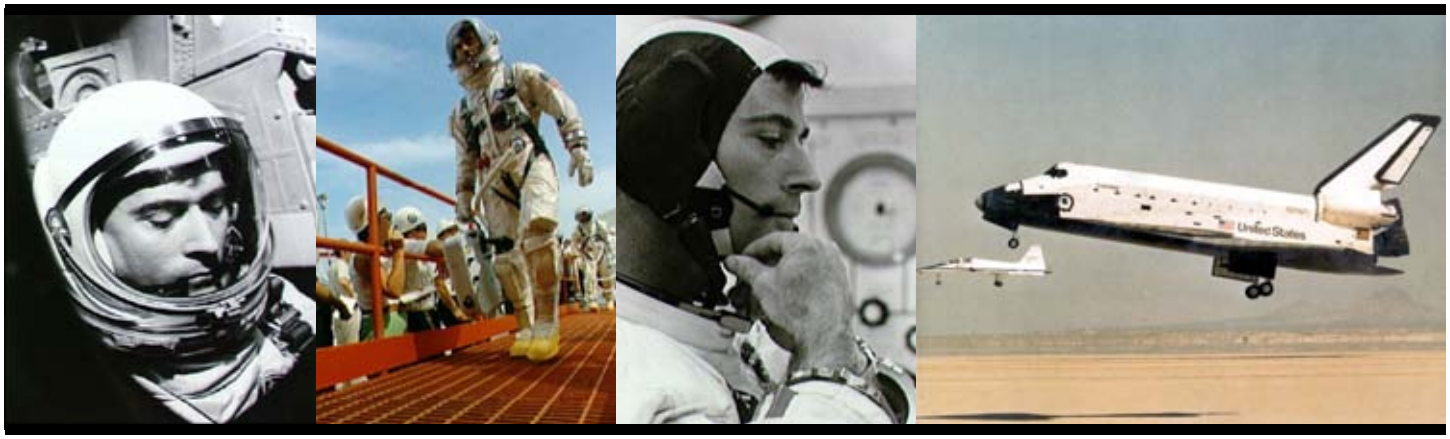
Odds and Ends

SPECIAL EVENTS, PICTORIALS, ETC.



NASA Space Pioneer John Young, Astronaut Without Equal, Retires

"John Young's achievements during his 42-year career at NASA are unmatched. He was the first human to fly in space six times and launch seven times, six times from Earth and once from the moon. He is the only astronaut to pilot four different types of spacecraft, flying in the Gemini, Apollo and Space Shuttle programs. Young is the longest serving astronaut in history. His retirement from NASA is effective Dec. 31." - NASA



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AIAA Mission

Advance the arts, sciences, and technology of aerospace, and nurture and promote the professionalism of those engaged in these pursuits. AIAA seeks to meet the professional needs and interests of its members, as well as to improve the public understanding of the profession and its contributions.

Become a Member of AIAA

Are you interested in becoming a member of AIAA, or renewing your membership? You can fill out your membership application online at the AIAA national web site:

www.aiaa.org

Select the AIAA membership option.