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Cover: Morpheus testing. Image credit: NASA.
Looking Back at our 2011-2012 Year

SEAN CARTER, CHAIR

Wow! What a year! It’s gone by too fast. This month of June 2012 marks the last month of my term as your AIAA Houston Section Chair. It has been a wild ride to be sure. This year we’ve heard from members of Congress, the JSC Center Director, and an impressive cadre of distinguished speakers.

This spring alone, our section hosted the…

- 2012 AIAA Region IV Student Paper Competition
- Yuri’s Night Houston 2012 Fun Run and Celebration Event
- 2012 AIAA Houston Section’s Annual Technical Symposium
- AIAA Houston Section’s 50th Anniversary Gala Celebration

It’s been a busy and fun year. We also marked our 50th year anniversary. To celebrate, we brought back members from throughout our history to share stories and give recognition of all that came before us. JSC Center Director Mike Coats attended with his wife and shared warm memories of AIAA and wishes for the next 50 years of our partnership with JSC.

Please accept my thanks for allowing me to serve as your Chair for this great 2011-12 year. I would like to sign off by recognizing those who have been our most consistent members through the years! Congratulations!

60 Years with AIAA

Dr. Angelo Miele

Left: Dr. Angelo Miele in 1987 from our 25th anniversary booklet.

50 Years with AIAA

Roy W. Meinke


40 Years with AIAA

Thomas E. Diegelman Anita E. Gale

25 Years with AIAA

Walter J. Barnett Charles H. Campbell Lee A. Coggins Toby B. Martin Norman N. Parker Donald H. Peterson, Sr. Dr. James H. Stramler Timothy D. Suit

Dr. J. Olusegun Thomas Victor H. Treat, Jr. Keith D. Zimmerman Larry S. Bell Dr. Tak Kahto Jeffrey S. Osterlund Dr. Eric L. Petersen
Weather, Climate, Special Editions & Dreams
DOUGLAS YAZELL, EDITOR

“We can say with high confidence that the recent heat waves in Texas and Russia, and the one in Europe in 2003, which killed tens of thousands, were not natural events — they were caused by human-induced climate change.”

That is a quote from a New York Times article, “Game Over for the Climate” from “op-ed contributor” James Hansen. The New York Times wrote at the end of this article, “James Hansen directs the NASA Goddard Institute for Space Studies and is the author of Storms of My Grandchildren.”

Since we have a French sister section (www.3af-mp.fr) and other European contacts, that quote about Europe sticks in my mind.

Eric Berger is an outstanding science, space and weather reporter for the Houston Chronicle. His Chronicle SciGuy blog addressed these claims about Russia and Texas, but not Europe, and Eric concludes:

“Here’s the real problem. Hansen is entirely correct in saying that climate change is happening, that humans are a principal driver, and some extreme weather will get worse. But to obtain political movement and public support for this issue, there needs to be more than dire warnings about the future. We need to see effects now in order to spend money to improve the future.

“That’s why there’s a great desire among climate activists to tie climate change to extreme weather events. That provides a good reason in the pragmatic world of politics to address a pressing need.

“Unfortunately the science of climate change and extreme weather isn’t quite yet up to the task, and Hansen, here, appears to be overreaching some.”

In other news, we produced a special edition of Horizons for the 50th anniversary of AIAA Houston Section, a 15 MB PDF file with 46 pages, extending the 20-page 1987 booklet that celebrated our 25th anniversary. This is on our web site, and our new web site is www.aiaahouston.org instead of www.aiaa-houston.org, as of July 1, 2012, but it will take a while to fully populate the new web site.

Thanks to Dr. Jon Olansen and the Project Morpheus team for this issue’s cover story! They are doing inspiring work. (Morpheus is the god of dreams and dreamers.)

Additional links:
http://www.eea.europa.eu/themes/climate

E-mail: douglas.yazell[at]me.com
For a Horizons archive on a national AIAA web site click here.

Starting July 1, 2012, our new web site will be www.aiaahouston.org, but it might not be fully populated right away. Thanks to our new webmaster Irene Chan!

Corrections to page 10 of last issue: See this issue’s Section News page!

Right: Skylon is a design for an unpiloted space plane by the British company Reaction Engines Limited (REL). Specifications (Skylon C2): Capacity: Potential for up to 30 passengers (in a special passenger module). Caption and image: Wikipedia. Image attribution: GW_Simulations. Since we have a Houston connection, maybe this will make a good Horizons article one day soon?
It’s early morning and numerous engineers, rocket scientists and various support personnel are already hard at work in the field west of JSC’s building 14. The Morpheus team is preparing for another tether test – this time with a suite of instruments from the Autonomous Landing & Hazard Avoidance Technology (ALHAT) project integrated on board the vehicle. This scene has become a regular occurrence on site at the Johnson Space Center, as the Morpheus project has worked to fully characterize the performance of its vertical test bed in preparation for some approach and landing tests at KSC later this summer.

The Morpheus Project began in earnest in June 2010, an offshoot of a concept development activity called “Project M” that envisioned demonstrating precision landing of a bipedal humanoid Robonaut on the lunar surface via a “green” propellantlander – all in 1000 days. Morpheus, named for the Greek god of dreams and dreamers (though Matrix fans may point to Lawrence Fishburne’s iconic character), continues the lander technology development activity that could eventually support human and robotic missions to any surface.

The Morpheus Project provides an autonomous, reusable, rocket-powered, terrestrial Vertical Takeoff / Vertical Landing (VTVL) vehicle for testing integrated spacecraft and planetary lander technologies. The integrated Vertical Test Bed (VTB) platform provides a means to develop, mature, refine, and demonstrate advanced technologies promoting enhanced autonomy, reliability, safety, reusability, In-Situ Resource Utilization (ISRU), precision navigation and safe landing capabilities.

The four primary goals established for Morpheus include a) technology advancement; b) lean development; c) innovative partnerships; and d) education & outreach. Project team members diligently and continuously pursue all four goals. Pursuing these goals in support of NASA’s strategic development has yielded a system capable of advancing the aforementioned technologies in an integrated flight system in the terrestrial environment.

NASA’s strategic goal of extending human activities across the solar system requires an integrated architecture to conduct human space exploration missions beyond Low Earth Orbit (LEO). This architecture would include advanced, robust in-space transit and landing vehicles capable of supporting a variety of lunar, asteroid and planetary missions; automated hazard detection and avoidance technologies to reduce risk to crews, landers and precursor robotic payloads; and ISRU to support crews during extended stays on extraterrestrial surfaces and provide for their safe return to earth. NASA’s Advanced Exploration Systems (AES) portfolio includes several fast-paced, milestone-driven pro-


Below: A banner from the Morpheus web site. Image credit: NASA.

(Continued on page 6)
Morpheus

(Continued from page 5)
jects that are developing these necessary capabilities. Specifically, the Morpheus Project and the ALHAT Project provide technological foundations for key components of the greater exploration architecture required to move humans beyond LEO.

Our project mantra is: while technologies offer promise, capabilities offer potential solutions with application for future human exploration beyond LEO. Morpheus provides a bridge for evolving these technologies into capable systems that can be demonstrated and tested. Successful implementation of these capabilities will enable access to landing sites that were previously considered to be too hazardous to risk a robotic lander mission, much less a human mission.

Though designed and developed primarily by an in-house team at JSC, project personnel aggressively pursue partnerships across other NASA centers, commercial entities and academia in support of Morpheus development and test activities. Morpheus and ALHAT have partnerships with Kennedy Space Center (KSC) for flight testing; Stennis for engine testing; Marshall for engine development and lander expertise; Goddard for core software development; and Langley and the Jet Propulsion Laboratory (JPL) for ALHAT development. Commercial partnerships with enterprises such as Jacobs Engineering, Armadillo Aerospace, and Draper Labs have augmented the development and operation of many aspects of the project.

Technology Maturation

One of the primary technology components of the Morpheus Project is a liquid oxygen (LOX) / liquid methane (LCH4) propelled vehicle. The Morpheus LOX / methane propulsion system can provide a specific impulse during space flight of up to 321 seconds; it is clean-burning, non-toxic, and cryogenic, but space-storable. For future space missions, oxygen and/or methane could potentially be produced in-situ, depending on the planetary surface. The oxygen is compatible on-board with life support systems and oxygen / methane systems are being studied for power generation as well. These attributes make LOX/methane propulsion an attractive technology when the entire spacecraft system is considered. LOX and methane are also readily available and relatively safe and easy to handle, allowing for frequent, low-cost ground testing.

ALHAT, the primary Morpheus payload, provides the second key technology: autonomous precision landing and hazard avoidance. When landing autonomously on any planetary or other surface, the vehicle must be able to identify a safe landing site that is free of large boulders, rocks, craters, or highly sloping surfaces.

A primary objective of Morpheus in FY12 is to demonstrate and advance the Technology Readiness Level (TRL) of the precision landing and hazard avoidance capabilities developed by the ALHAT system. The ALHAT project has been developing an integrated Autonomous Guidance, Navigation and Control (AGNC) hardware and software system capable of detecting and avoiding surface hazards and autonomously guiding a crewed or robotic space vehicle to a safe touchdown within 90 meters of a pre-designated planetary or asteroid site. ALHAT uses an onboard laser altimeter, a Doppler velocimeter, and a flash Light Detection and Ranging (LIDAR) for the onboard sensors to perform surface relative navigation and hazard detection. Morpheus is designed to carry ALHAT sensors and software supporting tests that will demonstrate an integrated vehicle capability to perform these tasks.

(Continued on page 7)
Vehicle Systems

Operation of a VTB encompasses a wide range of elements and disciplines that are common to a human spaceflight development, including the spacecraft, ground systems, payload integration, flight operations, logistics, and safety.

The Morpheus prototype vehicle sizing was predicated on a 500 kg payload lunar reference mission. The Morpheus 1.5 VTB is a “quad” lander design with four tanks, a single gimbaled engine and an aluminum structure beneath a top deck for mounting GNC, avionics and power components and payloads. The propulsion system uses an impinging element-type engine design, which is film-cooled and operates as a blow-down system. The engine is throttleable, producing up to 4300 lbf of thrust. Closing either of two motorized valves in the TTS will shut off the flow of liquid oxygen and methane to the engine and terminate engine thrust. The commands to initiate thrust termination are sent from a control unit located in the operations center during any live engine testing.

In order to design and build rapidly, team members are always looking to leverage existing NASA resources wherever it makes sense. For example, our software developers built our vehicle software around Goddard Space Flight Center’s Core Flight Software (CFS), a set of reusable software modules in a flexible framework that can be adapted to various space applications. Starting with CFS, we added custom application code unique to the Morpheus vehicle and mission design, enabling the vehicle to execute planned flight profiles completely autonomously, from the time that the operator sends the command for main stage ignition through vehicle landing and engine shutdown. Autonomous flight operations are required for robotic landers at remote destinations, and from the beginning, Morpheus has endeavored to keep the vehicle subsystems and software directly applicable to space flight.

Ground Systems

The VTB Flight Complex (VFC) at JSC includes a 20’ x 20’ concrete pad located on a section of the JSC antenna range near an old Apollo-era antenna tower. About 2000 feet away is the Morpheus control center for on-site field testing at JSC, the small two-story building 18 that was formerly used for rooftop (Continued on page 8)
Morpheus

GPS testing and storage. Inside this old building, our operator workstations use GSFC’s Integrated Test and Operations System (ITOS) ground software. Like CFS, ITOS was developed as ground control and display software for GSFC space vehicles and is available to other NASA projects.

Ground systems also include propulsion Ground Support Equipment (GSE). The consumables required for an engine test include liquid oxygen, liquefied natural gas, helium, liquid nitrogen, and gaseous nitrogen. A portable ground power cart is used for extended operations, minimizing the internal flight power needs.

JSC’s Center Operations provides substantial support to test activities as well, from riggers, cranes and transportation assets to emergency services and fire protection.

Operations

The final element of the Morpheus system is Operations. Nine primary operator positions are staffed by team members: test conductor (TC), operator (OPS), propulsion (PROP), avionics, power and software (APS), guidance, navigation and control (GNC), ground control (GC), a range safety officers (RSO), and the flight manager (FM). During tests with payloads aboard, another position may be included, such as one for ALHAT. Each position is certified through specific training.

Certification is also required for three pad crew (PAD) positions. PAD-1 is the pad crew leader and is responsible for executing manual vehicle operations. PAD-2 and PAD-3 conduct all handling of cryogenic fluids and most other consumables.

Morpheus Testing

Morpheus testing includes three major types of integrated tests: hot-fire, tether, and free-flight. During hot-fire testing the vehicle is completely restrained from movement and the primary focus is to test the LOX/methane propulsion system. For tether tests the vehicle is suspended from a crane to enable testing of the propulsion and integrated GN&C without the risk of a vehicle departure or crash. Morpheus “free-flights” demonstrate the fully integrated flight capability of the vehicle with no restraints. Free-flight safeguards include both automatic on-board aborts and remotely commanded aborts, as well as the redundant and independent TTS that can be activated by spotters who visually determine trajectory deviations.

As a small team, the Morpheus Project is able to try different management approaches and assess suitability for larger activities. Our lean development philosophy has been to prototype and test early and often, learn, improve, and repeat. This helps us avoid “paralysis by analysis” so that we can maintain our rapid pace of development. Learning from the last test and preparing for the next test in an aggressive test schedule is an important forcing function, promoting team focus on expeditiously understanding and improving subsystems and the integrated vehicle. The development model of refining the design through prototyping and testing, rather than through exhaustive requirements definition and analysis, has been highly effective for the Morpheus project.

Preparing for flight tests at KSC, we’ve gained a lot of operational experience in a short period of time, completing a couple of dozen field tests at JSC over the past year and a half. The test early, test (Continued from page 7)

Right: Morpheus Prop and GNC operators at work in the Morpheus control room. Image credit: NASA/Joe Bibby.

Right: Morpheus pad operations. Image credit: NASA/Kris Kehe.
(Continued from page 8) Often philosophy has resulted in the team conducting 6 hot fire and 17 tethered tests to date. The first several tests demonstrated the basic integrated vehicle capability and allowed the team to wring out the ground systems and operations. In late 2011, many upgrades were made based on lessons learned from the initial flight test campaign, and Morpheus 1.5 testing began in February 2012. Since then, tests have focused on tuning the GN&C performance and integrating the ALHAT sensors and components onto the vehicle. Most recently, we performed tether tests with ALHAT’s gimbaled HDS active on top of the VTB, continuously moving to counteract the motions of the hovering VTB, enabling it to detect and track targets out in the field.

With outreach as a prime objective, we strive to connect with the public in multiple ways. During each test, we stream mission telemetry, voice loops, and video from the Morpheus testing control center to JSC’s Mission Control Center (MCC). From there, data and video can be made available to internal and external networks for NASA personnel and the general public. Social media sites (Facebook, Twitter, YouTube, etc.) are also regularly used. We even have an iMorpheus app (developed by a co-op) that graphically depicts vehicle flights with live streaming data. I encourage readers to follow us online at our website http://morpheuslander.jsc.nasa.gov/live.

Several of the tests had notable results. Tether Test 2, conducted early in the project test campaign, experienced an avionics failure that caused the engine throttle to fail full open at ignition, and the resulting vehicle motion under the tether was much more dynamic than expected. It may have appeared as a test failure, but the team took the opportunity to critically review the throttle valve control and made a number of improvements in that design. Additionally, the GN&C team was able to collect dynamic motion data that would not have otherwise been available during a normal test. Just six days later, the team had made the repairs and conducted a well-behaved Tether Test 3. As originally envisioned, these videos were posted to the internet with a description of what happened during each test.

Every test has the potential to initiate small grass fires, primarily due to spalling of the concrete pad under engine thrust. Tether Test 5, on June 1, 2011, was the most stable hover at that time and so was a Morpheus test success, but made the news due to a grass fire that was ignited and spread through the dry field adjacent to the launch area. Fire Protection personnel were on the scene for this test as planned, but unfortunately had to split forces when a fire alarm was activated in another JSC building immediately (Continued on page 10)

Left: Morpheus hot fire test. Image credit: NASA/Kris Kehe.

Left: Morpheus ignition. Image credit: NASA/Joe Bibby.
Morpheus

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after the test completed. The fire was stopped with damage only to a number of hay bales, but the event led the team to reevaluate and improve our fire prevention and suppression approach, including adding a fire break around the perimeter of the test area, raising the tether height to reduce the potential for concrete spalling, and getting a pumper truck to have available for JSC’s Fire Protection Services (FPS) personnel. Since Tether 5, only a handful of tests have resulted in small grass fires, all quickly extinguished.

Upcoming Tests

At this time, our higher performing HD5 LOX / methane engine is undergoing testing with tremendous support from our partners at Stennis Space Center. Integrated vehicle tests at JSC with the new engine, as well as new LOX / methane RCS engines, with final verification of dynamic stability, will complete our planned test series at JSC.

Currently scheduled for mid-July, the team will transport the vehicle and ground support equipment to KSC to begin a free flight test campaign. Our partners at KSC have done an excellent job preparing for our arrival and are nearing completion of the flight test site preparation at the Shuttle Landing Facility (SLF). Preparation includes the buildup of a simulated planetary surface, complete with rocks, craters, and slopes, north of the SLF runway, to serve as the target landing site. The test cam-

(Continued on page 11)
paige will begin with short 30m x 30m “hops,” and culminates in a two-minute Hazard Detection Phase (HDP) flight trajectory with a maximum altitude just over 500 meters and a range of one kilometer. The HDP trajectory simulates a landing approach phase that allows the ALHAT system and Morpheus vehicle to perform hazard detection and avoidance, scanning the hazard landing field, and redesignating the vehicle to a safe landing site within that field.

Beyond FY12

Morpheus will continue to spearhead innovative ways of doing business that streamline management overhead and maintain the flexibility to address the challenges of system development, while retaining what rigor is needed to expeditiously proceed toward a flight-capable design. Many of the Morpheus team members previously worked on large-scale NASA human spaceflight projects and programs such as ISS, Shuttle, and Orion. These large programs have thousands of geographically distributed team members, a high number of contractor organizations, and a multi-step governance model. Morpheus was challenged to evaluate ways to reduce overhead, create efficiencies in the team organizational structure, and improve team collaboration and communication, using methods that could potentially scale back up to streamline flight projects and programs. The team will continue this effort to improve the way that NASA executes projects, and will continue to share these innovations both within and outside of the NASA organization.

Beyond FY12, Morpheus will continue to mature the technologies and integrated capabilities to support a space-capable system. Under the AES program, Morpheus plans to evaluate alternate lander designs, including composite tanks and structure. The project will also develop a regeneratively cooled engine and increase vehicle reliability with redundant avionics, power, and GN&C components. In FY13-14, Morpheus plans to conduct even higher energy (6-kilometer slant range) landing profiles, simulating a complete surface approach trajectory, and carrying evolutionary ALHAT components that are smaller and higher performing, yet require less power. Morpheus will maintain a robust prototype and testing profile, ensuring that technologies and capabilities will have a high level of maturity when NASA is ready to on-ramp them for future spaceflight missions.

Author

Dr. Jon B. Olansen serves as the Project Manager for the Morpheus Project. Jon earned his B.S. in Aerospace Engineering and M.S. in Mechanical Engineering from the University of Notre Dame. He obtained his Ph.D. in Bio-Mechanical Engineering as a National Instruments Fellow at Rice University, where he specialized in biomedical experimentation in electrophysiology and cardiopulmonary hemodynamics. He has published several journal articles related to his research and authored a reference book on biomedical instrumentation. Jon began his career at JSC as a Space Shuttle flight controller (Mechanical, Maintenance, Arms and Crew Systems, or MMACS), supporting 32 missions and logging more than 4200 hours in Mission Control. Dr. Olansen has since held a number of positions of increasing responsibility including tours in Flight Crew operations, Safety & Mission Assurance, the Shuttle Program Office and the Exploration Systems Mission Directorate at NASA Headquarters. Jon recently left his role as the Manager of the Engineering Directorate Planning & Control Office at JSC to pursue the Morpheus activity full time.

Note the publication of a May 2012 conference paper:

**Global Space Exploration Conference (GLEX)**
AIAA and The International Astronautical Federation (IAF)
GLEX-2012.05.2.4x12761
Morpheus: Advancing Technologies for Human Exploration
Jon B. Olansen, PhD, lead author
Stephen R. Monday
Jennifer D. Mitchell
Michael Baine, PhD

A crowd of over 100 people enjoyed this special dinner meeting on June 6, 2012, at the NASA/JSC Gilruth Center Alamo Ballroom. JSC Center Director Mike Coats addressed the crowd before the panel discussion with five former Section Chairs. Panel moderator Norman Chaffee made a few introductory remarks, then Douglas Yazell spoke in place of James C. McLane, Jr., our 1971-72 Chair, and Douglas spoke mostly about Jim’s service to our section during that 1971-72 year and, starting in 1987, Jim’s leadership in starting up our (Shanghai based) Chinese sister section. The additional speakers made initial remarks in the order shown in the photographs, AIAA Fellow Guy Thibodaux, Norman Chaffee, Dr. Zafar Taqvi, and Ellen Gillespie.

Our Section started in 1962 as The Institute of Aeronautical Sciences (IAS) Houston Section. The American Institute of Aeronautics (AIAA) did not exist until 1963, but claims 1931 as its starting year, since it was created by merging The American Rocket Society (started in 1930 as The American Interplanetary Society) and the IAS (started in 1932).

Each paid attendee and guests of honor received a NASA commemorative medallion containing flown metal, a lapel pin created for this anniversary, and a 46-page anniversary booklet.

Happy Anniversary!
AIAA Houston Section almost had its dinner meeting of June 6, 2012, at this location! It was a celebration of the 50th anniversary of AIAA Houston Section. We rounded up the required funding, but other factors led us to use another venue.

Now and then they talk about building a bed and breakfast facility on the second floor. Museum volunteers also envision a restaurant in the museum one day.

The art deco and art moderne building has been beautifully restored so far. The ground floor atrium is like new, restored to its majestic initial appearance like in 1940, when the facility was far larger than Houston’s needs. By 1946 or 1948, it was too small for Houston’s needs. Be sure to visit the museum soon!

There are various ways to support the museum: become a member, attend the monthly Wings & Wheels lunch programs (usually on the third Saturday of the month), become a volunteer, etc.

As you can see from the 2010 photograph, there are a few floors with rooftop pedestrian areas. They will be great for taking photos of aircraft, but for now, upper floors are closed to the public due to fire codes.
The AIAA-Houston chapter held its 2012 Annual Technical Symposium at its usual Gilruth Center venue from 8:00 to 4:30 PM on May 18. Before an early crowd of 40 attendees which eventually grew to over 120 by day’s end, our conference General Chair Satya Pilla introduced the morning’s keynote speaker, NASA Orion Program Manager Mark Geyer.

Mr. Geyer began by describing the history behind the development of NASA’s newest exploration vehicle. After the fly-off planned for 2004/2005 to decide on a Crew Exploration Vehicle (CEV) design proved too expensive, a subsequent Phase I competition for the Orion vehicle was executed and then cancelled in 2010. The design eventually evolved into the Multi-Purpose Crew Vehicle (MPCV) that is familiar today. Despite the volatility in the funding (and nomenclature) for the vehicle, the fundamental requirements have been relatively stable. Mr. Geyer went on to outline the manifest planned leading up to the 2014 flight test, and to explain the various roles the government currently plays in the development of the Orion vehicle, from overseer to government supplier to provider of engineering support.

The NASA open architecture design approach for the Orion was described briefly, along with the numerous trade studies that have already been completed and planned flight campaign. He stressed the difficulty in the abort system design, noting that this scenario is the loads driver and that every study performed supports the tractor (rather than pusher) approach. The CM structure design was described next. Among the components and systems described were the composite crew pressure vessel, the water drop test, acoustic testing, crew safety equipment, and avionics. Mr. Geyer continued with a brief description of the planned Exploration Mission Flight 1 (EFT-1). After launching on a Delta-IV Heavy, the vehicle will make two orbits up to an altitude of 3000 miles. Key separation

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events will be tested, as well as an entry at near-lunar-return velocities. Additional abort and exploration mission tests were described, includ-
ing a 7-day, unmanned, free return lunar mission and a 10-to 14-day crewed lunar mis-

sion.

Destinations for the Orion include the moon and asteroids, but Mr. Geyer also noted that the Orion is required by law to perform as a back-up for the International Space Station (ISS). It is being designed to accommodate ISS docking, although the detailed design for many of these func-
tions has been de-
ferred. He pointed out that since its design is not optimized for ISS dock-
ing, it cannot compete on a financial basis with transport-
tation services provided by the Soyuz or those planned by other commercial providers. Mr. Geyer closed by encour-
aging those interested to fol-
lows the progress of the Orion design on social media such as Facebook and Twitter.

After the morning’s parallel break-out sessions on topics such as aero/astro, propulsion, GN&C, systems engineering, modeling & simulation, and structures & mechanical engi-
neering, a lunch of sandwich-
es and fruit was provided. The afternoon’s keynote address featured astronaut speakers Andrew Thomas and Chris Ferguson. A former US Navy pilot, Mr. Ferguson flew aboard Space Shuttle flights STS-115, STS-126, and STS-135, and went to work in the Crewed Capsule Develop-
ment program at Boeing after retiring from NASA in De-
cember 2011. He mused on how much KSC and JSC have changed in the year since the Space Shuttle has retired and how much the four emerging commercial competitors, Boe-
ing, SpaceX, Sierra Nevada, and Blue Origin, have accompl-
ished with the limited fund-
ing available. Of the three major components of the country’s manned spaceflight (Continued on page 16)

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Left: Dr. Satya Pilla, ATS 2012 General Chair (behind the podium) presents a keynote speaker gift to Andrew Thomas of the NASA astronaut office. Image credit: Steve Everett using Satya Pilla’s camera.

Left: Keynote speaker Mark Geyer, NASA/JSC, Orion Multi-
Purpose Crew Vehicle (MPCV). Image credit: Dr. Satya Pilla.

Left: The ATS 2012 keynote speaker gift and door prize, from the Official KSC Visitor Complex Space Shop. This crystal paperweight is af-
fordable and available in this limited edition. Only 2011 will be made, in honor of the 1981-2011 history of the NASA Space Transporta-
and Space Launch System (SLS), the ISS is the cornerstone and is serving as the development test bed for systems which will be required for a future Mars mission. Mr. Ferguson went on to describe Boeing’s progress and its interaction with the Bigelow company, including showing a video of the company’s concept. Having just completed PDR, Boeing is preparing for CDR and an eventual pad abort test, orbital flight test, and ultimately a crewed flight test after December 2015. After mentioning some of the remaining challenges and opportunities, he encouraged those of us working in human spaceflight to stay focused. He closed with the reminder that a flag which flew on STS-1 and was left on the ISS by STS-135 will someday be returned by one of the commercial vehicles now in development.

Astronaut Andy Thomas continued the lunchtime presentation with his view of spaceflight today and tomorrow, and how we should move forward. Dr. Thomas, who flew aboard Shuttle flights STS-77, STS-89, STS-102, STS-114, is currently working issues for the Exploration Branch of the Astronaut Office. He said that although the Shuttle has given us so much, with its retirement we are left to rely on the Soyuz. Plans to have the Crewed Capsule Vehicle (CCV) developed by the commercial sector and online sometime in the middle of the decade have freed up NASA to develop heavy lift capability with SLS and reach destinations such as the Moon, asteroids and Mars. However, given the cancellation rate of the manned programs in the past few decades, a successful program will need the following attributes: relevance, affordability, perceptible progress, and acceptable risk. Culture has changed since Apollo, and
programs in the future will have to be sustained based on their perceived relevance to the public, either through economics, national security, or spiritual security. A program must also be affordable given the consistent decline in the funding available to NASA. A lack of demonstrable and visible progress, such as that seen in the Apollo program, hurt the development of the Freedom Space Station and cast doubt on the Shuttle program. It is clear the US must be willing to accept risk, and Dr. Thomas noted that it was aversion to risk that motivated Kennedy to disallow John Glenn to fly again and caused the CAIB to question why Columbia was allowed to fly a mission based solely on science research. The new challenge for the manned space program is a shift to development of capability in the form of small steps toward short term goals. In answer to attendees’ questions, Dr. Thomas denied the need for a “spectacle,” such as a Chinese Moon landing, to motivate the space program, but that it should be realistically based on exploration, and that it is our job to communicate the appropriate messages to Congress and the public.

The afternoon general session ended with a presentation of a commemorative crystal to each of the speakers and to the lucky door prize winner Ken Lassmann, and then the symposium concluded with another set of parallel tracks in GN&C, systems engineering, communications and tracking, architectures, and flight sciences.


Left: Molly White (at left) with session chair Dr. Albert A. Jackson IV. Image credit: Douglas Yazell.

ATS 2012

Planning Committee

Dr. Satya Pilla, General Chair
Ellen Gillespie
Dr. Albert A. Jackson IV
Dr. Steven E. Everett
Raphael Munoz
Matt Johnson
Sarah Shull
Douglas Yazell
Editorial

Planetary Resources: Flight of Fancy or Real Wealth?
SHEN GE, CONTRIBUTOR, JUNE 17, 2012

In recent times, the space industry has received a lot of coverage in mainstream media due to the high interest in space expressed by the rich and famous. So far, every private space company has been funded by a multimillionaire if not billionaire. When billionaires from backgrounds in technology such as Google co-founder and the developer of Microsoft Office team up with movie directors and politicians, naturally all eyes turn to this startup company. Planetary Resources (henceforth known as PR) certainly has a stellar cast of investors and advisers which the mass media has been repeatedly highlighting as well as their ambitious stated goal of mining asteroids.

However, two things need to be better defined: (1) the exact objectives of PR in mining asteroids and (2) how they propose to do it. PR specified the resources of water and rare metals. The justification of water as a resource is: “A single water-rich 500-meter-wide asteroid contains 80 times more water than the largest supertanker could carry and could provide. If the water were converted to rocket propellant, it would provide more than 200 times the rocket fuel required to launch all the rockets ever launched in human history.”

The assumption of water as a valuable resource in space is fundamentally flawed for several reasons. First, PR assumes future spacecrafts will mostly use liquid oxygen/liquid hydrogen (LOX/LH2) as rocket propellant. Despite its high specific impulse, cryogenic systems are required for LOX/LH2 systems and these systems are known to be complicated, expensive, and occupying large volumes due to the low density of hydrogen. This is why more dangerous but denser and non-cryogenic systems are still often used. This also does not take into account other methods of propulsion such as electric propulsion or solar cells which do not require substantial fuel at all, if any.

Second and equally crucial, the current market size for spacecrafts is too small to justify mining for water as a sellable resource. With less than 50 new launches every year currently and perhaps 10% to use the LOX/LH2 systems if optimism is assumed, PR will be spending much more than it makes. The market size will only increase if there are more launches of spacecraft every year but that can only happen with reduced launch costs. Private space companies such as SpaceX will be ensuring this happens. However, with the reduction of launch costs, the value of water will also be decreased. Water is only a valuable resource since the current exorbitant rates of launch costs have the direct impact that any dense material, whether it be water or any payload, costs a lot to launch. Currently, even the cheapest heavy lift launch vehicle (heavy lift meaning more than 25,000

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pounds), the Ukraine Zenit 2, launches payloads to LEO at an expense of $1000/kg.

So the chicken-and-egg problem is as follows. There’s no market right now for water since there’s not enough launches that need water as a fuel source. There’s no market in the future for water since the launch costs will be low enough by then that bringing water from Earth will be cheaper than mining them from asteroids.

PR’s second main target of resources is rare metals. As PR puts it, “In space, a single platinum-rich 500 meter wide asteroid contains about 174 times the yearly world output of platinum, and 1.5 times the known world reserves of platinum group metals.”

Economics tell us that a resource is valuable if it’s in short supply. Consider aluminum which was more valuable than gold when the creation of aluminum was not yet discovered. The Emperor Napoleon III used aluminum silverware only for his most highly esteemed guests in the 19th century. Consider a different story of rice with a different “emperor” called Emperor Norton in the United States in the 19th century.

Joshua Norton, seeing that China placed a ban on the export of rice, which caused the cost of rice in San Francisco to skyrocket from four cents per pound to thirty-six cents per pound, bought all the rice in the market that was shipping from Peru to hike up the price. Unfortunately or fortunately, he failed to profit from his strategy, since more rice came in anyway, and rice came back down to the price of three cents per pound.

These simple stories illustrate the value found in scarcity. Rare metals such as gold and platinum are only worth a great deal because they are rare. Once PR floods the market with these rare metals, they will no longer be considered “rare.” Instead, they may be even considered cheaper than iron or nickel given their abundance. Of course, PR can claim to have a monopoly of such resources and only dispense them at a trickle or sell them at a high price as out-of-space rare metals, but that would mean they will be a company with monopolistic intent. World governments would take action against them.

Aside from PR’s vision statement, the implementation (the “how”) also leaves much to be desired. The first project of PR’s, the LEO space telescope, is a multipurpose telescope designed for looking outwards into space as well as looking inwards at Earth. As PR puts it, “LEO is capable of surveying for near-Earth asteroids during one orbit, [and] then [being] retasked for rain forest observation on the next. The possibilities for utility and engagement are only limited by the imagination of the user.”

A payload for a spacecraft must have precise scientific requirements in order for instrumentation to be designed to accomplish these aims. A spacecraft meant only to look at the sun has a different set of configurations than an optical telescope to look at the universe such as Hubble. By generalizing the tasks of PR’s planned telescope, they end up with two strikes against them. First, they will need an expensive and costly telescope with multiple instruments since they are all necessary to cover the different aspects of a very general mission. Second, they lose time in actually finding near Earth asteroids. When their telescope is looking at the ground half the time, half the time they won’t be finding asteroids.

Clearly, the current agenda of Planetary Resources leaves much to be desired. Perhaps they have a more defined alternate agenda not shown to the public which is more sensible, but currently what I see is that they believe that having money is more important than having brains.

The Columbus laboratory module and the Automated Transfer Vehicle (ATV) are the two major contributions of Europe to the International Space Station (ISS). In order for the ISS to be continuously operational until at least 2020, each partner nation should participate in its operations, but also provide in-kind services. Three ATVs have been launched from French Guiana (using an Ariane 5 rocket each time): ATV-1 (Jules Verne) in 2008, the ATV-2 (Johannes Kepler) in 2011 and the ATV-3 (Edoardo Amaldi) in 2012. Coming next are ATV-4 (Albert Einstein) in 2013 and ATV-5 (Georges Lemaitre) in 2014.

The European Space Agency (ESA) and NASA were dis-

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cussing, even recently, a possible contribution from ESA to the NASA Orion Multi-Purpose Crew Vehicle (MPCV) project (a subject already suggested in the 3AF MP newsletter la Gazette, issue number 22) by supplying services in order that Europe fulfills its "post-ATV" obligations. On January 16, 2012, the Director General of ESA reiterated to reporters his wish that this contribution take the form of elements of the Orion MPCV service module. For Europe, this would be a matter of making the best use of the expertise of the ATV program and Columbus. For the U.S., it would allow them to save time on the development of Orion, and to share the cost. Approvals from Europe remain to be obtained (after the next ESA ministerial meeting scheduled for late 2012), as well as approvals from the United States.

Unfortunately, in an article dated February 17, 2012, in Aviation Week and Space Technology (source: internet), titled "France, Italy Shun Orion Development," we learn the current position of the Presidents of the French National Center for Space Studies (CNES) and the Italian Space Agency (ASI) that reflects their opposition to their possible participation in the development of the Orion MPCV service module. So there is a disagreement currently existing between France and Italy on the one hand, and on the other hand, the barter (ATV as the service module for Orion MPCV, to be launched on NASA's planned heavy-lift rocket, the Space Launch System, or SLS) mentioned by Thomas Reiter (ESA) on September 19, 2011, before the British Royal Aeronautical Society (RAeS), described in la Gazette 3AF MP No. 22. To be continued...
Mario Diaz, Aviation Director, Ellington Airport, made a presentation recently at the May 16, 2012 membership meeting of the Bay Area Houston Economic Partnership. Janice Larson alerted me to this surprising and exciting idea, “Ellington Spaceport!” Bob Payne at BAHEP supplied me with PDF charts from the presentation, along with PDF charts from another presentation from a different author about the military projects at Ellington Airport / Field.

I will continue to work on contacting the offices of these (Continued on page 23)
two presenters, in hopes of having detailed articles in Horizons about these AIAA-related activities in our backyard, so to speak. Meanwhile, here are a few images that will be of interest to our readers, thanks to Mr. Diaz.

Ellington Airport

**ELLINGTON AIRPORT SPACEPORT FEASIBILITY STUDY**

**SpacePort overview**

**Efforts to Date:** Completed operational feasibility study

**Next Steps:** Study to assess commercial viability
- FAA Certification as SpacePort, Environmental Assessment required
- For horizontal launch capabilities only, X Concept and Z Concept vehicles
- Will work with prospective aerospace companies, research companies, aerospace manufacturing, commercial space carriers on leases at Ellington
Yuri’s Night Houston 2012

Yuri’s 5k Fun Run and Space Day 2012

MICHAEL FROSTAD

To celebrate Humanity's first steps into Space, specifically Yuri Gagarin's flight of Vostok-1 and STS-1 Space Shuttle Columbia's first flight, AIAA Houston Section hosted two events in April.

The first was the annual Yuri’s 5k Fun Run held at Challenger 7 Memorial Park on April 7th. The Yuri's 5k, which supports the Challenger Center for Space Science Education, has grown to be part of the yearly runners tradition in the Houston Clear Lake area.

The activities began at 8am with a kids 1k run. The kids took off like rockets, each looking to lead the pack. As each one returned the crowd would erupt in applause encouraging them to finish strong. It was a fun activity for all.

Shortly after the Kids 1k run it was time for the main event, Yuri's 5k. Over 400 people came to run or walk the 5k on the near perfect morning at the park.

The course is a double loop through the park with the first loop adding in the obstacle of the Challenger Memorial Knoll. With volunteers, family members, and friends cheering people on throughout the varied terrain of the course, the race brings a smile to your face. Not to mention the medals for the winners, the free massages, and food.

The second event was held April 21st at Discovery Green in downtown Houston. The Society of Women Engineers (SWE) and Engineers Without Borders (EWB) joined AIAA Houston at the park with exhibits and water rockets.

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Volunteers spent the afternoon showing and discussing all the different aspects of Human Spaceflight and how some of that knowledge is helping to improve life on Earth. Posters describing many of the spacecraft in work, history of the liquid fueled rocket, International Space Station research, and future destinations allowed people to see the breadth of work being performed by the AIAA community.

Of course, the big hit with the kids on this very warm Space Day were the water rockets. Over 100 water rockets were created and launched throughout the afternoon thanks to SWE and North Forest High School volunteers.

AIAA Houston would like to thank all of the participants and sponsors for helping to make this year's fun run and Space Day the best yet! A special thank you to Jacobs Technology for being a premier sponsor of the events. We would also like to thank ERC for their support as well as Odyssey Space Research, Walmart, Accord Texaswide and Motorola.

In addition, our Space Day partners and volunteers from the Society of Women Engineers and Engineers Without Borders, as well as North Forest High School, really are the ones who made it a great event at Discovery Green.

These two events gave us an opportunity to discuss space exploration with many in the Houston community and the large number of participants in the Yuri's 5k Fun Run combined with the great sponsor support for both events allowed AIAA Houston to make a $10,000 donation to the Challenger Center for Space Science Education! We hope to see you all again next year!

For more photos of the event please see the following links:

http://www.yurisnighthouston.net/

https://picasaweb.google.com/100078783678297762833/2012Yuri5kSpaceDay

Yuri's Night
Houston 2012
Current Events

Launch of Chinese Astronauts, June 15, 2012

**SHEN GE, CONTRIBUTOR & DOUGLAS YAZELL, EDITOR**

*Right: Liu Yang, the first Chinese woman to go into space. Image source: Enjoy Space. Image credit: CNSA.*

*Right: The crew of Shenzhou-9, from left, Liu Yang, Jing Haipeng and Liu Wang. Image source: Enjoy Space. Image credit: CNSA.*

*Right: The space station Tiangong-1 (right) on orbit with an approaching Shenzhou spacecraft (artist’s image). Image source: Enjoy Space. Image credit: CNSA.*
The Experimental Aircraft Association (EAA)

EAA Chapter 12 Mission
The EAA’s Chapter 12, located at Ellington Field in Houston, Texas, is an organization that promotes all forms of recreational aviation. The organization includes interest in homebuilt, experimental, antique and classic, warbirds, aerobatic aircraft, ultra lights, helicopters and commercially manufactured aircraft and the associated technologies.

This organization brings people together with an interest in recreational aviation, facilitating social interaction and information sharing between aviation enthusiasts. Many of the services that EAA offers provide valuable support resources for those that wish to develop and improve various skills related to aircraft construction and restoration, piloting, aviation safety, and aviation education.

Every individual and organization with an interest in aviation and aviation technology is encouraged to participate (EAA membership is not required, but encouraged).

Meetings are generally from 6:30 PM to 9 PM at Ellington Field in Houston Texas. We welcome everyone. Come as you are and bring a guest; we are an all aviation friendly organization!


Experimental Aircraft Association (EAA) web site: www.eaa.org

Scheduled/Preliminary Chapter 12 Event/Meeting Ideas and Recurring Events:
1st Saturdays – Waco/Macgregor TX (KPWG), Far East Side of Field, Chap 59, Pancake Breakfast with all the goodies 8-10 AM, Dale Breedlove, jdbvmt[at]netscape.com
2nd Saturdays – Conroe TX Chapter 302 10 AM Lone Star Builder’s Ctr, Lone Star Executive
2nd Saturdays – Luftin TX Fajita Fly-In (LFK)
2nd Saturdays – New Braunfels TX Pancake Fly-In
3rd Saturdays – Wings & Wheels, 1941 Air Terminal Museum, Hobby Airport, Houston TX
3rd Saturdays – Jasper TX BBQ Lunch Fly-In (JAS)
3rd Saturdays – Tyler TX Breakfast Fly-In, 8-11, Pounds Field (TYR)
4th Saturdays – Denton TX Tex-Mex Fly-In
4th Saturdays – Leesville LA Lunch Fly-In (L39)
4th Saturdays – Shreveport LA Lunch Fly-In (DTN)
Last Saturdays – Denton Fly-In 11AM-2 PM (KDTO)

In our May 2011 issue we started our series EAA/AIAA profiles in general and experimental aviation with Lance Borden, who is rebuilding his Inland Sport airplane, an aircraft manufactured by his grandfather’s 1929-1932 company. The second in this series was a profile of Paul F. Dye. The third profile will appear as soon as possible. This series was suggested by Richard Sessions of EAA Chapter 12.

EAA is the Experimental Aircraft Association. The Houston Chapter is #12, one of the earliest created among the hundreds of chapters.

Left: RV9A on the ramp! This is a photo from the 1940 Air Terminal Museum web site, from the August 2011 Wings & Wheels monthly event, whose theme for that day was the annual Oshkosh Air Show and the EAA. Image credit: The Museum.
NASA wind tunnel reports are, as might be expected, excellent sources of information regarding certain aspects of a large number of unbuilt aircraft and spacecraft projects. What they tend to not be terribly useful for is programmatic or historical information about the designs they cover. It is not uncommon for a wind tunnel report to describe the aerodynamic characteristics of a very interesting vehicle, but provide precisely no information regarding who designed the vehicle (was it an internal NASA design, or produced by a contractor?), whether the (Continued on page 29)
At the time, NASA and the rest of the American aerospace community were hard at work on producing designs for manned lifting entry vehicles—spaceplanes, in other words. The range of concepts was wide open; everything from darts to lifting bodies, from stubby capsules to variable geometry vehicles was studied. And generally, even without program information, the function of a design tested in a wind tunnel could be determined if only the scale of the model was known. But Ames wind tunnel tested a design that was suggested for two roles: the first, as an orbital "taxi" for the transport of crew into space (presumably to a space station); the second... as a fighter jet equipped with armament and...
The basic vehicle was a variable geometry design that would stay folded up as a lifting body until well after re-entry, but at low supersonic speeds would unfold large wings and eject a cover protecting an under-nose inlet for jet engines used for cruise. For the passenger version – which seemed to have room for a single pilot and three passengers, and some cargo capacity – a single jet engine was included, presumably for crossrange and/or go-around capability. But the second version replaced the passengers and cargo with added fuel capacity and more voluminous inlet ducts for four larger turbojet engines. In the nose ahead of the pilot was space for “armament” and “ammunition.” No information is given as to what that armament was... presumably one or more machineguns, but also possibly a “rocket gun” firing guided or unguided missiles. Cruise Mach number was 2, but wing unfolding would begin at Mach 5 and 120,000 feet. The turbojets could be started at about 60,000 feet, between Mach 1 and 2. The four engines would produce 14,000 pounds of thrust. Launch weight of both the military and orbital versions was 20,000 pounds.

What was the role here? Sadly, the reports deal solely with the aerodynamics of the design, and do not provide that information. Was it a corporate design being tested by NASA, or was it a NASA design? The passenger version was of course meant to be orbital, so it’s clear that the armed version would at the very least have been capable of global range, if given similar rocket boosting. But what was the idea behind shooting a dogfighter around the world in 45 minutes? Unfortunately, no information is available.

Pure speculation: the armed version may well have been a latecomer to the design. Orbital logistics was very likely always the prime mission; an armed version might well have been a last-minute addition to the roles the basic design could fulfill. But what

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jet engines.

Below: Powered flight performance envelope of military version (NASA, 1963)
In 1962, NASA was on the hunt for the “Post-Nova” (renamed “Post-Saturn” in 1963) launch vehicle, an advanced booster capable of orbiting around one million pounds of payload. Numerous companies tendered a great many designs, from multi-stage expendables to single-stage reusables. Douglas Missiles & Space produced the ROMBUS concept for a reusable single-stage to orbit vehicle, starting with a study that appears to have been a relatively mundane jet fighter with an extremely odd mission profile might have been suggested as an escort design for another concept.

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E-Publication

Below: Display model of folding-wing re-entry vehicle (via NASA Historical Archives)

intended to transport 1,200 fully armed US Marines anywhere on Earth in 45 minutes.

The NASA-Ames “fighter” preceded official publication of the ICARUS concept. But it is just barely possible that there was some discussion between Douglas, USAF, USMC and NASA personnel prior to this leading to some interest being expressed by someone in the idea of a fighter jet that could be launched at the same time as ICARUS and either take out anti-ICARUS weapons systems prior to the ICARUS arriving, and/or provide air cover for ICARUS during and after landing, until conventional fighters could arrive. This is, of course, purest speculation.

If anyone has any further information on this concept, either on the design or the role, I’d love to see it!

References


For information on the Douglas ROMBUS and ICARUS vehicles, see Aerospace Projects Review issue V2N6: www.aerospaceprojectsreview.com
From Donya Ziraksari:

Dear Committee,

I want to thank the Apollo Scholarship committee for their generous award. I will be using the scholarship to continue pursuing my Bachelor’s of Science degree in Mechanical Engineering with a concentration in Aerospace Engineering, which I plan on receiving in the fall of 2014 from the University of New Mexico. Soon after I complete my undergraduate coursework, I plan on attending graduate school to pursue my Master of Science in Mechanical Engineering.

I moved to the United States from Iran four years ago, where I was an honor student in Applied Mathematics and Physics. I have been studying here in New Mexico since I arrived and I am thankful for the opportunities to finish my education and work here.

In addition to my studies, I am currently working on research projects, such as satellite development, and laser-vibration experiments, with some of our Mechanical Engineering professors here at the University of New Mexico and in collaboration with the United States Air Force.

When I graduate I hope to work as a professional in an aerospace-related field that is beneficial to society. There are many recent developments and breakthroughs in our quest to understand and explore space beyond our own Earth, and I want to be in a contributing role in not only acquiring knowledge, but also helping to come up with new and useful products and innovative solutions that complement my strong desire to help people.

Upon completion of my B.S. degree, I would like to enroll in a M.E. graduate school program with a concentration in nanotechnology. As a professional in this area, my goal is to be able to come up with new and useful products and innovative solutions that would complement my strong desire to help people. Through my contribution in the field, I would like to prevent mechanical errors and make sure machines are safe for all users. My desire is to someday work for a company that cares about people’s ideas and needs. I want to help disadvantaged communities within the U.S. and around the world maximizing all resources available. I believe that building strong collaborations with global corporations that share the same humanitarian mission is critical for all of us, considering the limited resources and lack of funding many countries have. I want to continue being open-minded about different ideas and methods that would enable me to grapple technical problems from around the globe.

Scholarship

The 2011-2012 Spirit of Apollo scholarship from AIAA Houston Section is $1,000. Congratulations to our winner, Donya Ziraksari! Thanks to our Scholarship Chair Rafael Munoz.
Current Events

SpaceX Dragon capsule reaches The International Space Station (ISS) and splashes down for a successful recovery. For this first arrival at ISS, the cargo was not essential. This was a SpaceX milestone in the NASA Commercial Orbital Transportation Services (COTS) contract. Launch: May 22, 2012, on a SpaceX Falcon 9 rocket. Splashdown: May 31, 2012. Image credits: NASA.
Space Shuttle Replica Arrives at Space Center Houston from Florida

Images by Ellen Gillespie (two photographs below at Space Center Houston) and Douglas Yazell (at the Hilton Hotel on NASA Parkway, with fireworks going off as the space shuttle barge docks.) The space shuttle replica arrived by the Hilton Hotel on June 17, 2012.
“My name is John Llewellyn and I am a recovering person from flight control. […] “I went down and stayed down at the Cape because that was the only simulator that was working. The one up here, as usual, was "behi-i-i-nd schedule!" [Laughter] […] “Look, the good thing about it is I’m so glad to be here and we could talk about this stuff, I could run it off and tell you things, and I’d like to do it. Like I say, I’m recovering from it. I never got over it. It’s kind of like PTSD! [Laughter] […] “I am so lucky to be American and being able to work on Apollo Program. Because we did it. We took, in 1958, I think […] We took that thing and went to the Moon, and landed, and got the guy, and brought him back! And we did it in ten years! And we didn’t get any help from anybody. […] (Continued on page 37)
“So I am really proud of NASA, and I hope you do [sic]. And we do [sic] going to leave you a legacy, and I would appreciate it if you would do something with it! Thank you.”

Editor’s note:
I recalled a memorable mention of John Llewellyn in Sy Liebergot’s book about Apollo 13, so I was all ears when John Llewellyn spoke at this 2008 event. Those last two sentences seem to show a bit of an accent or a dialect, something I imagine stuck with him since his youth. There is a certain poetry to his way of speaking, so I do my best to report those last two sentences just as he said them.

The 40th anniversary of Apollo continues in 2012. Apollo 17 is next (launch date, December 7, 1972). The NASA commemorative medallions containing flown metal are a set of 13 medallions, all showing that Apollo 40th anniversary logo on one side. One shows the NASA logo on the other side. The others show the mission patches for the twelve human space flight Apollo missions, Apollo 1 and 7-17. Released for sale (very affordable) so far are the NASA logo and Apollo 11, 12, 13, 16 and 17 medallions. Apollo 15 will be the next to be available for purchase.

Above: From the left, Marianne Dyson (moderator), Dr. Albert A. Jackson IV (event organizer & former lunar module crew instructor), Hal Beck, Rod Rose, Marty Jenness, Ken Young, and John Llewellyn. Image credit: Douglas Yazell.

Above: Back row, from left: Marty Jenness, Dr. Christopher Kraft, John Llewellyn, Ken Young, Glynn Lunney, Emil Schiesser and Dr. Albert A. Jackson IV (event. From row from left: Hal Beck, Rod Rose, and Marianne Dyson (moderator). Image credit: Douglas Yazell.

Links from our French Sister Section for Staying Informed:

http://www.esa.int/esaEO/SEM097EH1TF_LPgmnes_0.html

‘ESA-Sentinels’ satellites web site: http://www.esa.int/esaLP/SEM097EH1TF_LPgmnes_0.html

http://smsc.cnes.fr/Fr/oceans.htm
http://smsc.cnes.fr/IASI/Fr/

‘Pleiades’ web site: http://www.cnes.fr/web/CNES-fr/3227-pleiades.php (Pleiade-1 is already flying)

Cryosat-2 web site: http://www.esa.int/esaLP/LPcryosat.html

SMOS web site: http://smsc.cnes.fr/SMOS/Fr/

AIAA Houston Section events & other events related to aeronautics & astronautics. This May / June 2012 issue of Horizons is scheduled to be online by June 30, 2012. All items are subject to change without notice.

AIAA Houston Section council meetings: for info, email secretary[at]aiaa-houston.org
Time: 5:30 - 6:30 PM usually
Day: First Monday of most months except for holidays.
Location: NASA/JSC Gilruth Center is often used. The room varies.
The new AIAA year starts July 1, 2012.

July 2012: Annual Honors and Awards dinner meeting. Postponed from June 2012 to July 2012 because of the June 6, 2012 dinner meeting celebrating the 50th anniversary of AIAA Houston Section, and to give us time to conduct our election on about Friday, June 8, 2012.
Date: TBD
Venue: TBD

August 2012: Annual leadership retreat.
Date: TBD, probably after the Regional Leadership Conference (below)

AIAA National & International Conferences

15 - 19 July 2012 San Diego, California
2nd International Conference on Environmental Systems

30 July - 1 August 2012 Atlanta, Georgia

2-3 August 2012: Regional Leadership Conference (RLC), Atlanta, Georgia
Venue: Hyatt Regency Atlanta

13 - 16 August 2012, Minneapolis, Minnesota
AIAA Guidance, Navigation and Control and Co-located Conferences

11 - 13 September 2012, Pasadena, California
AIAA Complex Aerospace Systems Exchange

12 - 13 September 2012, Pasadena, California
AIAA SPACE 2012 Conference & Exposition

17 - 19 September 2012, Indianapolis, Indiana
12th AIAA Aviation Technology, Integration, and Operations (ATIO) Conference and 14th AIAA/ISSMO Multidisciplinary Analysis and Optimization Conference

24 - 28 September 2012, Tours, France
18th AIAA/3AF International Space Planes and Hypersonic Systems and Technologies Conference

24 - 28 September 2012, Ft. Walton Beach, Florida
7th AIAA Biennial National Forum on Weapon System Effectiveness
In last month’s puzzle, the problem was posed of computing the location of a lightning strike given the times heard from the thunder in three different locations. Let’s assume your office is at the origin of the reference frame, Alex’s office is at (0,9900) and Benny’s office is at (13200,-5500), where distances are in feet.

The time between hearing the thunder over Benny’s phone line and hearing it outside was 7 seconds, i.e., the difference in distances is given by

\[ d_1 - d_B = 7 \times 1100 \text{ ft/s} \]

Likewise, the time between hearing the thunder outside and over the phone at Alex’s office was 3 seconds, i.e., the difference in distances is given by

\[ d_A - d_2 = 3 \times 1100 \text{ ft/s} \]

Note that the locus of points for which the absolute value of the differences of the distances to two fixed points is constant is called a hyperbola. Thus, the problem above reduces to finding the intersection of two hyperbolas. Setting \( d_1 = d_2 \), the distance from O to the point of the lightning strike \((x,y)\) we get two simultaneous equations that can be solved. After some math, we find the point \((13200,0)\) is a distance of 5500 ft from B, 13200 ft from O, and 16500 ft from A, so that the traversal time taken for sound travelling at 1100 ft/s is 5 sec, 12 sec, and 15 sec, respectively. In other words, when the lightning strike happened at 5 seconds before noon, Benny and the others heard it at 12:00, it was heard outside 7 seconds later, and then it was heard by Alex and the others 3 seconds later.

This month, you are doing an engineering design and realize the problem may have been solved years ago. You find yourself digging through some old engineering notes that a retired colleague had stored away in his garage, and in them is a handwritten page of calculations on just the problem you are solving. However, one of the long division problems has become so smeared, only one digit, a “7”, is legible. Can you fill in the missing values based only on the knowledge of the location of the remaining digits?

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Send solutions to steven.e.everett@boeing.com.
Section News

**Newsletter submissions**: Friday, August 10, 2012, for the July / August 2012 issue. That will be online and publicized by Friday, August 31, 2012.

**Student Paper Conference (SPC)**: AIAA Houston Section hosts this Region IV (a four-state region: Texas, Oklahoma, New Mexico, and Arkansas) every other year. This year it took place at NASA/JSC on Friday, April 6, 2012. Thanks to organizers Daniel Nobles, Irene Chan, and others, it was a great success.

**The new AIAA year**: The new year starts on July 1, 2012. Our updated 45-person council will take effect on that date. As shown on our organization chart, 20 of those are elected, and they are the voters when votes are required. Since our hands were full with the dinner meeting of June 6, 2012 (our AIAA Houston Section 50th anniversary event), our annual honors and awards dinner meeting will take place in July instead of June 2012. The ballot went out via e-mail a few days ago as of today, Wednesday, June 13, 2012.

**The new web site**: Starting July 1, 2012, Irene Chan is our new webmaster. It may take some time to fully populate the new web site, www.aiaahouston.org, which replaces www.aiaa-houston.org. Thanks very much to outgoing webmaster Gary Cowan and Curbside Multimedia! He updated our web site the past few years to give it a very colorful and modern look, after our use of phpwebhosting for a few years.

**The weekly astronomy lunch**: It’s amazing to think that for years, Dr. Albert A. Jackson IV (our section’s current astrodynamics technical committee Chair) hosted an informal astronomy lunch lecture almost every week for almost every year for years! The lecture speakers and topics were listed in Horizons. That tradition started in about 1975 at JSC with astronomer (and author) Thornton Page as host. The tradition continues today, though Al Jackson and others moved it to The Colosseum on El Camino Real just north of Bay Area Blvd, at 11:00 AM on Wednesdays. There are no more lectures, but the tradition is still there, and it is in Al’s genes! He still consults for NASA. Come join the group anytime. Contact douglas.yazell[at]jme.com if you have questions before attending.

**The 100 YSS (The 100 Year Starship Project)** is not an AIAA project. It started in late 2011 with a symposium in Orlando, Florida, organized mostly by DARPA (The Department of Defense Research Projects Agency), with some help from NASA/Ames. They held a competition to award $500,000 to a team that would organize this human space flight to another star system in the next 100 years without using any more government money. But the 2012 Public Symposium is coming to Houston! It will take place September 13-16, 2012 in Houston. See www.100yss.org. Former astronaut Mae Jemison is a member of the winning team, so we have a Houston connection.

**Correction for the March / April 2012 issue**: We published three photographs of Neil Armstrong on page 10 of that issue, but some captions were wrong. Dr. Ryan Kobrick tells us that Professor David Klaus took the second photo and Dr. Kobrick took the first. The third photo is from Dr. Kobrick’s camera, taken by Luis Zea.

**This issue of Horizons is Volume 37, Number 7**, as shown on the cover. Next issue, the July / August 2012 issue, will be Volume 38, Number 1. The AIAA year starts on July 1, 2012, for most purposes. This May / June 2012 issue will be online and publicized by June 30, 2012.

**We created a new logo** for our dinner meeting of June 6, 2012 (the 50th anniversary of AIAA Houston Section). We added a blue marble Earth to the traditional logo, and a few words such as “Houston Section” and “Since 1962.” Douglas Yazell, Alan Sisson, and Michael Frostad worked on that, and your inputs are welcome as we work on a new logo for AIAA Houston Section. Horizons art contributor Don Kulba might have advice for us, too. In place of a blue marble Earth, maybe an ISS silhouette or an Orion MPCV silhouette would work better.

**The Lunar and Planetary Institute (LPI)** Cosmic Explorations public lecture took place on Thursday, June 7, 2012, featuring Dr. Stephen Clifford of LPI, “Mars Discoveries and Insights from 50 Years of Robotic Exploration.” They sometimes post the video, so watch for that!
Section News

Executive Council
July 01, 2011 - June 30, 2012
www.aiaa-houston.org

Candidates for the annual election of June 12 - 25, 2012 (see the organization chart above):

Chair: Jonathan Sandys
Vice Chair Technical: Brian Banker & Dr. Satya Pilla
Vice Chair Operations: Michael Frostad & Michael Martin
Secretary: Robert Plunkett
Treasurer: Clay Stangle
Councilors:
1) Shirley Brandt
2) Dr. Larry Friesen
3) Sarah Shull
4) Christopher Davila
5) Alan Sisson

Above: The web site above used www.aiaa-houston.org and was provided by Gary Cowan / Curbside Multimedia. It will be replaced starting July 1, 2012, though it might take time to fully implement the new web site using www.aiaahouston.org.
AIAA Mission & Vision Statement

The shaping, dynamic force in aerospace - THE forum for innovation, excellence and global leadership. AIAA advances the state of aerospace science, engineering, and technological leadership. Core missions include communications and advocacy, products and programs, membership value, and market and workforce development.

The World's Forum for Aerospace Leadership

Become a member of AIAA

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

Left: Hinode Views the 2012 Venus Transit

On June 5, 2012, Hinode captured these stunning views of the transit of Venus -- the last instance of this rare phenomenon until 2117. Hinode is a joint JAXA/NASA mission to study the connections of the sun’s surface magnetism, primarily in and around sunspots. NASA's Marshall Space Flight Center in Huntsville, Ala., manages Hinode science operations and oversaw development of the scientific instrumentation provided for the mission by NASA, and industry. The Lockheed Martin Corp. in Palo Alto, Calif., is the lead U.S. investigator for the Solar Optical Telescope.

Image credit: JAXA/NASA/Lockheed Martin

Left: Path of the 2012 Venus Transit

On June 5-6 2012, NASA's Solar Dynamics Observatory, or SDO, collected images of one of the rarest predictable solar events: the transit of Venus across the face of the sun. This event happens in pairs eight years apart that are separated from each other by 105 or 121 years. The last transit was in 2004 and the next will not happen until 2117.

Image Credit: NASA/SDO, AIA