AIAA HOUSTON SECTION
Horizons
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Celebrating the Centennial of Flight

Centennial of Flight Celebration Poster on display at the JSC main gate.

Horizons

January 2004

AIAA Houston Section ♦ ONLINE ♦ www.aiaa-houston.org

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Features

In Every Issue

Please submit stories and events to *Horizons* by
January 22

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(remove 'AIAA' before sending)

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Chair's Corner

Happy New Year from the AIAA Houston Section Leadership!

Another year is gone – and it was a good one! Both nationally and locally AIAA conducted a series of great events, including the celebration for the Centennial of Flight.

What do we do now?

Lots. Rather than resting on our laurels from last year's accomplishments we are moving ahead on a series of great presentations for the Spring, as well as a rejuvenated Annual Technical Symposium. In addition, we are progressing rapidly on the new website and working to improve the Section's service to its members.

With the New Year often come the New Years Resolutions. As a member of AIAA, what will you resolve? There are numerous appointed and elected positions available – a wealth of opportunities for you to stretch, learn, and grow.

My AIAA resolutions? As Chairperson I have so many, but they can be summed up to a single item: Building a team and an infrastructure that will better serve the local aerospace community. That's hard work and it requires a lot of people to accomplish. In particular we still need a newsletter editor and several technical committee chairs. In the longer run, we will need officers for next year, and elections are just around the corner.

Make it a one of your New Years Resolutions to get involved this year!

Michael L. Oelke
2003-04 Chairperson, AIAA Houston Section

Upcoming Distiguished Lecturer – Friday Feb 20th

By Chris Taylor, Programs Chair

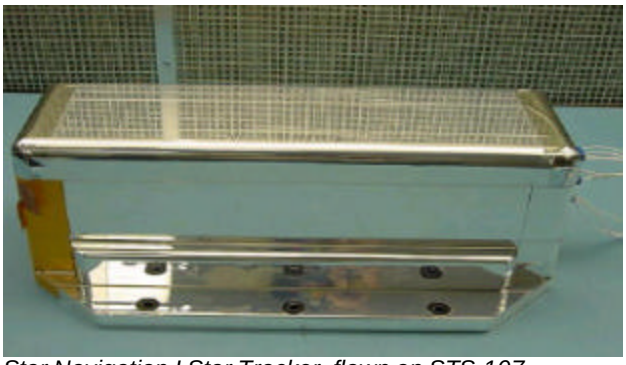
One of the programs that AIAA national provides the Sections is a list of distinguished lecturers from which we will receive up to two visits each year. This year we are proud to host Dr. George Kailiwai. He will be our speaker for the February dinner meeting on Friday, February 20, 2004. The title of his presentation is: *"The History and Future of Flight Test Training"*. The following is an excerpt from the distinguished lecturer guide:

> "Dr. George Kailiwai III is currently the Air Force Flight Test Center (AFFTC) Senior Technical Advisor. In his speech, Dr. Kailiwai describes his first experiences as a 10-year old boy living at Edwards Air Force Base (AFB), California, home of the AFFTC. His recollections include growing up during the mid-1960s amongst the flight testers who had "The Right Stuff," living in the austere environment of the Mojave Desert and the close-knit community of Edwards AFB, and the single-minded love for the AFFTC mission that permeated throughout the Edwards AFB community. This fascination with flight testing "Toward the Unknown" or Ad Inexplorata, motivated Dr. Kailiwai to accept an appointment to the United States Air Force Academy, return to the AFFTC on his first active duty assignment as a flight test engineer, apply to and gain acceptance into the USAF Test Pilot School (TPS), complete several other flight test assignments for the AFFTC, and eventually become the first ever, non-pilot, non-rated, flight test engineer to command the USAF Test Pilot School. Dr. Kailiwai's presentation is humorous, light-hearted and anecdotal, yet also highlights the awesome technological capabilities tested and evaluated at the AFFTC over the last 37 years."

Join us next month for a great presentation!

Lunch n Learn Report: StarNAV 1 Star Tracker

By Daniel Nobles and Holly Feldman



Star Navigation I Star Tracker, flown on STS-107

The AIAA Houston Section held a Lunch-and-Learn on Friday, December 19, 2003 to present the flight results of StarNAV 1, a new star tracker developed at Texas A&M. The event was held in NASA's building 16, and was presented by Dr. Thomas Pollock, an associate professor of at Texas A&M University, and Holly Feldman and Janell Rodriguez, both sophomores from Texas A&M University.

The purpose of the StarNAV I flight experiment was to validate a relatively new star catalog search algorithm developed by Dr. Daniele Mortari, associate professor of Texas A&M University. The Second Estimator of the Optimal Quaternion (ESOQ-2) is the fastest available optimal attitude estimation algorithm. It starts from the well-known q-method solution equation, but leads to the computation of the optimal principal axis as a cross product between two row vectors of a symmetric 3x3 matrix. The introduced singularity is avoided by employing only one sequential rotation. The resulting proposed algorithm is a reliable, non-singular, easy to implement, and able to identify the quasi-parallel condition when the attitude computation is impossible. The method has been demonstrated to be very suitable for star trackers. It was first implemented on the GSAT spacecraft mission, launched by the first Geo-Stationary Launch Vehicle in April of 2001 by ISRO Satellite Center of Bagalore, India.

StarNAV I was designed to validate this algorithm. It was an inexpensive star tracker built at Texas A&M that implemented commercial off the shelf (COTS) technologies. The assembled unit was about the size of a large shoebox. The CCD array was held inside a vacuum vessel and actively cooled by a thermoelectric cooler to –30ºC. The optical assembly was created using a set of optics from a commercial 35mm lens (Canon). The baffle assembly consists of 2 plates with varying hole diameters to create a conical light path of 7º to the CCD array. The CCD array had an integration time of 80 ms. The RT12 Philips camera used in the StarNAV I experiment had pixel squares of side dimension 15µm (pixel size). The focal length was determined to be 49.6×10^{-3} mm. θ was found to be 1.04 arc minutes, or 0.0019 radians.

StarNAV I was flown as a flight experiment on STS-107 and was extremely successful. By day 5 of the mission, the experiment fulfilled all of its goals. However, on day 7 of the mission the experiment no longer functioned due a pass through a South Atlantic Anomaly. This has been resolved in the models that followed by implementing radiation-hardened electronics. Unfortunately, the hardware was lost during STS-107's tragic re-entry.

The results downloaded from StarNAV I inflight, however, were enough to validate the hardware, and improvements are already under development. StarNAV II will have two perpendicular fields of view, and StarNAV III will have three perpendicular fields of view. Holly Feldman and Janell Rodriguez, spoke about their work on the Khalstar project, which will implement StarNAV II. The research for Khalstar is mostly being performed by the Space Engineering Institute, an undergraduate program encompassing hands-on laboratory training as well as involvement in professional endeavors.

StarNAV I proved that star trackers need not be expensive in order to function well. It was a simple and elegant design that will shape the next generation of star trackers. StarNAV I is a partnership between the Aerospace Engineering Department of Texas A&M University and the Spacecraft Technology Center, and is supported by the Society of Mexican American Engineers and Scientists, Jackson and Tull, and SpaceHAB.

At the conclusion of the presentation, Dr. Alan Jackson, chair of the AIAA Houston Section Astrodynamics Technical Committee, presented the speaker with a poster celebrating 100 years of the evolution of powered flight. After lunch, Dave Stovall (Lockheed Martin) joined Dr. Jackson to give our guests a tour of the System Engineering Simulator (SES) in building 16. Using the large, dome screen for visuals, they docked the space shuttle with the space station starting at the last 30 feet of approach. Also, the Aggie students successfully grappled the Hubble space telescope.

Celebrating the Houston Section's 41st Anniversary

by Michael Oelke, AIAA Chairperson

Did you know that Howard Hughes sent a representative to attend the founding meetings of the Houston Section of AIAA? On November 14th approximately 50 people learned that and many other interesting facts about our Section's history at the 41st Anniversary Reunion held at the JSC Alamo Ballroom.

Many long time members brought memorabilia they had collected and displayed it on several tables. After allowing a period of time for old and new members to mingle, a short recap of the Section's history was provided by past chairmen:

1962: Dr. Alan Chapman, founding chairperson
60's: Guy Thibodeaux
70's: Jim Mc Lane
80's: Norm Chaffee
90's: Dr. Zafar Taqvi
00's: Michael Oelke

Following the presentations, anniversary awards were handed out to 25th, 40th, and a 50th anniversary members who were present.

The evening concluded with another social. Attendees were encouraged to write a personal note on a notepad and place it in a time capsule before they left. This time capsule was loaded with these messages, as well as items from current events. It was sealed and will be opened on the Section's 60th anniversary.

Andy Hobokan displays a piece of netting salvaged from Aquarius*, the Apollo 13 LEM, before it was separated from the Command Service Module*

Past Chair Jim Mc Lane describes the Houston Section visits to China to AIAA national representative Ola Martin.

The best aspect of the event was providing an opportunity for members across the decades to meet, in many cases for the first time. This legacy is invaluable and helps new members draw inspiration not only for their role in AIAA, but in their careers as well.

One thing identified while preparing for and during the event is the lack of Section records from the 60's through the 80's. If you have any of these records (newsletters, meeting fliers, minutes, etc.), please contact any of the Houston Section officers (organization chart is on the website) and submit the information to us. We are investigating options for archiving the records and placing them in a publicly-accessible location.

On to the 50th Anniversary!

Linear Parameter Varying Control and Applications

by Ellen Gillespie, United Space Alliance

On October 21, 2003, Dr. Karolos Grigoriadis from the University of Houston Mechanical Engineering Department presented a lunch-and-learn topic entitled "Linear Parameter Varying Control and Applications to Active Microgravity Isolation." Our AIAA-Houston Guidance, Navigation and Control technical committee organized his visit.

A Linear Parameter Varying (LPV) system has a system model that depends on bounded varying parameters measured in real-time. The system controller schedule is adjusted based on the real-time measurement of the key time-varying parameters. In this manner, the controller mimics the non-linearity and variability of the system.

One of the advantages of an LPV control system is that it provides guaranteed stability and performance. It uses efficient convex optimization-based performance measures to produce systematic gain scheduling to address system variability.

An example of a successful LPV control application is microgravity isolation. The idea was to design microgravity isolation controllers that adapt from a "soft" setting to a "hard" setting. In this way the controller adapts itself to the harshness of its operating environment. The motivation behind this work was to develop a means to conduct acceleration sensitive microgravity experiments on the International Space Station (ISS). A variety of vibro-acoustic disturbances exist aboard the ISS including low frequency excitations (due to gravity gradient forces and atmospheric drag), intermediate frequency excitations (due to astronaut motion, thruster firings, etc), and high frequency vibrations (caused by pumps, fans, compressors, etc). Since the ISS is required to maintain a strict microgravity environment, an LPV control system was designed to control the vibrations in the rack and payload areas.

A two level strategy was applied to achieve microgravity isolation. On the first level good isolation performance was achieved by creating a "soft" setting for small displacements, and a "stiff" setting to minimize large displacements. The focus was therefore changed from one of isolation performance to displacement minimization. The amount of displacement is measured real-time, and performance is based on the amount of displacement.

On the second level of adaptation, the operating environment is quantified as smooth (minimal ISS disturbances) or rough (significant ISS disturbances). During smooth operating conditions, the focus is on good isolation for a wide range of displacements, rapidly shifting focus to displacement minimization as limits are approached. In rough operating conditions, the focus is continually shifted from isolation performance to displacement minimization to avoid bumping.

The resulting LPV controller is scheduled based on displacement and harshness of the operating environment. This strategy provides good isolation and prevents the rack from bumping onto the hard stops. It demonstrates that LPV control provides an efficient systematic framework for optimized robust control of systems with variability and nonlinearities. Dr. Grigoriadis is also the Director of the Aerospace Engineering Graduate Program at UH and he can be contacted at karolos@uh.edu.

Report on the Meeting of the American Astronautical Society

by Larry Jay Friesen, Executive Council Member

On November 18 and 19, the American Astronautical Society (AAS) held its National Conference and 50th Annual Meeting at South Shore Harbour. The meeting had the theme "The Dream is Alive" and was dedicated to the Columbia 7.

The conference opened with a video titled "Thank God Dreams Survive", which featured images of explorers and innovators, including Columbus, the Wright brothers, Edison, Neil Armstrong, and both the Challenger 7 and the Columbia 7. Mark Craig, Associate Director of JSC and Technical Vice President of the AAS, welcomed a group of teachers who were attending the conference.

Randy Stone, Deputy Director of JSC, gave an opening address. He offered the opinion that "He who stops exploring, dies." The keynote speaker was William Gerstenmaier, International Space Station Program Manager at JSC, who offered an insider's view of the Space Station program. Roald Sagdeev, founder and director of the East-West Center for Space Sciences, received this year's Carl Sagan Memorial Award and gave the Award address.

Lunchtime speaker on Tuesday, November 18, was Elon Musk, Chairman & CEO of Space Exploration Technologies Corporation (SpaceX). SpaceX is currently developing a 2-stage launch vehicle, the Falcon, capable of launching a 1500 lb. payload for roughly $6 million + range fees. SpaceX expects to make the first launch of a Falcon early in 2004.

The first and second sessions ran in parallel on Tuesday afternoon. Session 1 was "The Quest for Assured Access to Space"; Session 2 was a history session, "From Aeroplanes to Spaceplanes". Several good papers were presented in the History Session. Jon Rogers presented "Flights of Fancy - Spaceship Designs that Never Flew". He showed how spaceships from science fiction and from early theoretical studies provided both inspiration and design input that led eventually to real spaceships. Steven Justice of Lockheed Martin presented a paper on "Skunk Works Projects".

A third session titled “International Views of the Future of Space”, was held mid-afternoon on Tuesday. Japan was represented by Masato Koyama, Director of the Japan Aerospace Agency (JAXA). David Wyn-Roberts, Head of the European Space Agency Houston Office spoke for ESA. Unfortunately, this session had to proceed without an official representative from the U.S. The speaker originally scheduled to represent the U.S. point of view had been detained by duties in Washington, D.C. at the last moment.

Mr. Koyama provided an overview of Japan’s space program. JAXA is working on a broad range of initiatives, from the Japanese experiment module "Kibo" for the ISS program to Earth environmental observation to next generation expendable launch vehicles and candidates for future space transportation systems.

Mr. Wyn-Roberts said that Europeans support science and see human space flight as supporting science. Mr. Wyn-Roberts discussed the ESA Columbus lab module for the ISS and an Advanced Transfer Vehicle being developed for the ISS and an advanced reentry system for cargo and people. Europeans are also brainstorming ideas about what humans could do in space in 30 to 50 years.

The closing address on Tuesday was presented by Michael Mott, Vice President & General Manager for NASA Systems at Boeing. As a former pilot, he had relied extensively on checklists. Some items he recommended that we include in our checklists were: (1) Leadership is something we all have to assume. (2) Don’t confuse technology with commitment. (3) Focus on accomplishment, not credit. (4) Realistic expectations (Don’t expect million dollar results on a dime budget). (5) Teamwork.

The second day was filled with equally impressive presentations. The morning began with a media roundtable and a session on Mars. Sessions on “Military Human Space Operations” and “Space in the Classroom” took place in the afternoon. Among the many excellent presentations were James Garvin, Lead Scientist for Mars Exploration in the Office of Space Science at NASA HQ, Dr. Everett Gibson, Senior Scientist in the Office of Astromaterials Research and Exploration, at NASA-JSC, and Dr. Franklin Chang-Diaz, Director of the Advanced Space Propulsion Laboratory at NASA-JSC.

Overall, this was an excellent conference and provided the attendees the opportunity to meet a broad range of experts from the international space community. Keep your eyes open for future local conferences, whether by AIAA, AAS, or another organization!

Help AIAA Help You - Update Your Member Records!!

by Elizabeth Blome, Membership Chair

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. Additionally, our environment provides most people with the ability to move from one company to another as we try to expand our occupational horizons.

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 at http://www.aiaa.org/ 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 or by email at: AIAAelizabeth.c.blome@nasa.gov (remove the “AIAA” before e-mailing).

Becoming an AIAA Member or Renewing Your Existing Membership

by Elizabeth Blome, Membership Chair

Are you interested in becoming a member of the AIAA or renewing your membership? Do you know of someone who should become a member? That person or you can fill out a membership application online by going to the AIAA National website at http://www.aiaa.org/ (click on Join/Renew/Update) or call 1-800-NEW-AIAA (639-2422).

Please note if you have not used the AIAA on-line store then you will need to set up an account before purchasing a new membership (or even if you are renewing your membership). If you are purchasing a new membership the "store" will assign a temporary account access number to you until you have an AIAA membership number assigned to you. All existing members will use their membership numbers to establish an account.

Also if you know any students who would like to upgrade from a student member to professional member, all they need to do is submit a professional membership form and indicate that they are upgrading. This will enable that person to receive their first year of professional membership free.

If you are or know someone who needs to transfer their membership affiliation to the Houston section, please go or direct them to the National AIAA website to update membership information.

If you have any questions regarding any of the items addressed above please feel free to call AIAA National customer service number listed earlier. Feel free to also contact me at 281-244-7121 or by email at AIAAelizabeth.c.blome@nasa.gov (remove the "AIAA" before e-mailing).

Congratulations to our New Senior Members!

by Elizabeth Blome, Membership Chair

Durell M. Ashby	Stanley G. Love
Kendrick T. Aung	Edgar A. Medina
Ali Beskok	Jorge A. Molina
Vatsal N. Bulsara	John N. Opiela
Yareni I. Finn	Gurpartap S. Sandhoo
Samuel F. Galls	Dax A. Slaughter
Dave Hanson	James T. Tidwell
Johnny E. Hurtado	Scott C. Wenger

Q: Do you know how many grades of membership there are?

by Elizabeth Blome, Membership Chair

A: There ten grades of AIAA membership. For information on upgrading your membership, please go www.aiaa.org, and select the FORMS tab! Applications are due by April 15th (ahh…tax day!). Go ahead, apply – wouldn't it be nice to have something positive happen on the 15th?

Student
Student Member applicants shall be recommended by any faculty member of a recognized educational institution and must be bona fide students.

Associate Member
Associate Members are those interested in the development or application of aeronautics and astronautics. Associate Members may not vote.

Member
Applicants shall have achieved a Bachelor's Degree in science or engineering, or equivalent qualifications through professional practice.

Senior Member
Senior Members shall be persons who have demonstrated successful professional practice in the arts, sciences, or technology of aeronautics or astronautics for the equivalent of at least eight (8) years.

Associate Fellow
Nominees must be AIAA Senior Members, have 12 years of professional experience, and furnish 3 references, Associate Fellow grade or higher.

Fellow
Nominees must be members of the AIAA and be Associate Fellows. A Fellow Grade Committee appointed by the AIAA President and composed of active Fellows representative of the broad interests of the Institute, shall receive all nominations and evaluate the qualifications of nominees.

Honorary Fellow
Any voting AIAA member in good standing can nominate honorary Fellows from the ranks of Fellows. An Honorary Fellow Selection Board will study records of the nominees.

Honorary Member
Honorary Members shall be nominated by the Honors & Awards Committee and elected by the Board.

Affiliate Member
Affiliate Member grade applicants shall hold professional membership grade in recognized scientific, engineering, or professional societies and shall furnish the names of 2 references, both of which shall be of a grade equal to Member or higher. Affiliate Members may not vote or hold elective office.

Educator Associate
This membership is free to all K-12 teachers of the math, science or engineering teaching field. Educator Associate Members may not vote.

Calendar

January 2004

5 – 8	42nd Aerospace Sciences Mtg (Reno)
8	GN&C Lunch n' Learn: "Vision Based Relative Navigation for Autonomous Proximity Operations" with Dr. John Valasek/Texas A&M University and Dr. Declan Hughes/StarVision Technologies
17	Mars Rover Model Competition (University of Houston - Main Campus) (Judges Needed)
21	Dinner Meeting: StarDust
24	Future City Competition

February 2004

6	Deadline for ATS Abstracts
20	Dinner Meeting: Distinguished Lecture by Dr. George Ka'iliwai
20-22	Mars Settlement Design Competition (Judges needed)
22-28	National Engineers Week (Speakers needed)

March 2004

5 - 6	Mars Settlement Design Competition (2nd)
23	Dinner Meeting with Dr. John Lienhard
25 – 27	Science & Engineering fair of Houston (Reliant Park)

April 2004

1 – 3	FIRST Robotics "Lone Star Regional" Competition (Reliant Park)
4 – 6	Region IV Student Paper Conference (Judges Needed)
16	Annual Technical Symposium
22	Dinner Meeting (TBD)

May 2004

6	Space Day
20	Dinner Meeting (TBD)

June 2004

17	Awards Banquet

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AIAA Horizons

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