Horizons

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AIAA HOUSTON
American Institute of Aeronautics and Astronautics

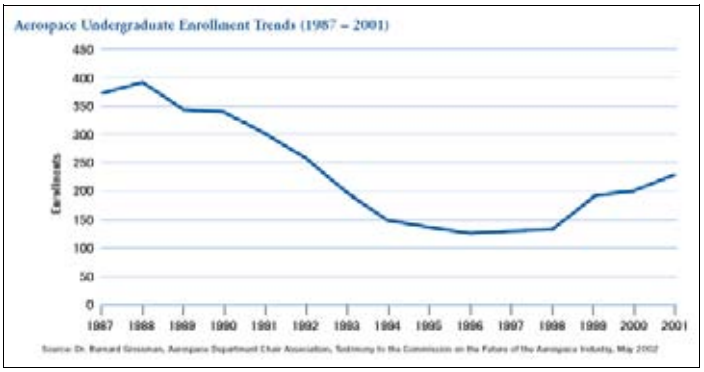
Contents

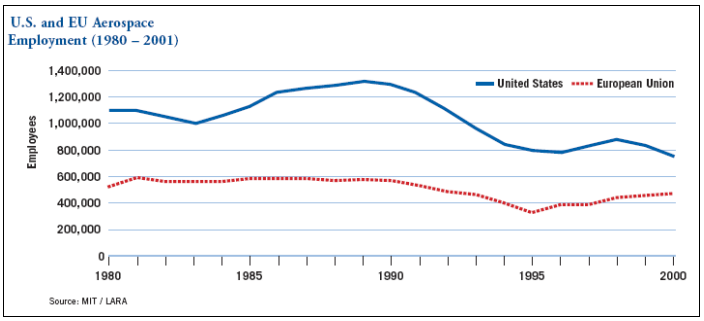
Education and the Future Workforce

JON S. BERNDT, EDITOR

We've heard for some time now various alarming statistics about the state of the current and future engineering workforce in America. In testimony before the Commission on the Future of the United States Aerospace Industry (CFUSAI), AIAA Public Policy Vice President Martin Kress stated in 2002, "*A key issue on the AIAA agenda is people and workforce-related issues. And, I fear, it will be a key issue for years to come. Simply stated, we are not producing an adequate number of scientists, engineers, technicians in the U.S.; our current technical workforce is aging; the market for technically skilled workers and managers is expanding exponentially, but our labor pool is flat at best – 200,000 new graduates each year are offset by 200,000 retirees.*" In testimony before the House Science Committee in August 2002, then NASA Administrator Sean O'Keefe echoed, "*Throughout the federal government, as well as the private sector, the challenge faced by a lack of scientists and engineers is real and is growing by the day*".

There are those who disagree that there is (or will be) a shortage of engineers and scientists, and that the alarm expressed is artificial. In a recent (July 2004) presentation given to the Congressional Caucus on Science and Technology, Michael Teitelbaum of the Alfred P. Sloan Foundation stated that there are "*no credible quantitative evidence of shortages*", and quoted a RAND statement (from 2002), "*... neither earnings patterns nor unemployment patterns indicate [a science and engineering] shortage in the data we were able to find.*" Mr. Teitelbaum suggests that industry and academia may be simply using claims of looming shortages as political marketing tools.





Forecasting future workforce needs is hard, and the labor market is cyclical, with booms and busts. There seem to be some data suggesting that mid-career layoffs are higher for those in the aerospace industry than elsewhere. Unfortunately (if actually true), this could add to another problem that has been pointed out: that the average age of the aerospace workforce is increasing. While greater numbers of older engineers and scientists retire, there are not enough mid-career scientists and engineers who have learned from them over time and will carry on their experience. This results in a loss of intellectual capital.

Perhaps because the aerospace industry is cyclical, high school students are less certain about pursuing a career in science and engineering than they were ten years ago, according to ACT (formerly The American College Testing Program). Personal investment in time and money for those who pursue a career in science and engineering is high. Does the profession hold any luster for those students considering their future, as they graduate from high school? The late CFUSAI Commissioner and former Congresswoman Tillie Fowler addressed that concern in a blunt warning: "*If the aerospace industry cannot attract and retain the best and the brightest, then the industry doesn't have a future*". Considering that (according to the Aerospace Industries Association) the "*U.S. aerospace*

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Chair's Corner

T. SOPHIA BRIGHT, CHAIRPERSON, AIAA HOUSTON

We are drawing to a close for this term of the Houston Section. I think that we have made great strides in realizing many of the goals that we started with at the beginning of the term.

We have, for the most part, completely transitioned the section information and announcements to the new section websites. We still have a few odds and ends that exist on our old site.

I feel that we have come a long way in improving our overall communications with our members. We have completely revamped our section newsletter as you have seen over the last few editions. We have explored other means to communicate with our membership using an electronic distribution of the newsletter and postcards to provide information to the membership. We also put together a new member survey to gauge our effectiveness in providing service to our membership.

We have also continued to provide professional and technical development avenues for our members. We hosted several well-received lunch-n-learns throughout the term and a successful Annual Technical Symposium in May.

And we have established a strong network of leadership to ensure continued success in the coming term. I would like to welcome the 2005-2006 term of officers for the Houston Section. I would also like to specifically offer my congratulations to the newly elected officers:

Chair – Steve King
Chair-Elect – Jayant Ramakrishnan
Vice Chair – Operations – John Keener
Treasurer – Brad Files
Secretary – Syri Koelfgen
Councilor – Mike Oelke
Councilor – Albert Meza
Councilor – Jesus Reyna
Vice Chair – Technical – Tim Propp

I want to thank everyone who volunteered his or her time and effort to make this year a success. Without these people we would not have been able to accomplish so much.

As my time draws to end as the Chair of the Houston Section, so is my time as a member of the Houston Section. I am very pleased to have been a part of the continued growth of the Houston Section and I will cherish my experiences. I have not only grown professionally through my membership and involvement, but I have also made very good friends who have shared a common passion for the space industry and the well-being of the JSC community. I am proud to have been associated with the Houston Section. Wishing you all the best of luck in the coming year! Mars or bust!

T. Sophia Bright
2004-2005 Chairperson, AIAA Houston Section

From the Editor

JON S. BERNDT, EDITOR, "HORIZONS"

Almost this entire issue is devoted to professional development, workforce, and education, with special attention given to students.

With concerns raised about the ability of our future science and engineering workforce to keep America at the top in a competitive global arena, it is appropriate that AIAA places an emphasis on education. AIAA has an extensive web presence for students and educators (see the link in this issue's *Staying Informed* column on page 8). The AIAA education page has a link to the AIAA Foundation web page. The Foundation was formed with the goal of "improving the scientific literacy of our youth" and for "advancing the arts and sciences of aerospace". The Foundation works to accomplish its goals through provision of scholarships, assistance, opportunities, and recognition, among other things. From the AIAA Foundation web page, one can find a link (at bottom) for K-12 educators that describes various programs and resources available to them. One program provides a grant of up to $200 per teacher for purchase of demonstration kits and other supplies to "energize science, math, and technology hands-on learning".

As mentioned, the AIAA Foundation also recognizes achievement. At the recent AIAA Houston Annual Awards Banquet, Houston AIAA section member Mrs. D. Lollie Garay was recognized for being awarded one of six AIAA Foundation Educator Associate awards, which are given once ever two years. See our January/February 2005 issue for the details on her award.

We hope you find this issue enjoyable and informative. We invite you to write to us with any feedback. Best wishes for a safe summer.

- JSB

Letters to the editor@aiaa-houston.org

AIAA HOUSTON

American Institute of Aeronautics and Astronautics

On Heavy Lift

The basic question is, do we want humans to be part of space exploration by sending them out into space to explore? If the answer is no, I agree with the assessment [see previous newsletter] 100%. We don't need heavy lift to do robotic missions. It may make the job easier in some instances, like JIMO, but for the most part we can work around the limitations of limited lift capability. If the answer is yes, then I think heavy lift is the safest and least expensive way to go and that using shuttle derived hardware is the best solution.

There's no way around the fact that lifting humans into space and returning them safely is a heavy lift requirement. We have always used the largest rockets in their class to do the job. Atlas, Titan, Saturn. If you want humans to stay in space for a significant length of time and travel beyond low earth orbit I think the system integration trade studies will clearly show that using fewer launch elements that are tested and integrated on the ground will be both safer and lower cost. Integration is very expensive and hard to do. More elements need more integration.

Assume two launchers, one medium and one heavy each with the same probability of launch failure. Now build your space exploration architecture with one of each. Medium lift requires more launches, more unique hardware elements to be integrated, more mission planning (more rendezvous). More separate things have to work correctly for a successful mission. More launches means a higher likelihood of failure. One launch failure means all the hardware on orbit will probably be lost because there is a finite amount of time it can remained parked before boil off of cryogenics or other reasons makes it useless. I'm quite sure that we won't have spare hardware for the particular element that is lost available or ready to launch in time to save the mission. Even if you did, would you want to risk it on a booster that had just failed? I think all these factors point us to a heavy lifter as the optimum solution. Will it be expensive to develop and operate? Yes, it will. But over the life of the program the cost is less. In fact, I would assert that you could more than pay for its development from the savings taken from not developing and integrating a greater number of smaller elements.

Using Shuttle elements is also logical. The most expensive pieces of hardware exist and are in production. The launch facilities exist and are in operation. Adapting existing hardware to meet new requirements is almost always less expensive than developing new hardware from scratch. It is also more difficult and expensive to add on "man-rated" capability than it is to design it in. The “army” required to operate a Shuttle hardware based heavy lifter is projected to be much less than the current NSTS requirement, mostly due to the projected landing mode, (aborts are much simpler), and the reusability of the projected CEV is limited. You’re fooling yourself if you think the workforce will be smaller for an architecture based around a medium lifter with lots of little elements required to accomplish the same mission requirements.

- Veteran STS Performance and Design Engineer

Horizons

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

T. Sophia Bright
Houston Section Chairperson

Jon S. Berndt
Editor

Regular Contributing Authors
Jon S. Berndt
Elizabeth Blome
Bill Miller
Daniel Nobles
Joy Conrad King
Sarah Shull
Steven R. King

Please address all newsletter correspondence to the Editor:

editor@aiaa-houston.org

Student Essay

I Chose Aerospace Engineering Because ...

CAROLINA RESTREPO, SENIOR, TEXAS A & M

I have always wanted to work for NASA. I grew up in Medellin, Colombia and spent my last 9 years before college in La Paz, Bolivia. I knew that if I wanted to reach my dream of going into space I would have to leave home and go to school in the US. I chose Texas A&M because both of my parents went there and because it was so close to JSC. I thought it would be great to have the chance to go see NASA in person as soon as I got to Texas because until that point I had only seen it on the Discovery channel.

I knew from the beginning that I wanted to be in engineering. I chose aerospace because I was intrigued by the senior design project, which involved designing and building either an airplane or a rocket. This past semester we designed a business jet, which we will be building and flying an RC model of in the fall.

Carolina is holding the SAFER (Simplified Aid for EVA Rescue). This picture was taken at the virtual reality lab where she got to teach the introductory class on how to use the SAFER in the VR environment.

When I started school in the spring of 2001 my main short - term goal was to make good grades to lead me on a path that would eventually help me get a job at NASA. During my first semester at A&M I found out that people my age were working at NASA and that I didn't have to wait so many years to be there. I went to the career center and asked to be a volunteer at the next career fair. The next semester I helped Bob Musgrove, JSC's co-op coordinator, set up the booth at the fair. That day I got an interview and a couple of months later I found out that I was accepted into the co-op program!

Working here as a co-op has been one of the best experiences of my life. I have worked at JSC for four semesters. I spent my first tour working in the Propulsion and Fluids branch where I had the chance to work with hardware and testing. During my second tour in the EVA Systems group I became certified in teaching the SAFER intro class in the virtual reality lab and had the opportunity to dive in the NBL during one of the STS-121 runs. My third tour was in the Flight Mechanics and Trajectory Design branch where I worked on improving and validating a vehicle mass sizing tool and writing a program that calculated entry points for a vehicle coming back from the moon that followed a skip-entry trajectory.

This summer is my last tour. I am working in the GN&C Design and Analysis branch. I will be investigating the effects of using the forward RCS jets on the shuttle during entry and during GRTLS. I will continue to work on this project at Texas A&M in the fall semester.

Next year I will start graduate school and I hope to come back to JSC as a grad co-op. Co-oping at JSC has helped me plan my future and have clear goals. After graduate school I would like to work for NASA and apply for the astronaut candidate program. Eventually I would like to teach at a university.

"The Ascent"

CHRIS HAAG, SENIOR, TEXAS A & M

Student Essay

It was the sound of the space shuttle engines that first grasped my attention. I was in a large theatre at Johnson Space Center (JSC) where they showed what a launch was really like. At the time, I was in the fourth grade. One of my teachers, Mrs. Ryals, had put together a group of about twenty students the prior year that focused on learning about some of the more nifty professions out there. Enough of us loved learning about astronauts that we all flew to Houston from my hometown of New Orleans for the day, where we had an awesome excursion at JSC. At my age, I remember thinking that I couldn't believe what man was capable of. The field of aerospace engineering… it seemed like an extraordinary journey and pursuit. Nevertheless, the dreams filled my little head, and it became something I desired to do.

At the time, though, it seemed too surreal for me to think about actually being able to fulfill any of these dreams. I had always thought that I'd just stay a kid forever. There was no type of lifestyle that I knew other than going to elementary school and playing tag with my friends. But, as I would soon find out, time is like one of those Duracell batteries… it likes to keep going.

It was probably near my eighth grade year that I started thinking a little more seriously about possible careers. It was then that I had Mr. Gaines as my math teacher. He had energy, he always had the attention of his students, and he knew how to make me want to succeed. Math was actually interesting when he taught it. And this wasn't just because of the stories he would tell or the math games we would play, but the main reason was because of the liveliness and force he brought into teaching – his vivacity showed just how much he cared about the subject. In his class, it was more than just learning how to use the FOIL method – it was conquering it. I thought of it as a mountain I was climbing – what was at the top I did not know, but how much of an adventure it was to climb up with him as the guide! And using my strength to pull myself from level to level - that was my perseverance. He built that up; he built up my will to learn, my determination.

I'll never forget playing him in the game of Othello – he was an indestructible piece of iron at that. Though I never could beat him, the victory was in the fortitude planted in me.

Needless to say, by the time I entered high school I could see myself using math in the long term. And my desire to learn about aerospace technology increased so much to the point that I made sure my bowling team was always called, "The Flying Cows" (maybe not the most aerodynamic of shapes, but it made for a funny logo). Projects were always an encouragement as well. I remember the task of building a structure eight inches tall out of fifty index cards and a roll of scotch tape. The goal was for the structure to hold our math textbook – somehow mine ended up holding 70 textbooks before it buckled. Boy was that ever a loud crash!

So more time went by, and the strong support of my parents never ceased. Museums, air shows, tours, books – whatever they could do to help foster my dreams, they always did. When the time came during my senior year to apply for colleges, I thought it would be difficult to pick a major. I recall getting a list from a counselor that included all the majors that one could pick. The second choice on the list was Aerospace Engineering – I thought that sounded like a "fun challenge" so I put a checkmark by it (the first on the list was Accounting…blah). Though I did read the rest of the list, my decision had already been made. There was only one checkmark on that piece of paper, and after I thought about it for a while, I couldn't believe I had initially thought the decision would be difficult.

I ended up attending Texas A&M University (WHOOP!) where I found out what "fun challenge" actually meant. Though the classes and study time might have gotten a little intense at times, I resolved to keep the dream alive. Over here the game of Othello never stops. And all the time, through the little daily successes of those sitting next to me, I have been amazed at seeing what man really is capable of. With a strong enough will, a cheerful energy, and a bag of gummy bears every once in a while (my particular study treat), hope and reality can converge.

I have one more semester until I receive my undergraduate degree from Texas A&M. I had a blast last year being the AIAA Chair in Aggieland, and I have had the pleasure of doing research this past year with Dr. John Valasek on control methodology for bio-nano morphing wing technology. During this summer I am working at Boeing in Seattle in the 787 Stability and Control group. It has been a true joy climbing up the mountain so far, especially with having so much inspiration from many mentors (that's the key in my opinion). I'm finding that the mountain just keeps getting higher; but, in all actuality, the climb is the best part.

Student Essay

Dare to Dream

JEFF MORRIS, SECOND YEAR MASTERS STUDENT, TEXAS A & M

My name is Jeff Morris. I am a second-year Master's student at Texas A&M University, studying Aerospace Engineering with a concentration in spacecraft dynamics and control. My thesis centers on automated spacecraft rendezvous and docking, and I plan to graduate in December. I am devoting this

summer to research and writing my thesis, while working part-time at StarVision Technologies, an engineering start-up firm spun off from Texas A&M University. Upon graduation, I ultimately plan to embark on my dream career, which is to design spacecraft control systems and actually get paid for it.

I have always loved space. I got hooked on science fiction early in life, and those around me were kind enough to feed my addiction. For example, one of my great-uncles supplied me with back-issues of *Analog Science Fiction Magazine* stretching over a period of nearly ten years. Space fiction and non-fiction books were common gifts from family members, and I liberally used the school library to supplement these gifts. In fact, throughout middle school, I gave myself the mission to round out my knowledge of the science-fiction greats, and methodically read Lester Del Rey, Arthur C. Clarke, Isaac Asimov, Ray Bradbury, and others as I could find their works. These writings about fantastical things and places caused me to dare to dream.

As I grew older, I added more books and articles about the space program, both past and present, to my reading list. Reading about the bravery of those involved, especially in the early days, definitely inspired me. They were willing to attempt things that had never been done before, even if it meant failing and failing spectacularly, and that fascinated me.

I knew that I wanted to become an engineer of some type as early as middle school. This was partly because I was always scientifically inclined, and mostly because of the large number of engineers in my extended family. It was simply a natural career choice. However, it didn't really dawn on me until sometime in high school that exploring space could actually be a legitimate career option for *me*, and not just a job that I read about others doing. I remember thinking to myself, 'Why *can't* I work in the space field?' I found out that aerospace engineering was a major offered at most engineering schools, and I knew I had found my path. Since that fateful choice, I have continued to be inspired to persevere in my studies by remembering the giants that have gone before me. I consider it a tremendous honor that I have the opportunity to work in the same field as Brahe, Gauss, Kepler, and Lagrange, as well as John Glenn, Buzz Aldrin, Richard Battin, John Junkins, and more recently Burt Rutan. They have left a tremendous legacy of accomplishment and discovery, and I want to do everything I can to continue that tradition.

Why have I chosen to devote my professional life to space and its exploration? Well, definitely the vastness and mystery of space is one reason. Man has been studying it for hundreds of years, yet we are only now beginning to realize just how little about our universe we actually know. I know that I will never run out of new things to discover or study, even if I spend my entire lifetime in this one area. Also, I can make a concrete, new contribution to humanity's body of knowledge by studying space. Dozens of discoveries have been unearthed just in my lifetime, and I want to be a part of that. I believe I have found my role in this great adventure by being an enabler – I want to spend my career helping to design the technologies that can get the scientists to other, new discoveries. Next, I believe that through exploring and studying space I can help make things better for my fellow man. All around us are greatly beneficial everyday technologies that have been spun off from the space program, and I expect that trend to continue.

Above all of these other reasons though, the primary reason I want to spend my life in the exploration of space is because it's there. Man has always been fueled by the instinct to grow and learn and adapt and accomplish. I believe this is what makes him unique among all of known creation. I believe it is what defines him as *human*. Developing technology to explore space is my calling. It chose me long ago, and I must respond to it. This, above all else, is why I became an aerospace engineer.

Managing Error in Space Operations

DAVID ROGERS, SAIC

A Lunch and Learn Summary Report

David Fuller, an Associate Fellow of the AIAA and valued member of the AIAA Space Operations Technical Committee, gave an outstanding presentation on "Managing Error in Space Operations" during the last Lunch 'n Learn held at JSC's building 16 on June 2.

The presentation drew 45 AIAA members and non-members alike to understand more fully why human error introduces itself and how can it be managed, especially within high reliability organizations such as the aviation, nuclear power, and space industries.

It was explained that in such organizations, defenses or controls are put into place to prevent existing hazards from developing into accidents. However, unsafe acts, local workplace factors, organizational factors and also latent conditions all too often weaken these defenses causing operational losses to still occur.

David Fuller noted that as we assess our operational defenses we ought to concentrate in areas where humans most often interface within a system. The extent, criticality and frequency of humans' activity increase greatly the propensity that human error will be introduced. Understanding that human error is inevitable; the goal shifts away from error elimination and instead toward error management. David cited from Karl Weick's, "Managing the Unexpected (2001)" that as organizations develop a safety culture, a reporting, just, flexible and learning culture become critical components.

Over the past 20 years, both commercial and military aviation communities have developed Crew Resource Management (CRM) training as a means to manage the human error problem. It was recognized that the majority of consequential errors (those errors that directly caused or contributed to conditions leading to an accident) manifested themselves within the human-human interface. CRM training provides a set of skills designed to increase the effectiveness and efficiency within this interaction. Effective command, leadership, communication, workload management, situational awareness and decision-making skills become the tools necessary to help develop highly reliable teams and workforces. The challenge that all organizations face when introducing CRM training is that traditional classroom instruction alone is not sufficient to bring about the desired change in behavior. Integration of these skills into the day-to-day work environment and opportunities to practice and evaluate their effectiveness is essential.

In 1997, the Johnson Space Center's (JSC) Space Flight Training Division adapted the concepts of CRM and developed Space Flight Resource Management (SFRM) for Shuttle flight crews and flight controllers. Developers realized that to achieve the transfer of training from the briefing to the operational environment these skills must be continually practiced and evaluated. Flight crew and controller training debriefs became the vehicle to incorporate SFRM discussion within the already established technical debrief. By 2000, fully integrated SFRM and technical debriefs became part and parcel to the flight crew and controller training environment. Shuttle crews and controllers continually evaluate the effectives of their SFRM skill usage, develop strategies to improve those viewed an ineffective and identify effective usage to be replicated. NASA's SFRM training approach of CRM skills has been adopted by several major airlines, two nuclear power control teams, the Houston, Texas and Gillette, Wyoming Fire Departments as well as by the British and Australian Royal Air Forces. Efforts are currently underway in bringing SFRM training techniques to the JSC Mission Evaluation Room (MER) environment. Initial and follow-on SFRM training is being given to SAIC/GHG/Boeing personnel that provide Shuttle Safety & Mission Assurance console support to the MER.

David Fuller (Lunch 'n Learn presenter) has over 30 years of experience in operations, including air traffic control, NASA Space Shuttle and ISS operations, directing life and materials science experiments for the European and German Space Agencies and commercial communications satellites. He has a BS in biomedical engineering from Texas A&M University.

David Rogers (author) has over 19 years of experience in operations, served as a Naval Aviator, U.S. Navy Flight Instructor, Navy Aircrew Coordination Training Instructor, and Space Shuttle Guidance, Control/Propulsion instructor and was the lead developer and instructor for NASA's SFRM program. He now serves as a Senior Safety Engineer in the Shuttle Safety & Mission Assurance's Flight Operations Group. He has a BS in Mathematics from The Citadel and a Masters in Aeronautical Science from Embry-Riddle.

AAIA Houston Section encourages the creation of a local space operations TC to mirror the national AIAA Space Operations and Support TC. Examples of benefits and responsibilities are online at www.aiaa-houston.org. If interested, please contact the vice chair of the technical branch, Tim Propp, at 281-226-4692 or vicechair-tech@aiaa-houston.org.

Understanding that human error is inevitable, the goal shifts away from error elimination and instead toward error management.

Annual AIAA Awards Banquet Held

STEVEN KING, CHAIR ELECT

The Houston Section held its Annual Honors and Awards Banquet at Gilruth on Thursday evening, June 16th. The program was MC'ed by Steve King, Chair-Elect, and was attended by a mix of approximately 75 members and quests. At the banquet, the following AIAA Sustained Service Awards honorees were recognized:

50 Years: Dr. Robert Page (Fellow)
40 Years: Jeri Brown, Norm Chaffee, Andrew Hobokan, Chris Kraft (Honorary Fellow), Charlie Teixeira.
25 Years: Chittur Balasubramanian, Christopher Culbert, Phil Hopkins, Doris Lampe, Roscoe Lee, Scott Murray, Kevin Repa, Edwin Smythe, Srinivas Vadali, Glenn Venables, Prof. Larry Witte.

This was followed by the presentation of two AIAA Special Service Citations, both in the area of Pre-college Outreach. In his absence, Dr. Edgar Bering of the University of Houston was recognized for his work in establishing and maintaining an annual Mars Rover Model Competition. Norm Chaffee received his citation for hosting annually the Space Design Settlement Competitions held at JSC over the past seven years. In addition, Lollie Garay of the Redd School was acknowledged for receiving one of seven AIAA National Educator Associate Achievement awards for 32-years of involvement in science education.

Each member of this term's Houston Section Executive Council was recognized for helping make this past year a success. Council members receiving special acknowledgement for taking on additional responsibilities and projects included: Jon Berndt (Newsletter), Elizabeth Blome (Councilor & Membership), Padraig Moloney (Treasurer & International Space Activities Committee), Aaron Morris (History Technical Committee), Daniel Nobles (Programs), Tim Propp (Vice Chair – Technical), Murugan Subramaniam (Webmaster), and Douglas Yazell (Councilor). In her absence, the Section's Outstanding Achievement honoree for this year was announced as Ellen Gillespie. She distinguished herself as a Councilor and through attending the Regional Leadership Conference, helping organize tours, leading the GN&C Technical Committee, participating on the Annual Technical Symposium planning committee, and more. Our Section Chair, Sophia Bright, was unable to attend the banquet due to her recent relocation within Boeing to St. Louis, MO. Her Chair certificate and pin were previously presented to her at the June Executive Council meeting. We will all miss her drive and being with us. A special thanks was given to all for a job well done! Also, six lucky attendees went home with attaché cases that were given away as door prizes.

The awards were then followed by Dr. Seth Shostak, AIAA Distinguished Lecturer, giving an outstanding discussion on the background and approach to searching for intelligent life that may exist in the universe. He said one major debate centers on the definition of

(Continued on page 13)

"The National Advisory Committee for Aeronautics had outstanding technical skills and potential. The Army Ballistic Missile Agency, formed with Werner Von Braun and his team of scientists and engineers, was equally well qualified. These two groups formed the nucleus of NASA. Within the contractor community, there was a highly qualified workforce that had conducted aeronautical research from the end of World War II through the 1960s."

- George Abbey, Neal Lane
UNITED STATES SPACE POLICY, CHALLENGES, AND OPPORTUNITIES

Staying Informed

COMPILED BY JON S. BERNDT, EDITOR "HORIZONS"

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

AIAA Student and Educators
http://www.aiaa.org/education

American Society for Engineering Education
http://www.asee.org

NASA Office of Education
http://education.nasa.gov

Final Report of the Commission on the Future of the United States Aerospace Industry
http://www.ita.doc.gov/td/aerospace/aerospacecommission/AeroCommissionFinalReport.pdf (20MB)

AIA Aerospace Statistics
http://www.aia-aerospace.org/stats/aero_stats/aero_stats.cfm

United States Space Policy, Challenges and Opportunities (*Abbey*, *Lane*, June 2005)
http://www.amacad.org/publications/spacePolicy.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:

John W. Andrews
Jim Baker, SpaceHab
Brandon Burns
Henry M. Cathey, NMSU
David Colling
Peter A. Cuthbert
Isaac W. Ekoto
Sharath S. Girimaji, TAMU
Robert Horton
Robert D. Hunkins
Juniper C. Jairala
Cagri Kanver
Joy H. Kelly
Syri J. Koelfgen
Ramakrishna Kowta, UH
Mark I. Lane, TAMU
Tucker A. Lavin
Thanh T. Le
May Ann A. Li
Manoranjan Majji
Fred W. Martin
Greg M. Moran, TAMU
Matthew E. Nelson, TAMU
Scott M. Nemeth
Zoubeida Ounaies, TAMU
Andrew Prisbell
Carolina I. Restrepo, TAMU
Catherine B. Ryan, Alvin HS
Ross A. Stawaisz
O Haldun Unalmis
William Vantine
Nathanial Wearren
Evelyn J. Whisenhut Guthery
Bryan L. Witt, TAMU

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:

Robert Ambrose
John Balcerowski
William Bastedo
Chad Brewer
Jeff Donoughue
Justin Doyle
Sean Duffy
Henry Hoang
Hans Hofmeister
Jeffrey Marshall
Rajagopal Pachalla
Keun Joo Park
Jeff Phillips
Matthew Scudder
Scott Stover
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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. ▲

Professional Engineers License

ELIZABETH ZAPATA, PROFESSIONAL DEVELOPMENT

How does a Professional Engineer (P.E.) license help me? Why would I need one? And how do I get one?

Do these questions sound familiar? Well, they were all questions asked of six panelists at a past Lunch-n-Learn. So without further ado here is the follow-up. (Note: all information here is for the *Texas* Board of Engineers.)

It is illegal to represent yourself as an engineer if you do not have your P.E. license and are offering to perform engineering services to the public.

How to Obtain a P.E. License

The licensing procedure requires a *few* steps that will take time and effort to complete. The first step is to pass the Fundamentals of Engineering Exam (FE). This exam made by the NCEES (National Council of Examiners for Engineering and Surveying) does not allow the person to practice engineering. Instead it allows the person to become an Engineer-In-Training (EIT) *provided* a score of 70 or above is awarded. Along with the FE, the person must complete an engineering degree approved by the Texas Board of Professional Engineers. Four years of work in the engineering field is the next step on the way to licensing. This time period is to allow the EIT to use his/her engineering knowledge and logic while working on projects. You then might ask what constitutes the earned "experience?" One path is earning a graduate degree in engineering, which can count for 1 year of experience. A person is allowed up to 2 years of experience from graduate degrees. Another way to earn experience is four years of working with or for a licensed engineer. Remember it is a good idea to keep a detailed record of all of your engineering projects for the P.E. application process. Hint: Your group activity reports are a good starting spot. The key here is that the four years of experience is just a number and in reality the Board will decide how much of your work qualifies as experience. So make sure you have detailed accounts of how you used your engineering knowledge to better explain your work experience over the previous four years. Waivers to the FE and PE exams are possible but the Board of Engineers must vote to approve the waiver which is by no means an automatic approval. The following requirements are used in the waiver process and the forms are found on the website:

- Have not taken and failed the PE exam in the past 4 years
- Have an accredited degree with 12 years of engineering experience or a non-accredited degree with 16 years of experience
- Have a Ph.D. in engineering or other variations of a Ph.D.

For more detailed information on the waiver process please see the Board of Engineers website: http://www.tbpe.state.tx.us

For the P.E. application, you will need to fill out the forms provided on the Board of Engineers website. The form asks you to include a list of personal information, description of your education, a detailed summary of your engineering work, information pertaining to any other engineering license, information of any criminal record. Lastly, you must submit three references from engineers that have personal knowledge of your work. Try and remember that the end result will be worth any paper cuts. After the papers are submitted the Board will hopefully approve you to take the PE exam as the next step.

Last comes preparation for the *Principles and Practice of Engineering Exam*. Somewhere in the back of your brain you might recall the eight hours sitting hunched over a desk working on the FE exam. You soon realize that maybe you should prepare for the 8 hour PE exam a little more since this is exam is going to be harder. Luckily, you come to this realization a good 3 to 6 months before the exam. There are a couple of choices out there for you: 1) a self preparation book for on your own studying (Study guides can be found on the Texas Board of Engineers website.) or 2) a P.E. exam prep class that will cost you a pretty penny but is supposed to be worth it for those individuals that need a scheduled study time (like myself). During this time you must also decide which engineering exam to take. For many of you that is easy. If you are a Civil Engineer then you take the Civil test and so forth, but what about those of you out there with an Aerospace, Biomedical, or Software degree. Are you just up a creek with no paddle? The end result is that it is up to you to decide which test to take. If you feel you have the knowledge to take the Mechanical test then do so. Just do not forget to register, and good luck! Thirty days later you receive your results and can finish the application process with that passing score.

Why Become a P.E.?

There are plenty of reasons why you should strive to obtain your P.E. license but here are a few examples. First and foremost, it is a professional responsibility. As an engineer, you should always endeavor to serve the public, and a P.E. license is one more way to do just that. Also, the ability to diversify your career is another added benefit of obtaining a license. However, your responsibility to not approve or council engineering work outside of your field of

(Continued on page 11)

(PE License, continued from page 10)
knowledge is still applicable. The last notable reason to mention is the ability to use the title "Professional Engineer" in providing services to the public. It is illegal to represent yourself as an engineer if you do not have your P.E. license and are offering to perform engineering services to the public. One of the exemptions to this rule, of course, is none the less but yours truly....NASA. The Board of Engineers allows the space program employees to use the term "Engineer" without being licensed as long as it only pertains to said program. Another note about titles is if you are a P.E. license holder and inactive. You may still use this term with the word "inactive" included after the title. Please see Rule 137.3 in the Laws and Rules document that is found on the Texas Board of Engineers website for all exemptions and rules of the use of the term "engineer." Many people can use the word engineer, it just depends on the context it is used in. A last note about why you should become a P.E. is that obtaining your license is rewarding and a good asset if you decide to change careers.

You've Got the License....

Once you have obtained your license, you have added responsibilities. After your first year of being a P.E., you must start obtaining Continuing Education credits. These credits can be obtained by completing a college course or professionally sponsored course, teaching a course, publishing an article, paper, or book on the practice of engineering, attending professional Lunch-n-Learns, participating on a professional committee, and so forth. At least 15 hours of these credits must be obtained and documented yearly. Of those 15 hours at least one hour must be in Ethics training. Every licensed engineer is also required to pay an annual fee. The amount of the fee depends on whether you are an active PE, disabled, inactive, or 65 years or older. Please see the website for all addition scenarios and exceptions.

Many P.E.'s do not use the personalized stamp in their day-to-day activities, but all use the knowledge and skill that a Professional Engineering License offers. I invite you to share your experiences and comments about this article by writing to the *editor@aiaa-houston.org*.

A special thanks to the PEs who contributed their thoughts for this article. Steve King, Brett Anderson, Carlos Pena, Toni Clark, and Mike Ross.

After your first year of being a P.E., you must start obtaining Continuing Education credits.

Aerospace on the FASTRAC: Student-Built Satellites at UT

DOUGLAS YAZELL, COUNCILOR

Dr. E. Glenn Lightsey from the University of Texas at Austin delivered this presentation on Thursday, June 16, 2005 in building 16 at JSC for an audience of 80 people. He was the guest of the AIAA Houston section's Astrodynamics technical committee, and all four members attended- chair Albert Jackson, members Tim Crain and Douglas Yazell, and student member Prerit Shah, who will be a senior this fall in aerospace engineering at Texas A&M University.

Since someone who could not attend asked for a video of the talk, we videotaped this event, even though that is not our usual procedure. Before summarizing the talk from my review of the video (available to members and non-members in VHS or DVD-R format), the summary from our publicity flier is presented below:

"The University of Texas at Austin recently won a national competition sponsored by the U.S. Air Force, NASA, and the AIAA for the launch of a student built satellite in 2006. This presentation will provide an overview of the University Nanosatellite program and discuss the capabilities of the flight satellites and plans for their launch in 2006. UT-Austin's entry, the Formation Autonomy Spacecraft with Thrust, Relnav, Attitude, and Crosslink (FASTRAC), will demonstrate enabling technologies for satellite formations. Two flight-ready satellites have been designed, fabricated, integrated, and tested within a two year design period leading up to the competition. JSC donated valuable thermal/ vacuum chamber time which assisted with the design of the satellites. The mission experiments in GPS relative navigation, plasma microthrusters, and networked ground stations will be discussed. A follow on student mission which has been funded at UT-Austin, known as Autonomous Rendezvous & Rapid Turnout Experimental Inspector Satellite (ARTEMIS), will be introduced."

Dr. Lightsey is an associate professor in the department of aerospace engineering and engineering mechanics. His work includes dynamics, orbital mechanics, and satellite systems. Prior to joining UT in 1999, he worked at Goddard Spaceflight Center. While there, he earned his PhD from Stanford in 1997. His awards include AIAA national engineer of the year and NASA Manned Spaceflight Awards.

In the next 10 years, more and more possibilities for spacecraft formations are predicted. These satellites will be smaller and smaller, using components that are not currently on the shelf. New methods in guidance and formation are needed. In the last three or four years, UT Austin has created a satellite design program. One goal is to make it

(Continued on page 12)

A Lunch and Learn Summary Report

In the last three or four years, UT Austin has created a satellite design program. One goal is to make it a sustained and coordinated program using space hardware that results in flight opportunities.

(Continued from page 11)
a sustained and coordinated program using space hardware that results in flight opportunities. A second goal is the creation of a research center for autonomous, small satellites. A third and last goal is the creation of the Satellite Design Lab. Since UT is a research university, they are using research to make education more real.

Access to space remains difficult to obtain, and these projects last years at a time, making it a challenge to use them for student education. Failure might occur in flight despite winning the competition, but the team believes it can succeed. Additional work includes the creation of their own ground station. The mass of the two satellites used for FASTRAC is 15 kg each. Any university professor can write a proposal for the competitions, proposing to design and build a satellite in 2 years for $100,000 and to deliver it to the review on the day of the competition. Since they were not sure to win the nanosat 3 competition, they proposed ATEMIS for nanosat 4.

A first goal for FASTRAC is to show that they can maintain orbit using low-thrust propulsion. A second goal is to do relative navigation with GPS receivers, obtaining communication without guidance and without controlling the satellites. The last goal is to operate a simple version of the Deep Space Network, getting at least two universities involved with their ground stations. The payload must be delivered in September of 2005. The mission timeline is six months, but objectives might be meet in a few weeks.

The low-power plasma device was designed at UT, and it is also low-thrust, low-mass, and low-cost. It can deliver 100 micro Newtons of thrust. The gas has not been selected yet. Xenon is best (heavy) for thrust-impulse features, but it is expensive. Helium is cheaper but tends to leak. This device is built and working already. The UHF VHF ground station in their building has an S-band antenna and can track ISS and other satellites. A mix of graduate and undergraduate students make this a student-built satellite.

The final design of the structure is 20% of the mass budget, and the requirement for vibration included a 100-Hz reference. They overdesigned for a pogo mode along the longer dimension of the satellite, but judges liked seeing actual vibration test data and gave their OK for the request for deviation from requirements.

They made their own solar panels in their clean room after buying the solar cells. Lots of trial and error led to a good result. The battery design (nickel cadmium was strongly suggested over lithium) was a year-long design job for a student, a bigger job than expected. Each subsystems has its own microprocessor, so once the device drivers are written and the data is on the bus, the handshaking work is already done. The team decided they needed help on a (spring) separation device, and the startup company Planetary Systems Corporation donated their $80,000 system once they won the competition and a launch was promised. This was tested in a zero-g environment using the NASA KC-135, and video of that test was shown by Dr. Lightsey. JSC helped greatly by allowing thermal/vacuum testing in their Chamber N and by donating thermal analysis that UT students could not do in the time available. The amateur radio community will also be able to participate in the mission of FASTRAC.

A course at UT teaches web site design, so students created the site at http://fastrac.ae.texas.edu. The competition for nanosat 3 was in Reno, Nevada with one foot of snow on the ground on January 9, 2005. Students worked over the holidays with no pay and no course credit. Some satellites were diverted to San Francisco, but the UT team drove with snow chains for the last few miles, giving the satellite an unplanned vibration test. The team is now improving some subsystems and the delivery for flight will take place at the end of this summer. Launch date depends on the Air Force, but it will be in 2006 or 2007. It is not yet scheduled for launch.

The ARTEMIS project plans to add guidance, a high-impulse thruster, proximity guidance, a vision system, and a capability for a photograph of one satellite taken from the other one. They are taking risks that would not be allowed on more expensive programs. Forty or fifty students are now working on these projects, which is a big part of the department. Hard work is required and it is good experience for work on later "real" and more expensive programs. There are few requirements on this program (flying below the GPS constellation, etc.), but if the team creates requirements like orbit inclination, available launch vehicles might be scarce. Keeping the team's design knowledge for years like this is a challenge. They constantly bring in new students and train using vertical mentoring. Students might start with soldering, work CAD later, and then become a subsystem manager, they might decide to stay for graduate school, and they might become program manager. Students run things, and professors provide the vision. No PhD research is yet tied to this work, at least not directly.

Although Dr. Lightsey wrote the proposal which won, students do the work as if they were a company responding to requirements. Students decide what they can and cannot do. The desire to add a lot to ARTEMIS led students to decide to make the two satellite asymmetric, with one being more slender, like a frisbee.

("Awards Banquet" Continued from page 8)
"intelligence." Dr. Shostak presented the possibly that the continued advancements in computer processing power may allow the finding of a radio signal from an intelligent source within our lifetime. However, this source may be from a machine that has evolved beyond the biological constraints of its makers. It was felt that such contact would be analogous to Captain James Cook's landing in Australia ending the continent's over 40,000 years of living in isolation. But the impacted would be on a global scale ending some odd 4.5 billion years of isolation.

In closing, the new members of next term's Executive Council were recognized: Dr. Jayant Ramakrishnan (Chair-Elect), John Keener (Vice Chair – Operations), Dr. Syri Koelfgen (Secretary), Dr. Brad Files (Treasurer), and JR Reyna (Councilor).

Awards Banquet Gallery

[Clockwise from upper left]

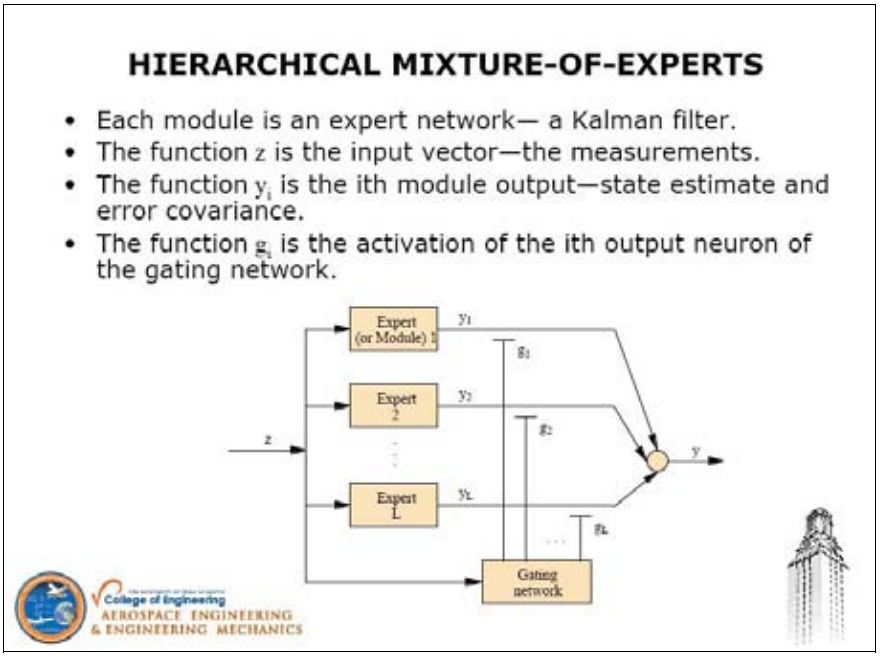
1) Incoming AIAA Houston Chair Steve King recognizes Norm Chaffee with a Special Service Citation. 2) Steve King recognizes teacher Lollie Garay. 3) Executive Council (EC) group 1: front row (left to right) Steve King, Dr. Larry Friesen, Dr. Rakhesh Bhargava, & Dr. Al Jackson; back row (left to right) Mike Begley & Glenn Jenkinson. 4) EC group 2: (left to right) Steve King, Luke Mays, Dr. Doug Schwaab, Brett Anderson, Joy Conrad King, Sarah Shull, Nicole Smith, Dr. John Valasek, & Liz Zapata. 5) EC group 3: (left to right) Steve King, Jon Berndt, Elizabeth Blome, Aaron Morris, Daniel Nobles, Tim Propp, & Douglas Yazell. 6) Dr. Seth Shostak

A Lunch and Learn Summary Report

Hierarchical Navigation Algorithms In Support of Mars Exploration

DOUGLAS YAZELL, COUNCILOR

The AIAA Houston section's Astrodynamics technical committee hosted this event on Thursday, May 19, 2005, in building 16 at JSC. Our section's Guidance, Navigation & Control technical committee co-sponsored the event. Dr. Robert H. Bishop, Department of Aerospace Engineering and Engineering Mechanics, The University of Texas at Austin, attracted a crowd of 60 people for this talk in rooms 111 and 113. Two large screens gave all attendees a good view of the PowerPoint charts. Dr. Bishop also gave our section permission to put his 56-page (3 MB) PowerPoint document on our web site, so please look for that soon at www.aiaa-houston.org using the links for technical committees.



"Topics for today" were listed as the following three subjects- navigation algorithm architecture overview, event detection during interplanetary cruise, and application to (Mars) entry, descent, and landing.

Dr. Bishop's team decided to consider adaptive estimation instead of older methods such as least squares estimation for orbit determination or extended Kalman filters. A timeline from 1960 to the present showed that mixture-of-experts arrived in the early 1990's, and UT investigations focused, starting in the late 1990's, on Hierarchical Mixture-of-Experts (HME) for orbit determination, then entry, descent, and landing. These include Kalman filters, gating networks, and multiple levels of modularity. Examples were shown using processing of Deep Space Network interplanetary cruise tracking data from the Mars Pathfinder mission for orbit determination.

The objective for application to Mars entry is to develop entry navigation flight software to support actively guided Mars entry. No Mars lander has yet employed active guidance with real time, onboard state estimation. Future missions will require precision landing- the ability to land within a few kilometers or less of the intended point. The part of the entry before parachute deployment is the most challenging, since it is fast-moving and poor in measurements.

References included the topics in the following list- adaptive filtering (early works), algorithms to handle unknown parameters, interactive multiple models, mixture of experts, HME for interplanetary navigation and atmospheric entry, and adaptive estimation.

A more complete description of the talk comes from the publicity flier written by Dr. Bishop- "Exploration spacecraft navigation currently relies on navigator experience and *ad hoc* techniques for the resolution of anomalous residual signatures from the operational tracking filter. Difficulties navigating recent missions, such as modeling the solar radiation pressure surface on MPL, or detecting off-nominal atmospheric density profiles during planetary entry for the MER landings, have illustrated the need for a systematic method of resolving anomalous behavior in the tracking solution. A modular navigation architecture employing banks of extended Kalman filters regulated by gating networks has been proposed to alert the navigator that a shift from optimal to suboptimal filtering has occurred. The architecture of the proposed navigation system will be presented and discussed. Results using Mars Pathfinder tracking data obtained from the Deep Space Network will be used to illustrate the capabilities of the navigation system to detect very small unmodeled thrusts in a timely fashion. Extensions of the adaptive navigation architecture to planetary entry, descent, and landing will be introduced and preliminary results presented."

Our AIAA Houston section is always looking for new members for our local technical committees. The astrodynamics technical committee currently has three members and one student member. The GN&C technical committee has seven members from seven "GN&C" organizations, as well as two student members. If you are interested in joining our work, please contact Tim Propp, vice chair of our technical branch, at 281-226-4692 or vicechair-tech@aiaa-houston.org.

Flight Day

SVETLANA HANSON, PRE-COLLEGE

On April 26 the AIAA Houston Section participated in the "Celebrate Flight from Da Vinci to NASA" event at the St. Francis Episcopal Day School. Kids and adults alike enjoyed launching "soda" rockets made with film containers and paper with Alka Seltzer and water used as rocket fuel. Svetlana Hanson from the Houston Section demonstrated the rockets then gave out instructions to make one at home. She also distributed some balsa wood gliders to the students.

Among other participants were NASA, the NASA Houston Rocket Club, Remax with their hot air balloon, Continental Airlines, the US Air Force, the Houston Zoo, and the Houston Hang Gliding Association.

Highlights of the event were the hot air balloon ascent, the helicopter landing with baseball star Roger Clemens, and the release of butterflies.

It was wonderful learning experience and exposed the kids to a wide variety of areas where flight can be applied.

Great Success on Mars Rover Competition

SVETLANA HANSON, PRE-COLLEGE

The third annual "Mars Rover Contest" took place at the University of Houston Main Campus on Saturday, January 22. The University of Houston and the AIAA Houston Section sponsored the event. About 70 teams from schools all over the Houston area participated in the contest.

Kids competed in the design and construction of a model Mars rover to carry out a specific science mission, such as searching for signs of water and/or life on Mars. It was the end of a six week school program that studied Mars. The models were constructed using recycled materials with minimal cost, mainly from purchasing the optional solar panels. It was amazing to find out what can be done with straws and shoeboxes on Mars. Imaginations went wild and a straw was not a straw anymore but a "claw" that picks up rocks or works as a cleaning tool to take care of the solar panel surface after a Martian wind storm.

Numerous volunteer judgers were rewarded with the pleasure of meeting so many kids interested in space exploration! Everyone thought that the event was very well organized and a great educational exercise. Edgar Bering of the University of Houston organized the event with his team of dedicated volunteers. They did an outstanding job of planning, organizing and running the contest.

So look forward to the invitation to be a judge in next year's event. It is a lot of fun.
For more information and to see pictures of the contest check out the web site:
http://troll.phys.uh.edu/MarsRover/

Pre-College Chair Joy Conrad King judging a Mars rover team.

Diversity in Education and at Work

DOUGLAS YAZELL, COUNCILOR

An often-quoted part of the mission of AIAA (from www.aiaa-houston.org) is, "... to advance the arts, sciences, and technology of aeronautics and astronautics, and to promote the professionalism of those engaged in these pursuits." Professionalism is enhanced by AIAA in many ways, and familiarity with the controversial subject of diversity in schools and workplaces is almost required by law and by policies in both public and private schools and workplaces.

Quoting from http://www.diversityatwork.com, in 1961, President Kennedy's executive order created the President's Commission on Equal Employment Opportunity, with the requirement that all US government contactors take "affirmative action" to see that hiring practices were fair, while giving no preferential treatment to any group. Origins of this can be traced to 1941 when President Roosevelt required nondiscrimination in hiring for defense contracts. In 1964, Congress passed the Civil Rights Act. Its Title VII prevents employers from discriminating because of race, color, religion, sex, or national origin. Title VII also stated that granting "preferential treatment to any group" was not allowed. That phase was required to obtain Senate passage, due to the power of several southern Senators. The US Supreme Court later (1978) ruled against quotas in California vs. Bakke, requiring a university to admit a white male student. In 1980, presidential candidate Reagan promised to end affirmative action, wanting to keep equal opportunity but to end federal quotas regarding race, ethnicity, and sex. He promised to return the focus to ability and qualification in hiring and education. Once elected, he appointed Clarence Thomas to head the Equal Employment Opportunity Commission. Mr. Thomas was a vocal opponent of quotas. He stated, "This policy fails because it allows employers to hide discrimination behind good numbers." Even today, this opposition to quotas is popular, though no alternative has been proposed. By 1995, the Supreme Court made a few rulings against affirmative action, California introduced an initiative to ban it, and national magazines attacked it. The Clinton administration responded by studying it and concluding, "Mend it, don't end it.".

Some companies now include community service and charity fundraising in their diversity goals, and some include subjects such as thinking style in their working definition of diversity. This quote from Virginia Tech University's web site (standards.pdf, 8/26/04, Standards for Inclusive Policies, Programs, and Practices) stuck with me: "The commitment to inclusion should also extend to the critical review of programs or policies that are race neutral in language and intent but result in outcomes that unfairly privilege select groups." That reference to outcomes led me to the web site for The American Observer and these quotes from an article dated 12/24/04: "Title IX bans discrimination based on gender under any education program that receives federal funding. ... What's wrong with Title IX as it is? The quota test - plain and simple. President Bush has stated time and again that he believes in equal opportunities NOT equal outcomes."

The business case for workplace diversity reflects global realities. Assumptions, stereotypes, and biases can remain hidden and hurt business. Diversity is sometimes described as how we are different and, contrary to the dictionary, how we are alike. An interesting exercise is to list how some of our coworkers are different from us (or like us), then list how many such qualities are visible and how many are invisible. The latter appears to be the longer list.

To reduce the impact of biases, stereotypes, and assumptions, employees are taught to say, "Ouch!". By speaking up when problems occur, the problems might be solved before they become worse. Employees are asked to learn more about other cultures and groups and to educate others. In the book, *The Dance of Intimacy*, author Harriet Lerner notes that subordinate groups know a dominant group's culture quite well, but the reverse is usually not true.

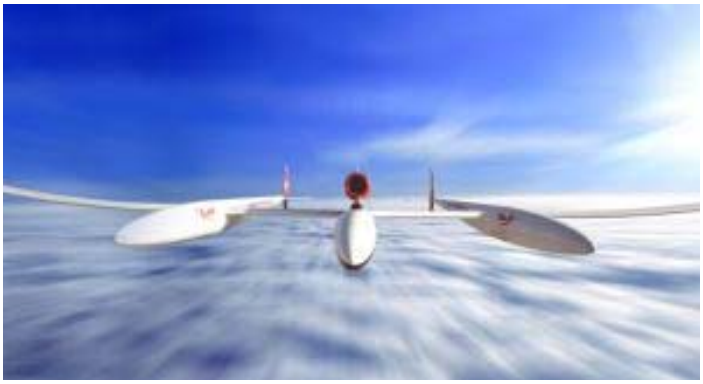
Nobel-Prize winning Professor Smalley of Rice University states (in a graph in an energy presentation at http://smalley.rice.edu) that two Asians now obtain science and engineering doctorates for every one American. He calls for an Apollo-like program to repeat the success of that post-Sputnik era by persuading young Americans to pursue such careers. As we tighten our borders and emphasize export compliance more than ever, we might find nontraditional groups coming into these disciplines in our country, making diversity in schools and workplaces even more a reality.

Most of us agree that equal justice for all is a noble goal worth putting into law. Similarly, I believe that equal education and employment opportunity for all is also worth legislating. My coworkers have hired people as young as high school students, so this controversy starts when people are that young and younger. Since we seek to be better and better examples of professionalism as we mature, this controversial subject of diversity in education and at work will continue to challenge us.

In the book, "The Dance of Intimacy", author Harriet Lerner notes that subordinate groups know a dominant group's culture quite well, but the reverse is usually not true.

Cranium Cruncher

BILL MILLER, JON BERNDT



Virgin Atlantic

Last Issue

Several entries were received for last issue's Cranium Cruncher: "What is the minimum number of aircraft …". Correct answers were received from Ron Sostaric and from our own Liz Zapata.

Solution: Three aircraft are needed.

So, aircraft A, B, and C all leave the start at the same time. At 1/8 d (d being the total distance around the world) aircraft C gave both A and B 1/4 of his tank of gas.

- A now has full tank (he used 1/4 to fly to d/8)
- B now has a full tank as well for same reason as A
- C now has 1/4 tank b/c he gave 1/2 (1/4 to each) to aircraft A & B

So, at the next time point aircraft C is back on base and A & B are at the 1/4 mark on distance. So, B now transfers 1/4 of his tank to A.

- A now once again has a full tank of gas
- B now has only 1/2 a tank of gas, just enough to get him home.

So, now A can make it to the 3/4 mark on the other side of the world. When he makes it to that point B will be there to meet him and C will already be at home refueling from giving B the 1/4 of the tank earlier.

- A is at the 3/4 mark with B refueling and has 1/4 of a tank from B
- B now has only 1/2 a tank, but enough to get him home.
- C is at home filling up the 1/2 of tank he used on B and return home

So now at the 7/8's mark A, B, and C meet again. B flies on by b/c he has enough to make it home but A and C transfer gas from C so that A can now make it home.

So, all aircraft make it back safely and constant air speed, and the no time for refueling was a definite plus.

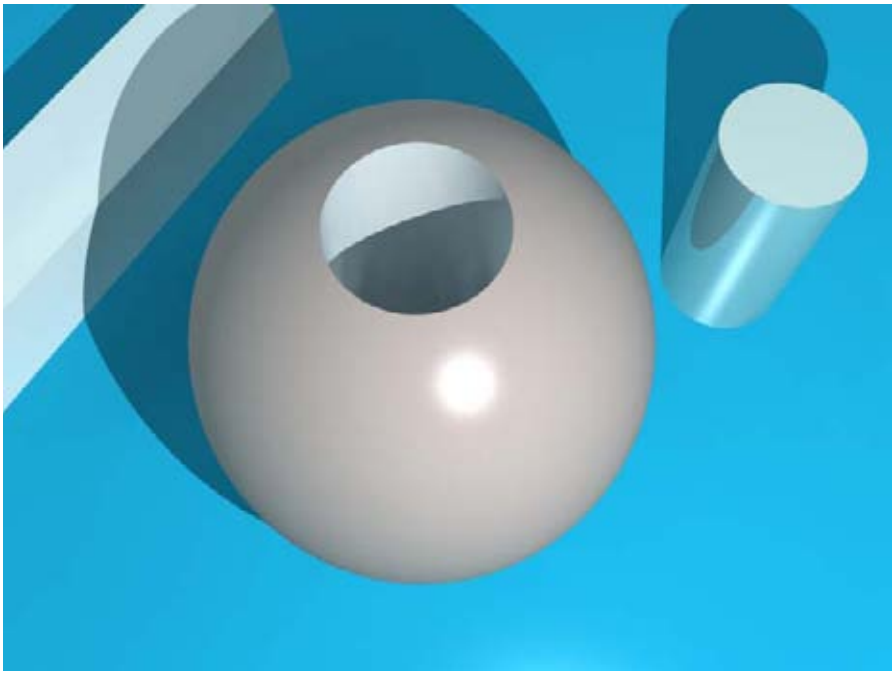
Current Cruncher

A cylindrical hole is drilled straight through the center of a solid sphere, leaving a hollow exactly six inches long. What is the volume remaining in the the sphere?"

1) No, there is no information missing.
2) Yes, this one is a little tricky.

Email solutions to wbmiller3@houston.rr.com. The answer and the names of those sending correct solutions will be printed in the next issue of Horizons.

Good luck!



CALENDAR

July
1 Start of Houston Section's 2005-2006 term
11 Executive Council meeting (Gilruth)
14-15 Region Leadership Conference in Tucson, AZ
21 July 21 LnL: Generic Software Coding Standards by Chuck DiFalco/LM
?? Executive Council retreat (Gilruth)
?? Apache helicopter demo (JSC or Ellington)

August
1 Executive Council meeting (Gilruth)
26-28 Ballunar Liftoff Festival (JSC)
?? "ISS Phantom Torque" by Dr. Jack Bacon/NASA-JSC
?? Public astronomical observing activity (UH-Clear Lake)
?? LnL: TBD

September
12 Executive Council meeting (Gilruth)
?? Dinner meeting (Gilruth)
?? LnL: TBD

October
3 Executive Council meeting (Gilruth)
8-9 "Wings Over Houston" Airshow
22 Kid's Balsa Wood Glider Workshop,
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.

Odds and Ends

SPECIAL EVENTS, PICTORIALS, ETC.

All Dry

On May 19th, 2005, NASA's Spirit rover camera captured this stunning view as the Sun sank below the rim of Gusev crater on Mars. This Panoramic Camera mosaic was taken around 6:07 in the evening of the rover's 489th martian day, or sol. Spirit was commanded to stay awake briefly after sending that sol's data to the Mars Odyssey orbiter just before sunset. This small panorama of the western sky was obtained using a filter combination that allows false color images to be generated that are similar to what a human would see, but with the colors slightly exaggerated. In this image, the bluish glow in the sky above the Sun would be visible to us if we were there, but an artifact of the Pancam's infrared imaging capabilities is that with this filter combination the redness of the sky farther from the sunset is exaggerated compared to the daytime colors of the martian sky. Because Mars is farther from the Sun than the Earth is, the Sun appears only about two-thirds the size that it appears in a sunset seen from the Earth. The terrain in the foreground is the rock outcrop "Jibsheet", a feature that Spirit has been investigating for several weeks (rover tracks are dimly visible leading up to Jibsheet). The floor of Gusev crater is visible in the distance, and the Sun is setting behind the wall of Gusev some 80 km (50 miles) in the distance. (NASA photograph)
NASA Mars Rover web site: http://marsrovers.jpl.nasa.gov

All Wet

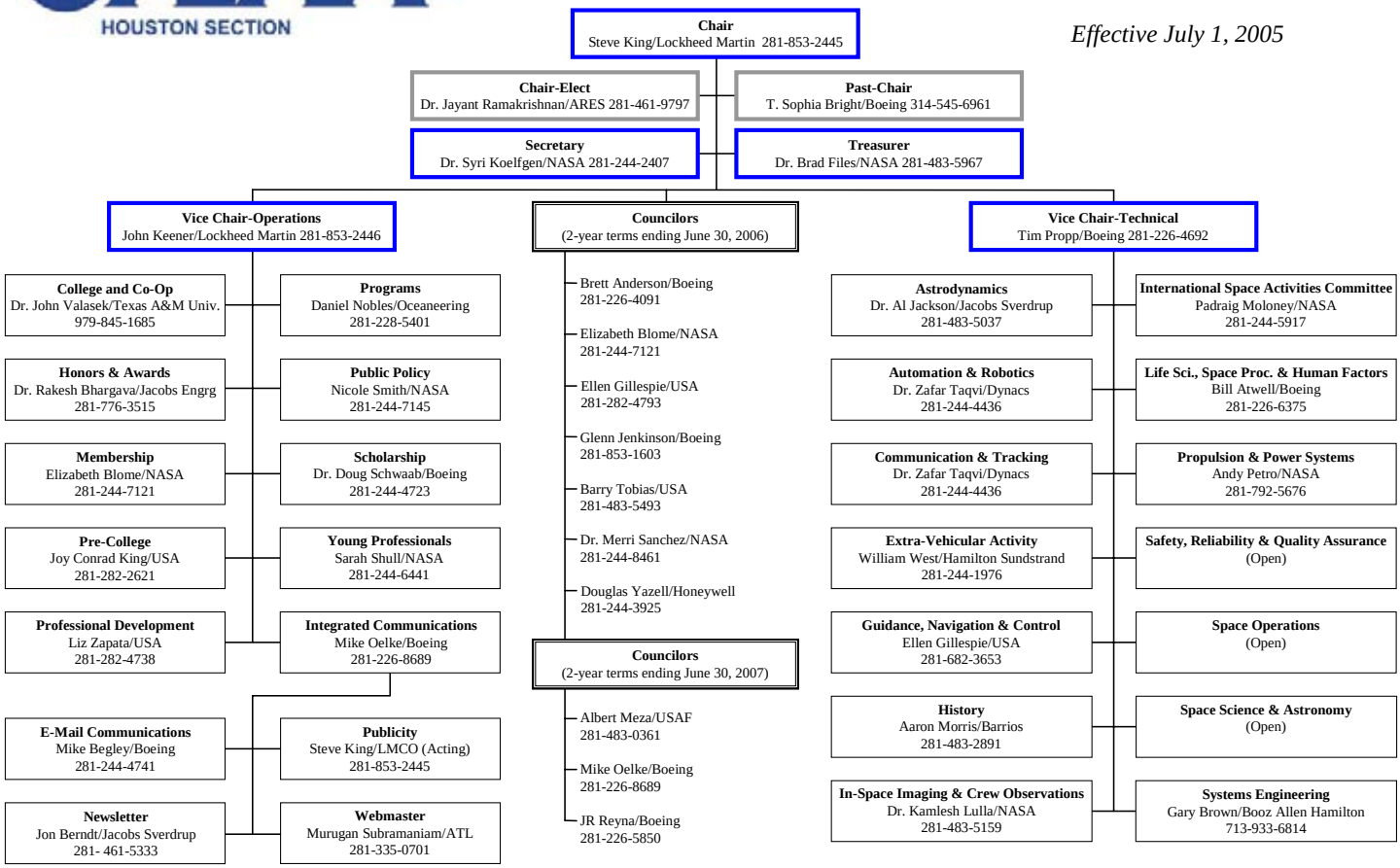
After catapulting the Space Shuttle orbiter and external tank to a high velocity during the first two minutes of flight, the solid rocket boosters separate and parachute into the ocean. As they enter the water tail first, air is trapped inside, and the boosters float upright. After the boosters are located, divers descend to the nozzle end and insert a plug . Once the plug is inserted, air is pumped in, the booster rises and rotates to a horizontal orientation and floats on the surface. The booster is then towed back to the launch site. (NASA photograph)

The Space Shuttle orbiter itself is planned to be grounded after 2010, but the solid rocket boosters are being considered for duty as the first stage for a CEV launch vehicle, as well as for part of a Shuttle-Derived Launch Vehicle. Such a heavy lift launch vehicle might be able to loft 100 tons or more into low earth orbit.

AIAA HOUSTON SECTION

Executive Council 2005-2006

Effective July 1, 2005



Section Announcements

AIAA HOUSTON EXECUTIVE COUNCIL

Young Professionals Chair Being Sought

Sarah Shull, the Houston Section's current Young Professionals Chair, will be leaving us later this summer us for a couple of years to pursue a masters degree at MIT. We wish her well in her upcoming Boston adventure and a big thanks for a job well done with the Young Professionals Committee. They are a group of members under the age of 35 that gather frequently for social interaction and work on projects of particular interest to younger members of our aerospace workforce. If you are interested in leading this Committee next term, please contact Steve King at chair@aiaa-houston.org or John Keener at vicechair-ops@aiaa-houston.org.

New newsletter content

The AIAA-Houston Newsletter, *Horizons*, will now be publishing information about upcoming presentations of locally-authored papers at the various conferences held throughout the year across the country. Local AIAA members who will be presenting papers are encouraged to inform us all about their plans. Authors/presenters may email the editor at editor@aiaa-houston.org with their name, presentation title, and conference information.

Writers Solicited for Horizons

Horizons welcomes submissions from readers for consideration to be published in future issues. Feature articles are typically 1,000 to 2,000 words in length, and may be accompanied by photographs or illustrations. For more information, please contact the editor@aiaa-houston.org.

Next Issue

The Annual Technical Symposium was a great success, and well attended. There will be a report on that in the next issue. Also, the results of the online membership survey will be announced.

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.

41st AIAA/ASME/SAE/ASEE Joint Propulsion Conference
Tucson, Arizona
10 - 13 Jul 2005

"Shuttle Derived Launch Vehicle Concepts"
W. Rothschild and D. Bailey, The Boeing Company, Houston, TX; E. Henderson, NASA Johnson Space Center, Houston, TX; and C. Crumbly, NASA Marshall Space Flight Center, Huntsville, AL

"Shuttle Derived In- Line CEV Launcher"
M. Tigges, NASA Johnson Space Center, Houston, TX; D. Sauvageau, ATK Thiokol, Brigham City, UT; D. Hawkins, ATK Thiokol, Promontory, UT; and J. Cimenski, Lockheed Martin Corporation, Denver, CO

"Shuttle Derived Side Mount Heavy Launch Vehicle"
T. Greenwood, NASA Marshall Space Flight Center, Huntsville, AL; D. Bailey, The Boeing Company, Houston, TX; S. Davis, NASA Marshall Space Flight Center, Huntsville, AL; and L. Engler, Morgan Research, Huntsville, AL

"Recent Advances in the Development of the VASIMR Propulsion System"
F. Chang-Diaz, J. Squire, T. Glover, A. Petro, V. Jacobson, and A. Ilin, NASA Johnson Space Center, Houston, TX

"A Facility for Testing High- Power Electric Propulsion Systems in Space - A Design Study"
A. Petro, NASA Johnson Space Center, Houston, TX

"Constant Range Skip- Entry Technique for Lunar Returns"
M. Tigges, NASA Johnson Space Center, Houston, TX

"STS- Derived Launch Vehicle (SDLV) Flight Demonstrations"
M. Shaw, The Boeing Company, Houston, TX; J. Johnson, NASA Marshall Space Flight Center, Huntsville, AL; and D. Sauvageau, ATK Thiokol, Brigham City, UT

"Fleet Evolution Approach to Transition Shuttle Program Assets to the Exploration Program"
E. Henderson and D. Sander, NASA Johnson Space Center, Houston, TX; D. Crew and C. Blacknall, United Space Alliance, LLC, Houston, TX

"Status of the Integrated Space Operations Summit"
G. Norbraten, E. Henderson, and C. Kramer, NASA Johnson Space Center, Houston, TX

"STS Derived Exploration Launch Operations"
L. Sorge and J. Siders, United Space Alliance LLC, Houston, TX; J. Best, NASA Marshall Space Flight Center, Huntsville, AL; and D. Sias, NASA Marshall Space Flight Center, KSC, FL

AIAA Guidance, Navigation, and Control Conference,
AIAA Atmospheric Flight Mechanics Conference,
AIAA Modeling and Simulation Technologies Conference
San Francisco, CA
15-18 August 2005

"Autonomous Rendezvous Guidance and Navigation for Orbital Express and Beyond"
by Joe Evans; Elfego Pinon, III; and Tom Mulder

"Shuttle Return to Flight: On- Orbit GN&C and Robotic System Operation Overview"
L. Nguyen, E. Bains and P. Hill, NASA Johnson Space Center, Houston, TX; K. Metrocavage, United Space Alliance, Houston, TX

"Shuttle Stability and Control During the Orbiter Repair Maneuver"
R. Hall and R. Barrington, Charles Stark Draper Laboratory, Inc., Houston, TX; K. Kirchwey, Charles Stark Draper Laboratory, Inc., Boston, MA; A. Alaniz, Charles Stark Draper Laboratory, Inc., Houston, TX; and K. Grigoriadis, University of Houston, Houston, TX

"International Space Station Control Moment Gyroscope Controller Design for Orbiter Repair Maneuver"
N. Bedrossian, J. Jang, and A. Alaniz, Charles Stark Draper Laboratory, Inc., Houston, TX; A. Barth and K. Sebelius, Lockheed Martin Corporation, Houston, TX; and Y. Mesfin, The Boeing Company, Houston, TX

"International Space Station U.S. GN&C Momentum Manager Controller Design"
C. Sims, The Boeing Company, Houston, TX; A. Barth, Lockheed Martin Corporation, Houston, TX

"ISS Russian Segment Motion Control System Operating Strategy During the Orbiter Repair Maneuver"
L. Nguyen, NASA Johnson Space Center, Houston, TX; A. Barth, K. Sebelius, G. Bennett, R. Henscheid, and W. Geissler, Lockheed Martin Corporation, Houston, TX

"Powered Descent Guidance Methods For The Moon and Mars"
R. Sostaric and J. Rea, NASA Johnson Space Center, Houston, TX

"Simulation Study of Flap Effects on a Commercial Transport Airplane in Upset Conditions"
K. Cunningham, J. Foster, G. Shah, and E. Stewart, NASA Langley Research Center, Hampton, VA; R. Rivers, NASA Johnson Space Center, Houston, TX; J. Wilborn and W. Gato, The Boeing Company, Seattle, WA

"Aerocapture Performance Analysis for a Venus Explorer Mission"
B. Starr, NASA Langley Research Center, Hampton, VA; and C. Westhelle, NASA Johnson Space Flight Center, Houston, TX

"Orbiter Repair Maneuver Contingency Separation Methods and Analysis"
M. Machula, NASA Johnson Space Center, Houston, TX

Upcoming Conference Presentations by Houston Members

CONTINUED …

"Space Shuttle Rbar Pitch Maneuver for Thermal Protection System Inspection Overview"
S. Walker, NASA Johnson Space Center, Houston, TX; J. LoPresti and M. Schrock, United Space Alliance, LLC., Houston, TX; and R. Hall, Charles Stark Draper Laboratory, Inc., Houston, TX

"RPOP Enhancements to Support the Space Shuttle R- Bar Pitch Maneuver for Tile Inspection"
J. Brazzel, NASA Johnson Space Center, Houston, TX; F. Clark and P. Spehar, Charles Stark Draper Laboratory Inc., Houston, TX

"SRMS Assisted Docking and Undocking for the Orbiter Repair Maneuver"
L. Quiocho, T. Briscoe and J. Schliesing, NASA Johnson Space Center, Houston, TX; J. Braman, California Institute of Technology, Pasadena, CA

"Integrated Simulation Design Challenges to Support TPS Repair Operations"
L. Quiocho and E. Crues, NASA Johnson Space Center, Houston, TX; A. Huynh and H. Nguyen, Lockheed Martin Corporation, Houston, TX; J. MacLean, METECS, Houston, TX

"Analysis of Manipulator Operations for Orbiter Tile Repair"
E. Bains and H. White, NASA Johnson Space Center, Houston, TX; R. Flores and V. Yuen, Jacobs Sverdrup, Houston, TX

"Upgrade of the SRMS Math Model to Support the Orbiter Tile Repair Maneuver"
E. Bains and Y. Kuo, NASA Johnson Space Center, Houston, TX; R. Ravindran and P. Nguyen, MDA, Brampton, Canada

"ISS Rendezvous Phasing Considerations Pertaining to Optimal STS-114/LF1 Launch Opportunities"
D. Adamo, United Space Alliance, Houston, TX

"Space Shuttle Probabilistic Risk Assessment Incorporation into Entry Public Risk Estimates"
R. Mrozinski, NASA Johnson Space Center, Houston, TX

"Probabilistic Debris Modeling for Public Risk Analyses"
G. Mendeck and S. Graybeal, NASA Johnson Space Center, Houston, TX

"Discussion of Technical Challenges in Estimating Public Safety"
G. Mendeck, NASA Johnson Space Center, Houston, TX

"MIMO Sliding Mode Attitude Command Flight Control System for a Helicopter"
D. McGeoch, E. McGookin, and S. Houston, University of Glasgow, Glasgow, Great Britain

"Robust Constrained Optimization Approach for International Space Station Centrifuge Rotor Auto- Balancing Controller"
B. Postma, J. Jang, and N. Bedrossian, Charles Stark Draper Laboratory, Inc., Houston, TX; and P. Spanos, Rice University, Houston, TX

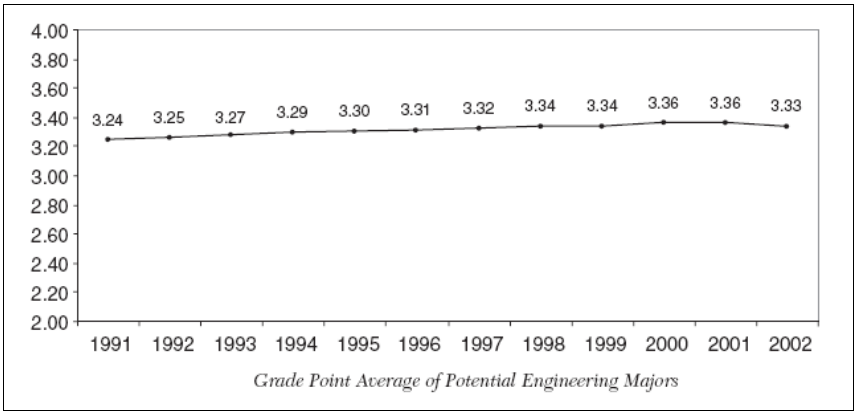
"State Estimation for International Space Station Centrifuge Rotor"
N. Bedrossian and M. Sullivan, Charles Stark Draper Laboratory, Inc., Houston, TX; and S. Nagarajaiah, Rice University, Houston, TX

"Entry Abort Determination with Non- Adaptive Neural Networks for Mars Precision Landers"
S. Graybeal, NASA Johnson Space Center, Houston, TX; K. Kranzusch, Iowa State University, Ames, IA

International Conference on Environmental Systems (ICES)
Rome, Italy
11-14 July 2005

"Parametric Shielding Strategies For Jupiter Magnetospheric Missions", *Bill Atwell*

(Workforce, continued from page 1)
industry provided a trade surplus of $31 billion in 2004", the warning should be taken seriously.



Grade Point Average of Potential Engineering Majors

What will interest students enough to consider a career in science or engineering? Horizons asked three aerospace engineering students from Texas A&M about that. Their essays are presented in this issue. For those old enough to remember the Apollo flights, it's commonly recollected how that program inspired them to one degree or another. The President's Vision for Space Exploration recognizes the potential impact that space exploration initiatives have on students: "*Space exploration holds a special place in the human imagination. Youth are especially drawn to Mars rovers, astronauts, and telescopes. If engaged effectively and creatively, space inspires children to seek careers in math, science, and engineering, careers that are critical to our future national economic competitiveness.*" Some have described the decision to pursue a career as an engineer as a *calling*. It is in that characterization that Norman Augustine's observation seems right on target, "*In spite of all the pratfalls and foibles about the aerospace industry, there are few endeavors in the entire history of mankind that can point to greater achievements than those associated with the aerospace industry and in particular that subset which has been stimulated by the need to help provide for the security of the free world, build a world transportation and communication system, and assault the frontiers of space.*"

It's not accurate to characterize the potential shortage of scientists and engineers in a *headcount* only, however. Also important is the quality of the math and science instruction that students are receiving in high school. In the ACT Policy Report:, *Maintaining a Strong Engineering Workforce*, the report concluded in part by saying, "*The primary question in examining these twelve years of ACT Assessment data for nearly 750,000 college-bound students planning to major in engineering is whether America's future engineering workforce will reflect the necessary levels of diversity and preparedness to continue the nation's competitive edge in the global marketplace. The answer, based upon the information presented in this report, appears uncertain. … The percentages of potential engineering majors in college preparatory programs and in the top quarter of their high school graduating class have … decreased. However, a greater percentage of today's potential engineering majors are completing core course requirements and their overall high school GPA has increased.*"

In his testimony before the CFUSAI, AIAA Vice-President Martin Kress offered some recommendations on how to address the potential future workforce problems:

"*AIAA recommends the establishment of a National Science and Technology Corps – a program where students receive free college tuition for pursuing courses in math, science, engineering, and computer sciences, provided they agree to work at a federal R&D lab or organization, or teach math and science in an inner-city or rural school. The latter option also has an associated certification requirement.*"

The ACT also has made recommendations to several target audiences. [See the URL in the sidebar.] One target audience is "professional engineering organizations", such as AIAA. The recommendations made by ACT to such organizations includes,

- Providing pre-college resources and programs
- Conveying a clear picture of what engineers do
- Targeting female and minority groups in underserved areas
- Increasing collaboration among the organizations to serve teachers better

Companies can also help in various ways, such as by facilitating onsite, after-hours, tutoring clinics for the children of its employees.

After falling to a 50 year low in February of 2004, aerospace industry employment rebounded dramatically over three straight quarters, creating over 27,000 new jobs between February and December, 2004. If that kind of growth keeps up, who will fill the positions?

- JSB

Primary References

Testimony of Martin Kress, AIAA Vice President of Public Policy, before the Commission on the Future of the United States Aerospace Industry (CFUSAI) www.aiaa.org/pdf/public/kresstest.pdf

Maintaining a Strong Engineering Workforce, ACT Policy Report www.act.org/path/policy/pdf/engineer.pdf

See also the *Staying Informed* column in this issue.

Houston Section
P.O. Box 57524
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