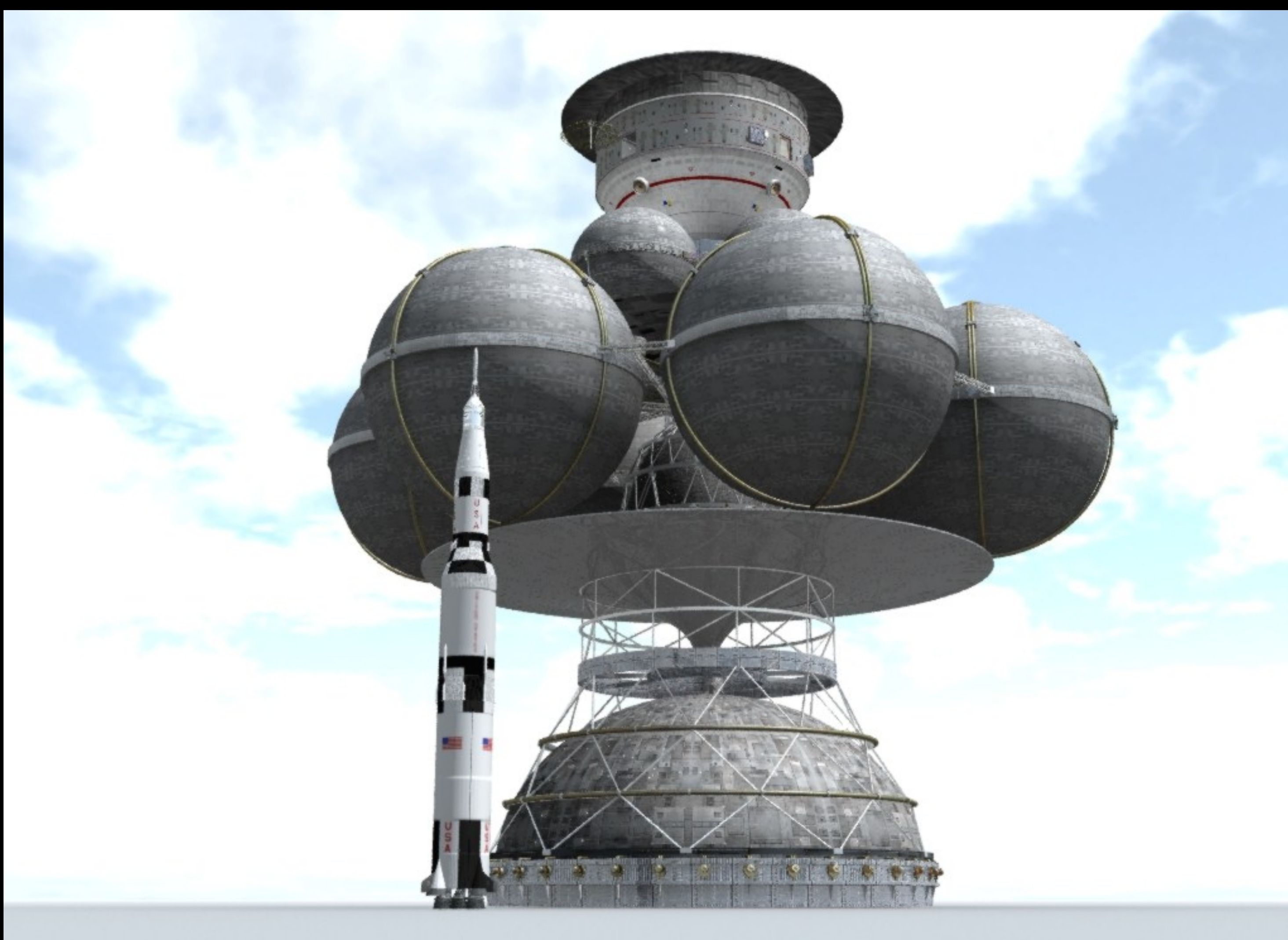
Horizons

Volume 37, Issue 3 AIAA Houston Section www.aiaa-houston.org November / December 2011

Project Icarus

Dr. Richard Obousy, Icarus Interstellar



AIAA HOUSTON
American Institute of Aeronautics and Astronautics

Horizons is a bimonthly publication of the Houston Section of the American Institute of Aeronautics and Astronautics.

Douglas Yazell
Editor
Past Editors: Dr. Steven E. Everett
Editing team: Don Kulba, Ellen Gillespie, Robert Beremand
Regular contributors: Dr. Steven Everett, Don Kulba, Philippe Mairet, Alan Simon, Shen Ge, Scott Lowther
Contributors this issue: Dr. Richard Obousy, Adrian Mann, Dr. Albert A. Jackson IV, Daniel Adamo, Tom Hile, Wes Kelly (Triton Systems, LLC)

November / December 2011

TABLE OF CONTENTS

(Page numbers are linked on this page. To return here, click on tops of pages.)

Horizons and AIAA Houston Web Site
AIAA National Communications Award Winner

2005 2006 2007

Cover (page 1): Daedalus next to Saturn V. Image credit: Adrian Mann, www.bisbos.com. Web site for Project Icarus: www.icarusinterstellar.org. Web site for the 100 Year Starship study from DARPA and NASA/Ames Research Center: www.100yss.org. Dr. Richard Obousy, Icarus Interstellar, gave a presentation at the 100 Year Starship Symposium on 9/30/11.

Early Warning Flyer for Our Section's Annual Technical Symposium

SEAN CARTER, CHAIR, ELLEN GILLESPIE & DR. SATYA PILLA

AIAA

American Institute of Aeronautics and Astronautics
HOUSTON SECTION • P.O. Box 57524 • Webster, Texas 77598
Web site: www.aiaa-houston.org

ATS Houston Section Annual Technical Symposium 2012

Schedule

08:00 – Registration $15 (all day)
08:15 – Keynote speaker
09:00 – Morning Sessions
12:00 – Luncheon
13:30 – Afternoon Sessions

Friday, May 18, 2012
NASA/JSC Gilruth Center

Topics

Space Exploration
Astrodynamics
Automation and Robotics
Communication and Tracking
EVA
GN&C
In-Space Imaging
Space Operations
Life Sciences and Human Factors
Propulsion and Power Systems
SR&QA
Systems Engineering
Space Commercialization
Structural Mechanics
Avionics
International Space Activities

Symposium Plans

- $15 Registration for everyone.
- Lunch buffet included in the registration cost
- Continental breakfast (including coffee) provided in the Alamo Ballroom during registration
- Advance registration is requested on the AIAA Houston Section web site.
- Submit abstracts for presentation.
- Only abstracts will be published (to streamline organization approval).
- Presentations will be limited to 30 minutes (computer projectors and vu-graph projectors available)
- One Windows laptop PC to be available in each room for presenters. Speakers have the option to use their own laptop.
- PowerPoint presentations to be viewable on our web site. Delivery of presentations expected at the registration desk.
- No Gilruth badging is required – ATS is open to the public. AIAA membership is not required.
- Invited speakers: one morning keynote speaker, one luncheon speaker (TBD)
- Please attend and/or present, including university professors, NASA/JSC personnel, and NASA/JSC contractors.

Contact the ATS General Chair for more information: Satya Pilla: vicechair-tech@aiaa-houston.org

Tentative Deadlines

Monday, April 30, 2012	– Abstracts due to planning committee (contact us sooner if possible)
Monday, May 7, 2012	– Abstract authors notified of abstract acceptance
Thursday, May 17, 2012	– Luncheon Reservations (pay at the door on Friday, May 18, 2012)
Friday, May 18, 2012	– Attendee and Speaker Registration Fee Payments (all day, starting at 8:00 AM)

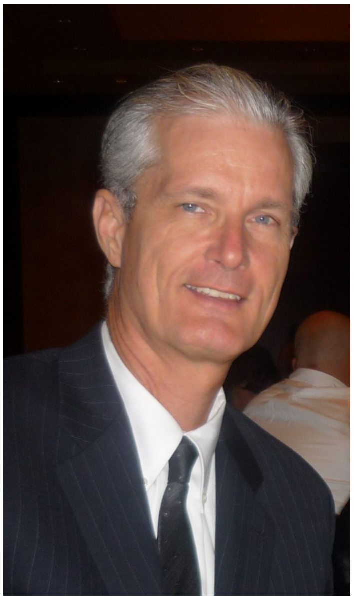
From the Chair

Above: Sean Carter in 2008 as General Chair of our Annual Technical Symposium at NASA/JSC. Image credit: Douglas Yazell

Sean Carter is generously donating the space for his column this month. Once he starts writing his Chair's column, we will have trouble limiting him to one page per issue!

www.aiaa-houston.org

From the Editor



E-mail:
editor-in-chief "at" aiaa-houston.org

Org chart:
www.aiaa-houston.org. This web site includes Horizons back issues to 2005 or earlier. For earlier issues, see the link on our history technical committee's web page.

Horizons 2011 and 2012

DOUGLAS YAZELL, EDITOR

AIAA Houston Section started in 1962, and our newsletter probably started in 1971. Jon Berndt was Editor from 2004 to 2007. He created the format we use today. He also led the transition to an online-only publication, ending our "snail mail" tradition, though Horizons' first online edition appeared earlier. By June of 2008, Horizons averaged 6,000 downloads per issue. Then for more than 2 years, we had no hit counter. Our current hit counter is for the newsletter web page, not showing hits per issue.

Dr. Steven E. Everett was Editor for 2 years ending June 30, 2010, then I took the reins on April 11, 2011. This issue is our 5th bimonthly publication of Horizons since that date:

1. Mar/ Apr 2011 (66 pgs.)
2. May / Jun 2011 (90 pgs.)
3. Jul / Aug 2011 (48 pgs.)
4. Sep / Oct 2011 (36 pgs.)
5. Nov / Dec 2011 (36 pgs.)

To add to the confusion, that 1st issue was called "May 2011", since it was published late on May 17, 2011, and the 2nd one was called "June 2011."

This low Horizons circulation for the last 3 years makes "snail mailing" our 800+ members look good, but we are not tempted to return to that successful but old technology.

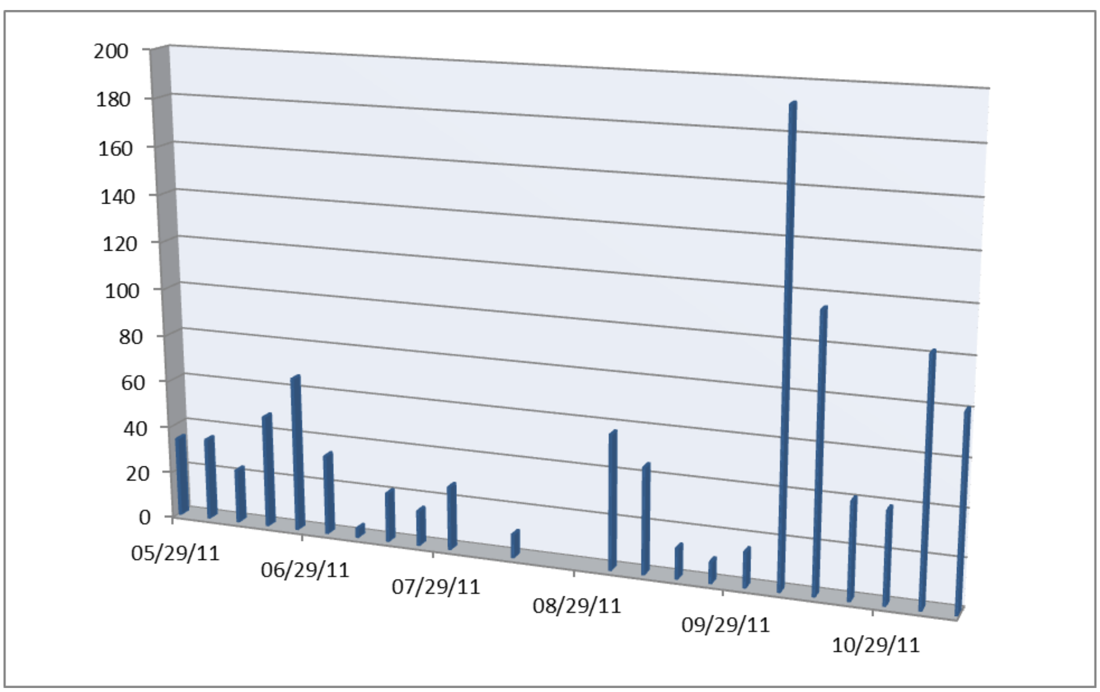
One publicity tool for each issue of Horizons is NASA's "JSC Today" daily e-mail note containing event announcements from civil servants and contractors. It goes to 3,000 or so civil servants and quite a few contractors. At the end of each of those notes, a URL is provided for the JSC Today archive.

Horizons e-mail publicity also goes to our 800+ members for each issue, though we probably dropped that ball now and then in the last 3 years. We also e-mail a publicity list of non-members who are interested in our events. That list probably includes company contacts.

Five or 10 years ago, our Communications Chair Steve King set up those procedures for publicity for Horizons and our section events, etc. He was followed by Gabe Garrett, then Matthew Easterly. Matthew is kindly filling in for that role now, but he announced his departure a few months ago. We are seeking a replacement for that and other positions on our org chart, which is visible on page 31 and on our web site.

Until next issue, Happy Landings!

Right: Our only hit counter data since 2008. The data starts on May 29, 2011. Image credit: Douglas Yazell



Our Horizons archive is https://info.aiaa.org/Regions/SC/Houston/Newsletters/Forms/AllItems.aspx. The February 1978 issue is the earliest issue there for now. The February 1987 issue was still called "Newsletter", and the September 1990 issue is named Horizons. Our archive is not yet complete. We don't know which issue was the first to be called Horizons. Thanks again to Dr. Larry Friesen for loaning us his copies, which go back to 1978.

Project Icarus

Icarus Interstellar

DR. ALBERT A. JACKSON IV, CHAIR, AIAA HOUSTON SECTION ASTRODYNAMICS TECHNICAL COMMITTEE

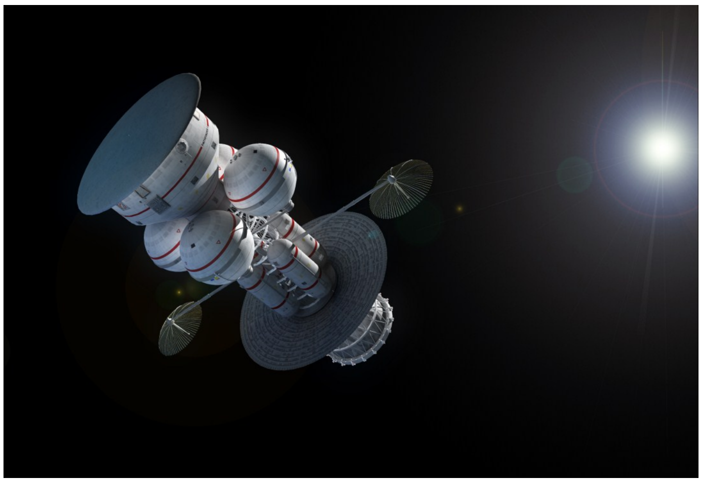
Konstantin Tsiolkovsky, Hermann Oberth and Robert Goddard (and others) laid the early technical groundwork for spaceflight, but, as far as I know, the first end-to-end integrated space mission design was carried out by the British Interplanetary Society (BIS) 1936 – 1939. This was a group effort bringing together many disciplines from propulsion to life support. After WWII the BIS completed this work, all the work documented in the Journal of the BIS. (There was an even further updated version published as a book, The Exploration of the Moon, by Arthur C. Clarke and R.A. Smith in 1954.)

The history of spaceflight starts with an idea, first travel off the Earth. Advances in the physical sciences inspired Verne and Wells to envision stories about travel to the Moon. This led to more speculations in fiction throughout the early 20th century. Increasingly sophisticated writers, some of whom were physical scientists and engineers, wrote about interplanetary flight in the literature we now call science fiction prose.

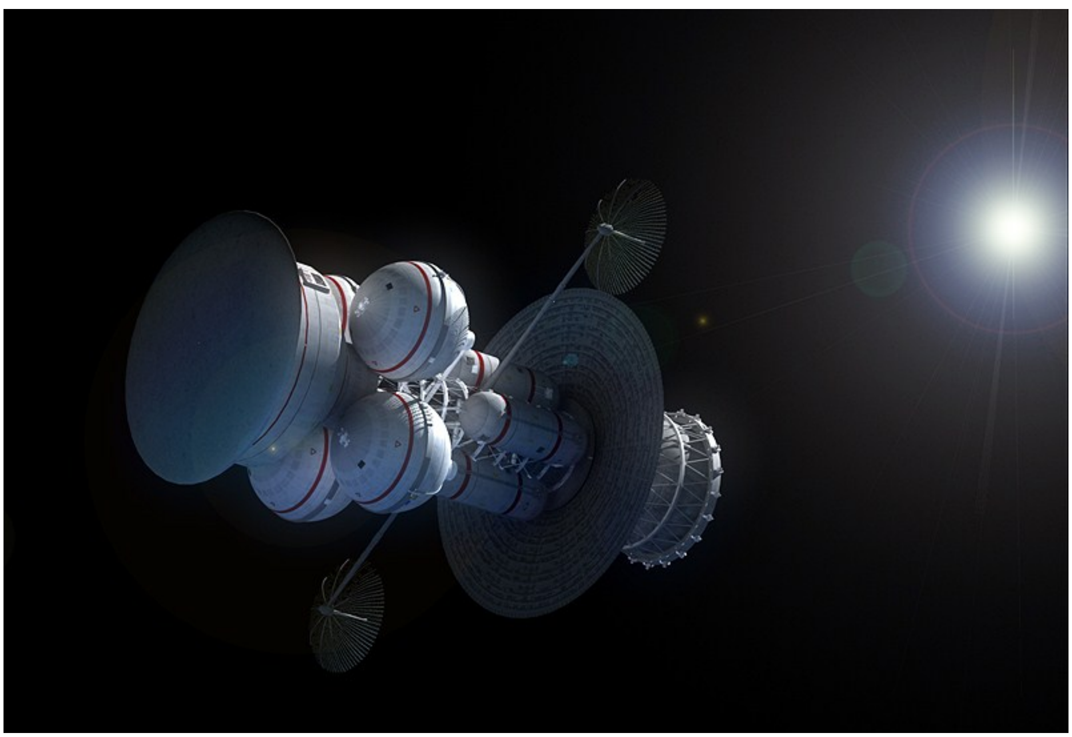
An increasing accumulation of facts from spaceflight pioneers, in the areas of propulsion and trajectories, finally became the tipping point of a synthesis. The BIS Moon mission and the Von Braun Das Marsprojekt are examples of a team of technical people assembling all the parts to execute a real mis-

(Continued on page 6)

AIAA Houston Section astrodynamics technical committee web page: http://www.aiaa-houston.org/Astrodynamics.aspx



Left: Pathfinder Probe (Interstellar Precursor Mission to 1,000 AU - Icarus Interstellar Concept Craft), containing 4 large propellant tanks. Image credit: Adrian Mann.



Left: Starfinder Probe (Interstellar Precursor Mission to 10,000 AU - Icarus Interstellar Concept Craft), containing 5 large propellant tanks. Image credit: Adrian Mann.

Web sites:

Artist Adrian Mann: www.bisbos.com

Project Icarus: www.icarusinterstellar.org

100 Year Starship Study: www.100yss.org

Icarus Interstellar

Above: Dr. Richard Obousy, Senior Designer and President, Project Icarus Research Group. Image credit: Project Icarus.

(Continued from page 5)

sion. The details get complicated; not only propulsion, vehicle structures and trajectory analysis, but also components such as life support and many logistic aspects must be considered.

By the early 1970's several real solar system spaceflight projects, unmanned and manned, had been brought to fruition. During the 1950's and 1960's there was a slow rise of interest in the technical aspects of interstellar flight. It is difficult to express how different interstellar travel is from interplanetary travel. The consequences of the basic mastery of the energies involved are daunting. A feasibility study became a compelling idea.

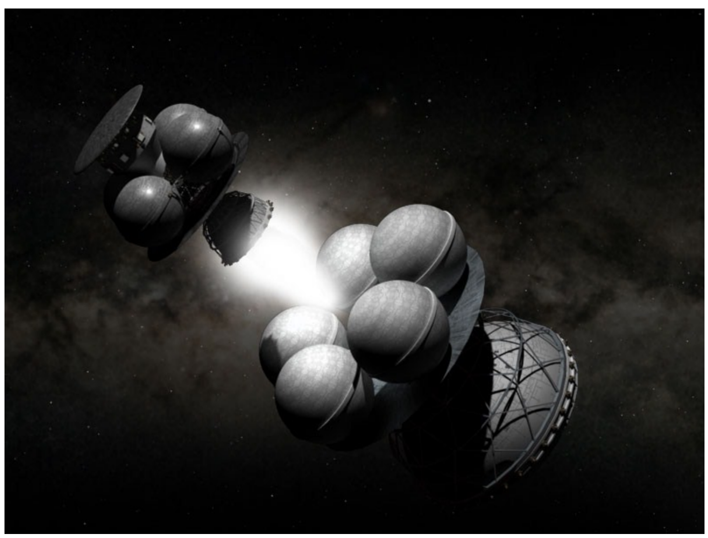
In 1973 the British Interplanetary Society felt a tipping point had been reached and started the Daedalus project, an interstellar travel design project. A comprehensive report was published in 1978: Bond, A., Martin, A. R., Buckland, R. A., Grant, T. J., Lawton, A. T., et al., "Project Daedalus," Journal of the British Interplanetary Society, 31 (Supplement, 1978).

The study covers the areas of propulsion, fuel, experiments, data management, power supply, structure, protection, and on-board repairs, with each of these broken down into subcategories.

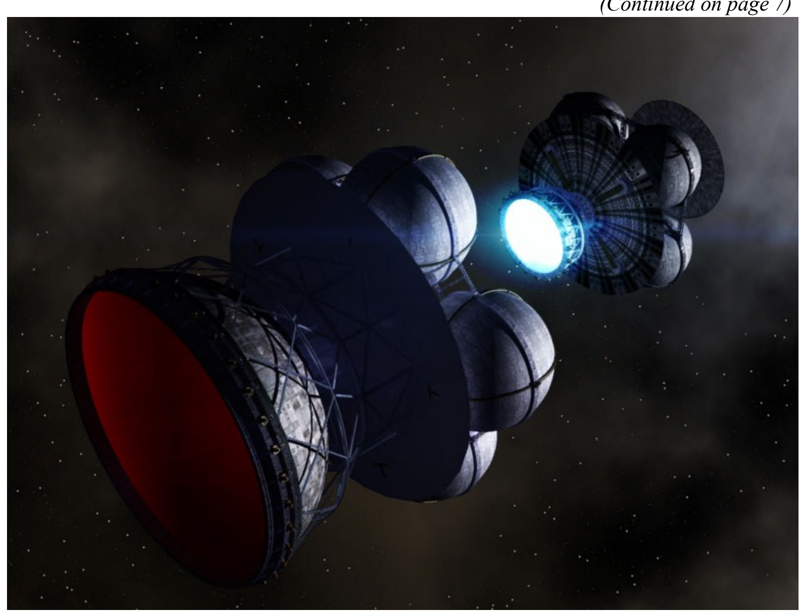
After a little over 30 years it was decided to revisit Project Daedalus. The main purpose was to motivate a new generation of scientists in designing space missions that can explore beyond our solar system. All the mission components needed updating after a 30 year interval. The original destination was Bernard's star (thought at the time to have a planet, since found to be invalid). Now that the Kepler observatory exists, thousands of extra solar planets have been found and the prospect of finding a terrestrial planet will only improve in time.

In 2009 a new study and organization called Icarus was launched by Mr. Kelvin Long and Dr. Andreas Tziolas and

(Continued on page 7)



Right: Daedalus staging (1). Image credit: Adrian Mann.



Right: Daedalus staging (2). Image credit: Adrian Mann.

Web sites:

Artist Adrian Mann: www.bisbos.com

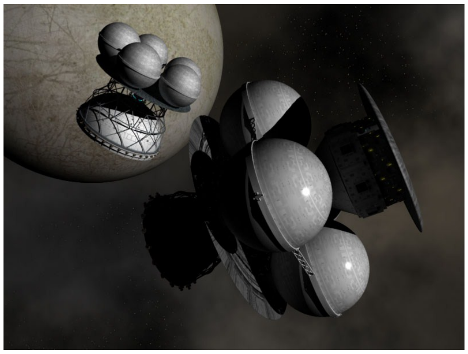
Project Icarus: www.icarusinterstellar.org

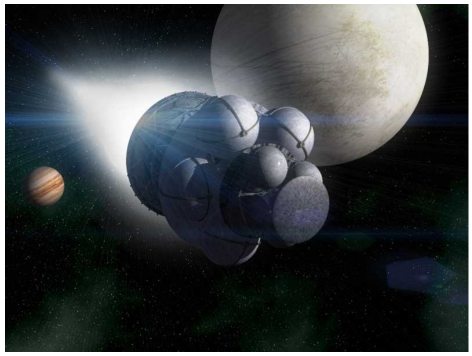
Project Icarus on Wikipedia: http://en.wikipedia.org/wiki/Project_Daedalus

(Continued from page 6)
Dr. Richard Obousy to revisit Daedalus.

An overview of the project was given by Dr. Obousy at the AIAA Houston Section Lunch and Learn on November 14th, 2011.

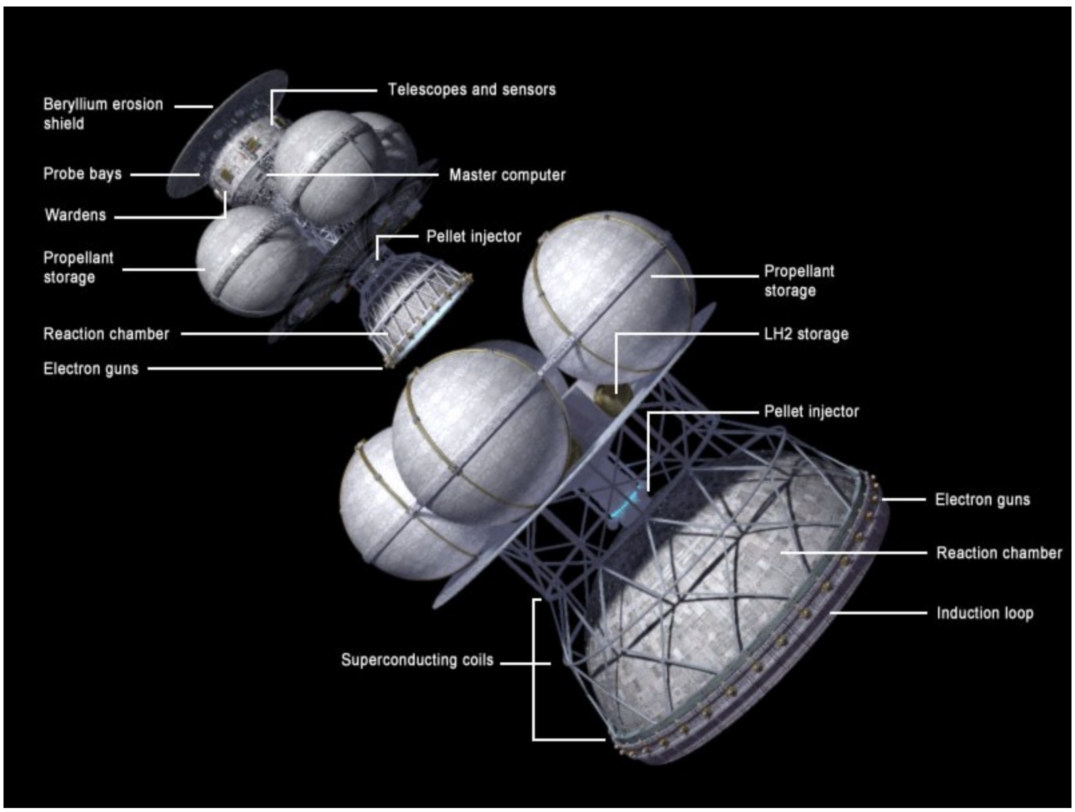
Icarus Interstellar





Far left: Daedalus under construction. Image credit: Adrian Mann.

Left: Daedalus departure. Image credit: Adrian Mann.



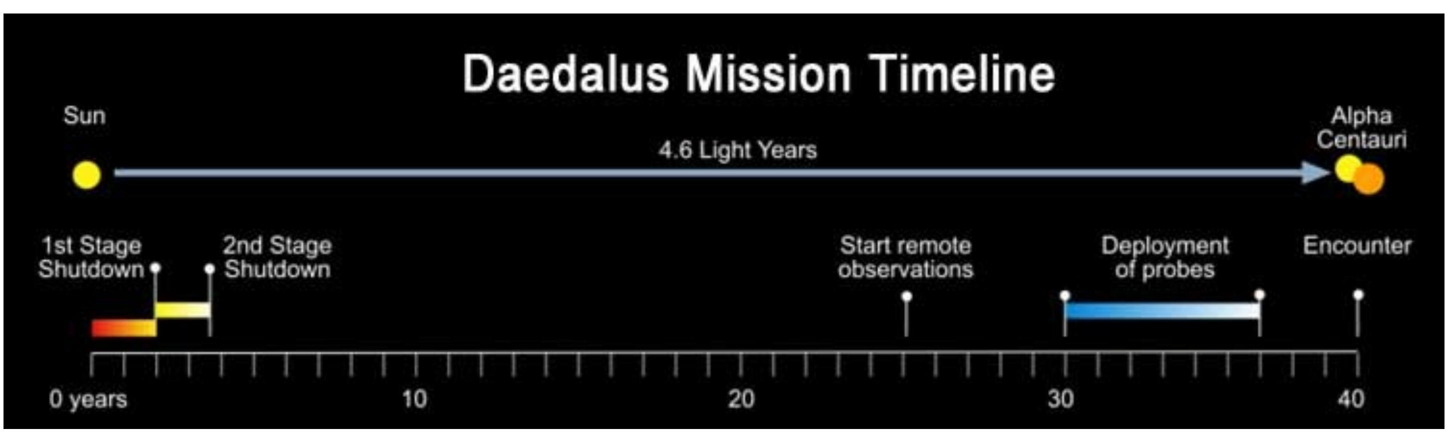
Left: Daedalus general arrangement. Image credit: Adrian Mann.

Web sites:

Artist Adrian Mann: www.bisbos.com

Project Icarus: www.icarusinterstellar.org

Below: Daedalus mission timeline. Image credit: Adrian Mann.



AAS in Houston

The American Astronautical Society (AAS) National Conference Celebrating Achievements Celebrating the Future

DOUGLAS YAZELL, EDITOR

The American Astronautical Society (AAS)
www.astronautical.org

See page 36 (the back cover) for photos and captions related to day 1 of this conference. Photos on this page and the next page are from day 2.

AAS Executive Assistant Diane Thompson and others at the reception desk provided a warm welcome, ensuring a good start for attendees at this 2-day national conference, November 15-16, 2011, at NASA/JSC Gilruth Center.

AAS Executive Director Jim Kirkpatrick explained that charts from this conference will be on the AAS web site about a week after the conference.

Day 1 started with remarks from AAS President Frank Slater, a keynote address by Brewster Shaw, and a panel moderated by John Shannon (Space Shuttle Program: 30 Years of Accomplishments). After lunch, Tara Ruttley presented an update about ISS Utilization, followed by two panel discussions, the first moderated by Kathy Nado (Then and Now: COTS / CRS Update), and the second moderated by Daniel McCleese (Robotic Exploration of the Solar System).

Day 2 started with a presentation by Lauri Hansen, NASA/JSC Chief of Staff and continued with a panel discussion moderated by Jeff Davis (Risks for Long Duration Human Spaceflight after Four

(Continued on page 9)

Right: Lauri Hansen, Chief of Staff, NASA/JSC, "NASA JSC Update" presentation. Image credit: D. Yazell

Right: From left to right: Joe Parrish (Panel Moderator, Cross-Cutting Technology Challenges that Must be Faced), John Saiz, Walt Faulconer, and George Nelson. Image credit: D. Yazell

Above: From left to right: Jeff Davis (Panel Moderator, Risks for Long Duration Spaceflight after Four Decades of Experience and Research), Terry Tadeo, Kathryn Keeton, Eddie Semones, Clarence Sams, Mark Ott, Torin McCoy, and Michele Perconok. Image credits: D. Yazell

(Continued from page 8)
Decades of Experience and Research). After lunch, guest speaker Jeff Hanley's presentation was followed by two panel discussions. Mr. Hanley is NASA/JSC Director of Human Exploration Development Support. The first panel was moderated by Patrick McKenzie (Deep Space Human Exploration), and the second was moderated by Steven Gonzalez (JSC Forging New Partnerships after the Shuttle Era and How Information will be Shared with New Commercial Space Companies).

The Honors & Awards Banquet took place at the nearby Hilton hotel. The banquet speaker was former NASA Administrator Michael Griffin. He spoke from rough notes without charts, and no video recording was made, but some attendees recorded the audio from both days of this excellent conference.

AAS in Houston

Left: Jeff Hanley, Director, Human Exploration Development Support, NASA/JSC. Image credit: D. Yazell

The Horizons team recorded audio using an iPad from all events of both days. Mr. Griffin's speech will be available in PDF format on an AAS or AIAA web site soon.

Left: From left to right: Patrick McKenzie (Panel Moderator, Deep Space Human Exploration), Larry Price, Alvin Drew, and Mike Gernhardt. Image credit: D. Yazell

Left: From left to right: Steven Gonzalez, (Panel Moderator, JSC Forging New Partnerships [...] with Commercial Space Companies), Linda Ham, John Curry, Walter Ulrich, & Philip Varghese. Image credits: D. Yazell

Left: Two snapshots from the AAS Honors and Awards Banquet.

Far left: Emme award winner Gloria Skurzynski with banquet speaker Michael Griffin.

Near left: Mr. and Mrs. Robert F. Thompson with Mr. Thompson's award. Image credits: D. Yazell

Astrodynamics

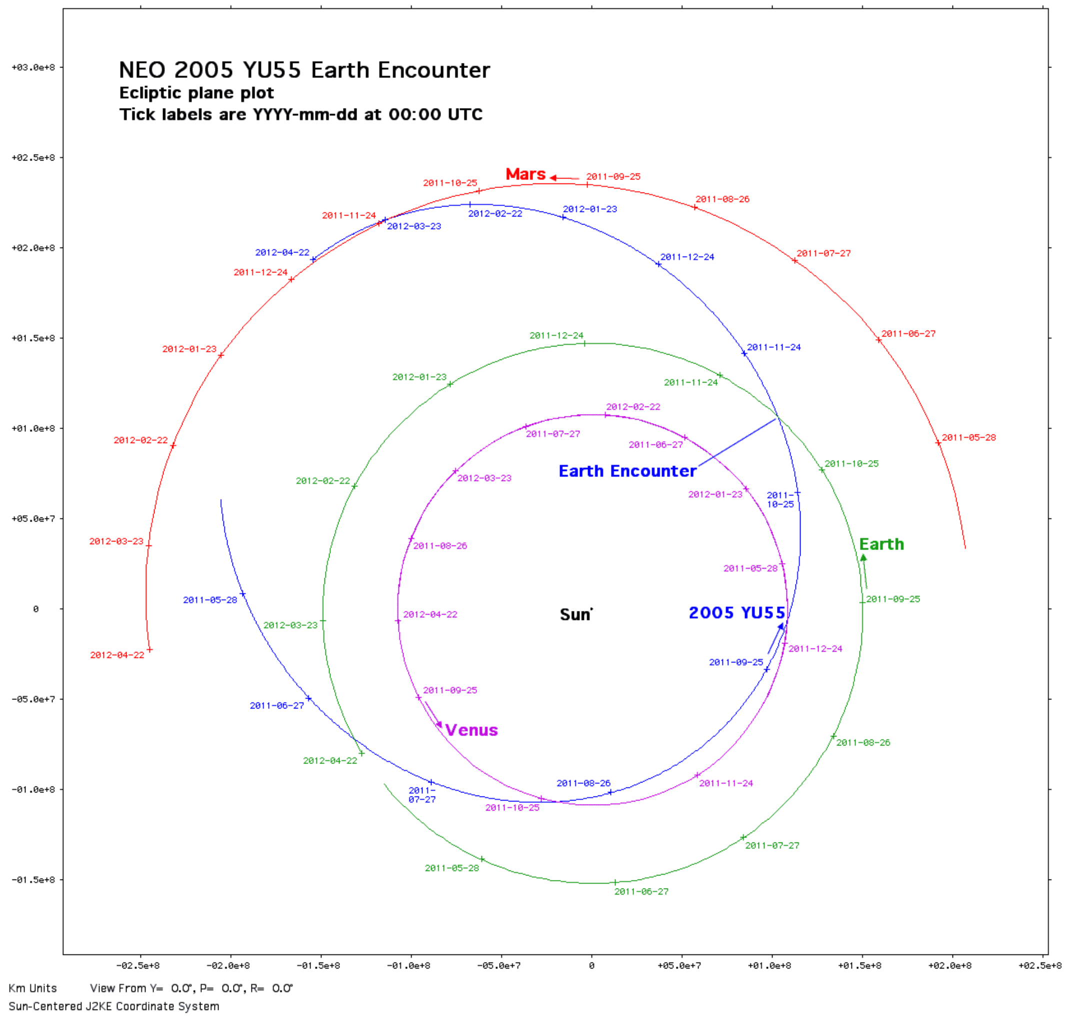
Near-Earth Object (NEO) 2005 YU$_{55}$: A Natural Interplanetary Cycler

DANIEL R. ADAMO, ASTRODYNAMICIST

With an Earth minimum orbit intersection distance (MOID) of 155,523 km and diameter near 400 m, near-Earth object (NEO) 2005 YU$_{55}$ is classified as a potentially hazardous object (PHO). Figure 1 illustrates heliocentric geometry associated with a close encounter between Earth and 2005 YU$_{55}$ during November 2011.

Since 2005 YU$_{55}$ has an ecliptic inclination between 0.3° and 0.5° throughout the 21st century, potential encounters with Venus, Earth, and Mars are evident in Figure 1. Indeed, such an encounter with Mars occurred most recently on 14.6 July 2002 UTC at a distance of 5,940,400 km. Potential mid-April Earth encounters, with 2005 YU$_{55}$ inbound towards its perihelion, are also evident in Figure 1. On 19.5 April 2010 UTC, the latest of these encounters occurred at a perigee distance of 2,273,000 km. Multiple radar observations of 2005 YU$_{55}$ were obtained during this encounter, resulting in a highly ac-

Right: Figure 1. Heliocentric inertial motion of Venus, Earth, Mars, and 2005 YU$_{55}$ in the ecliptic plane from May 2011 to May 2012. Image credit: Daniel R. Adamo.

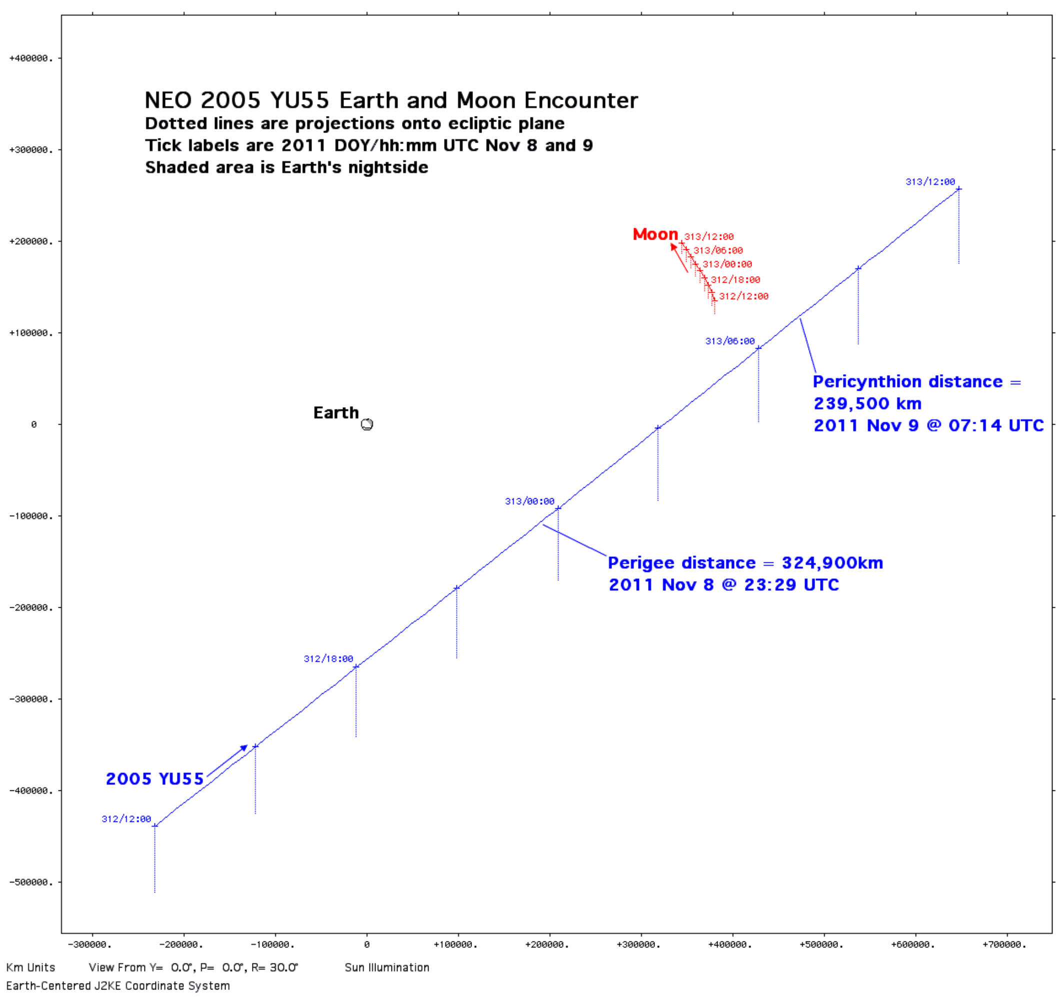


Astrodynamics

(Continued from page 10)
curate orbit solution. With this solution, it was possible to reacquire 2005 YU55 with the Goldstone Solar System Radar in California on 4 November 2011. Because November Earth encounters occur with 2005 YU55 travelling outbound from its perihelion, this NEO appears in terrestrial skies only during daytime hours before perigee occurs. Optical observations are therefore not possible until after perigee during a November encounter by 2005 YU55. Figure 2's geocentric trajectory plot reflects minor refinements (~1 s in timing; ~100 km in perigee) from 4 November 2011 Goldstone observations.

The 9.0 November 2011 UTC Earth encounter by 2005 YU55 is yet another example of an interplanetary "Red Baron" scenario. In this case, however, "Snoopy" has radar to maintain situational awareness even at low solar elongations.

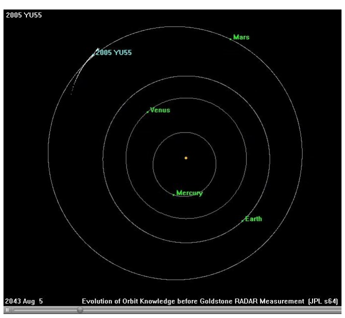
With a heliocentric semi-major axis a = 1.157 AU immediately after its November 2011 Earth encounter, 2005 YU55's orbit is classified as an Apollo. Consequently, 2005 YU55 completes a bit more than 4 heliocentric orbits as Earth completes 5 of them (this exact "4 : 5" resonance occurs when a = 1.1604 AU). After November 2011, 2005 YU55 has several encounters with Venus closer than 15 million km (0.1 AU): 13 million km on 20 Octo-



Left: Figure 2. Geocentric inertial motion of the Moon and 2005 YU55 viewed 30° from normal to the ecliptic plane during the 24 hours centered near 2005 YU55 perigee. Image credit: Daniel R. Adamo.

Astrodynamics

Below: Screen capture from the first of the two movies cited in the last paragraph of this article. Image credit: NASA.



ber 2027, 340 thousand km on 19 January 2029, and 8.5 million km on 1 June 2030. Perturbations from the 2029 Venus encounter increase *a* to 1.166 AU, thereby reversing 2005 YU_{55} deviations from the exact 4 : 5 resonance with Earth that had accumulated since 2011. As a result, the next 2005 YU_{55} Earth encounter closer than 15 million km after November 2011 falls near 12 November 2041. By that time, 3-sigma prediction uncertainty in perigee time has increased to over ±15 hours and perigee could occur from 14.8 to 17.1 million km within this uncertainty. The chief cause of uncertainty in this context is the 2029 Venus encounter, but additional future observations (some possibly conducted far from Earth) should keep prediction uncertainty in check before a Red Baron scenario can develop in some later November. No future Mars encounter closer than 15 million km is predicted for 2005 YU_{55} prior to 2080.

Interplanetary transportation architectures called "cyclers" have been proposed using orbits similar to 2005 YU_{55}'s. Their advantage is large masses, such as interplanetary human habitat and supporting infrastructure, can be left in interplanetary space without need to repeatedly accelerate them into and out of planetary gravity wells. But, as 2005 YU_{55} demonstrates in the 21st century, close planetary encounters do not occur naturally with any operationally sufficient frequency. Cyclers must therefore be accelerated by propulsion at strategic intervals to achieve frequent close encounters. At heliocentric eccentricity near 0.43 throughout the 21st century, 2005 YU_{55}'s orbit is not optimal for access from Venus, Earth, or Mars even though its period is conveniently near Earth's and its heliocentric apses lie near the orbits of Venus and Mars. It remains to be conclusively demonstrated whether or not cycler propulsive overhead exceeds that of simply parking an interplanetary transport for reuse near Earth and the destination.

All data relating to 2005 YU_{55} appearing in the foregoing narrative was obtained from the Jet Propulsion Laboratory's *Horizons* online solar system ephemeris computation service via URL http://ssd.jpl.nasa.gov/?horizons. The Jet Propulsion Laboratory has posted two time-lapse movies illustrating evolution of predicted 2005 YU_{55} heliocentric position uncertainty over the next 100 years. The first is at (see #1 below) and reflects uncertainties to roughly 3-sigma confidence without the 4 November 2011 Goldstone observations. Uncertainty in this movie rapidly increases after a close Venus encounter on 19.9 January 2029 UTC. The second movie at (see #2 below) portrays uncertainties with the 4 November Goldstone observations included. This additional knowledge postpones a rapid uncertainty increase until after the close Earth encounter circa 9 November 2075.

Movie links from the last paragraph:
1) http://ssd.jpl.nasa.gov/x/jdg/2005yu55/DAY_0_TRAJ_PRE-GOLDSTONE_s64_2005yu55_movie.mov
2) http://ssd.jpl.nasa.gov/x/jdg/2005yu55/DAY_1_TRAJ_GOLDSTONE_s72_2005yu55_movie.mov

1940 Air Terminal Museum at Hobby Airport

Museum

An AIAA Historic Aerospace Site

DOUGLAS YAZELL, EDITOR

This issue of Horizons is scheduled to be online and publicized on or before Wed., Dec. 7, 2011. Below is some Wings & Wheels news from the museum's web site about an upcoming event.

Wings & Wheels Dec. 2011

Houston Spotters & Museum Volunteer Appreciation Day"

Date: Sat., Dec. 17, 2011

HoustonSpotters.Net is a website dedicated to plane spotting in Houston.

Houston Spotters day is all about plane spotting and photography. Ramp tours of Hobby will be arranged, and groups of people will be taken around the field to spot planes and take photos.

This day is also a tribute to our invaluable volunteers who make museum events such as Wings & Wheels possible!

Wings & Wheels is a lunch-hour centered public event on the third Saturday of every month from about 11:00 AM to 3:00 PM. A recent innovation is the deluxe hot dog truck, so the maximum event ticket price is now $7 instead of $10 per person.

Until next issue, Happy Landings!

Above: The museum in August of 2010. Image credit: Douglas Yazell

Left: The flag of the state of Maryland, the only state flag using British heraldry. Image credit: Public domain.

A bimonthly column about the museum.

Left: Southwest Airline's Maryland One jet aircraft from the July 2011 Wings & Wheels event. It is not shown here, but the Southwest jet Lonestar One displays the flag of the state of Texas. Image credit: Tom Hile

1940 Air Terminal Museum

8325 Travelair Street
Houston, Texas 77061

(713) 454-1940 - Phone

www.1940airterminal.org

ISAC China

The English translation appears on the next page.

AIAA Houston Section's Chinese sister section relationships started in 1987 with the Shanghai Astronautical Society (SAS). The current Houston contact person is Marlo Graves. Her e-mail address is: marlograves[at]gmail.com. Marlo visited Shanghai and Beijing on our behalf 2 or 3 years ago, initiating new sister section activities in Beijing. Our Beijing contact person: Franklin Zhang.

See our web page at www.aiaa-houston.org. Click on technical committees, International Space Activities Committee (ISAC). The ISAC is chaired by Ludmila Dmitriev-Odier.

“胜利之吻”——中国航天技术的新突破

SHEN GE, CONTRIBUTOR

从 1966 年 3 月 16 日，美国“双子星”8 号飞船与“阿金纳”目标飞行器完成世界上首次载人手动交会对接，到 1967 年 10 月 30 日，苏联“宇宙”188 号飞船与“宇宙”186 号飞船进行世界上首次无人自动交会对接；从 1986 年和平号空间站核心舱发射升空，到 1998 年国际空间站开始建造；迄今为止，全世界共进行航天器交会对接活动 300 余次，其中发生故障 17 次，故障率超过 8%，因此交会对接也被称为航天安全“鬼门关”。

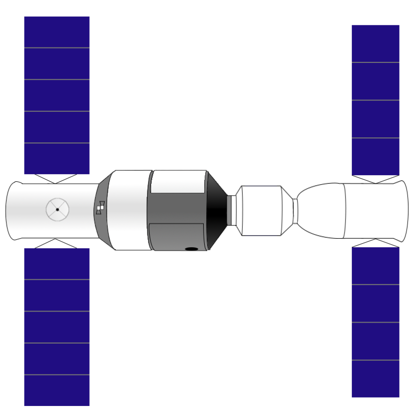
中国载人航天工程总设计师周建平说：“打个比方，这就像一场太空中举行的接力赛，所不同的是，跑道设在了距地面 343 公里的太空，前面的选手拿着一根绣花针，后面的选手要把一根丝线从针眼里穿过去，而且两位选手都要保持高速飞行。”

在离地面 343 公里的太空轨道上，中国“神舟八号”飞船和今年 9 月 29 日发射的“天宫一号”飞船绕地球一圈只需要 90 分钟，也就是说每 45 分钟就会经历一次昼夜更替。由于导引设备需要自身光源引导，因此，黑暗环境下更利于精确实施交会对接。此次天宫和神舟对接时，就是船上的黑夜状态。

“天宫一号”的实验舱内，搭载着一个特殊包裹，里面装有 300 面国际宇航联合会会旗。这些旗子是前不久由中国载人航天工程代表团从法国带回来的。今年 6 月，中国载人航天工程代表团应邀出席巴黎航展。航天员翟志刚作为中方代表接受国际宇航联合会移交的会旗。双方约定，将由“天宫一号”搭载这些会旗飞向太空，并于明年由中国执行载人交会对接任务的航天员带回地面。

今年 11 月 2 日在 1729GMT 的“胜利之吻”与 11 月 14 日的二次交会对接，不仅为中国迈出一大步，也促使整个世界取得同等发展。2016 年前，中国将研制并发射两个空间实验室，突破和掌握航天员中期驻留等空间站关键技术，开展一定规模的空间应用。当前“天宫一号”上的 300 面会旗曾搭乘俄罗斯联盟飞船送抵国际空间站，再由美国“奋进号”航天飞机带回地球。很显然，随着中国肩上的担子变得越来越重，中国与世界的交流合作将会不断取得诸多实质性进展。在新的太空时代里，这是件很受欢迎的发展。

Right: Drawing of Shenzou 8 docked to Tiangong 1. Image credit: Craigboy & Wikipedia, public domain, based on this image: http://i020.radikal.ru/1109/da/c1c14b396e92.jpg



“A Successful Kiss”, New Breakthroughs in Chinese Space

ISAC China

SHEN GE, CONTRIBUTOR

On March 16, 1966, Gemini 8’s successful docking with the Agena Target Vehicle (ATV) completed the world’s first human-controlled space rendezvous and docking. The next year, on October 30, 1967, the Soviet spacecrafts Kosmos 186 and Kosmos 188 made the first fully automated space docking in the history of space exploration. From the launch of Mir in 1986 and the launch of the International Space Station (ISS) in 1998, the world has conducted over 300 rendezvous and docking with a failure rate of 8%, i.e. in 17 of the cases, which indicates the reason for calling it the “Devil’s Gate.”

Chinese manned spaceflight lead engineer Jianping Zhou says: “To give an example, imagine a relay race in space except that the difference is that the track is the 343 km of space and the runner ahead is holding a thin sewing needle while the runner behind must take the thread and put it through the needle’s head. All of this happens while both runners maintain a high velocity.”

From an orbital altitude of 343 km, the Chinese Shenzhou 8 and the Tiangong 1, launched earlier this year on September 29, require 90 minutes to complete one orbit. In other words, every 45 minutes gives an opportunity to dock. Since the guidance setup requires its own light, a dark environment for docking is a more realistic docking environment. This was the setup for the two to dock.

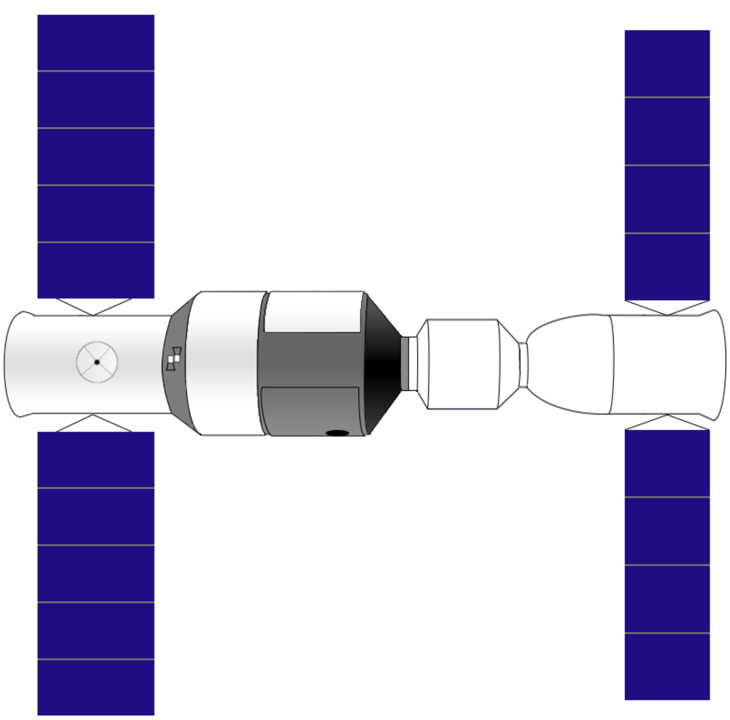
Within the cabin of Tiangong 1 is a special bag that contains flags from 300 countries. These flags were brought from the International Astronautical Federation (IAF) conference in Paris where Shenzhou 7 taikonaut Zhai Zhigang represented the Chinese and accepted the flags.

A successful “kiss” in space on Wednesday, November 2, 2011, at 17:29 GMT (Wednesday, 1:29 PM EDT, and 1:29 AM local time Thursday in China), and a following second successful docking on November 14, 2011, were leaps forward for China and leaps forward for the world. Before 2016, China expects to manufacture and launch two more space labs to maintain and further enlarge the human presence in space. The 300 flags that are currently on Tiangong 1 once flew on a Soyuz to the ISS and flew back to the Earth on a space shuttle. Clearly, while the burden on China’s space program grows heavier, the collaboration between China and the world will continue to grow tighter. This is a welcome development in this new space era.

The Chinese translation appears on the previous page.

AIAA Houston Section’s Chinese sister section relationships started in 1987 with the Shanghai Astronautical Society (SAS). The current Houston contact person is Marlo Graves. Her e-mail address is: marlograves[at]gmail.com. Marlo visited Shanghai and Beijing on our behalf 2 or 3 years ago, initiating new sister section activities in Beijing. Our Beijing contact person: Franklin Zhang.

See our web page at www.aiaa-houston.org. Click on technical committees, International Space Activities Committee (ISAC). The ISAC is chaired by Ludmila Dmitriev-Odier.



Left: Drawing of Shenzou 8 docked to Tiangong 1. Image credit: Craigboy & Wikipedia, public domain, based on this image: http://i020.radikal.ru/1109/da/c1c14b396e92.jpg

ISAC & 3AF MP

Right: "The Kepler instrument is a specially designed 0.95-meter diameter telescope called a photometer or light meter. It has a very large field of view for an astronomical telescope — 105 square degrees, which is comparable to the area of your hand held at arm's length. It needs that large a field in order to observe the necessary large number of stars. It stares at the same star field for the entire mission and continuously and simultaneously monitors the brightnesses of more than 100,000 stars for the life of the mission—3.5 or more years. The photometer must be space based to obtain the photometric precision needed to reliably see an Earth-like transit and to avoid interruptions caused by day-night cycles, seasonal cycles and atmospheric perturbations... Image & text credit: NASA

Planet "Kepler-16b orbits around both stars every 229 days, similar to Venus' 225-day orbit, but lies outside the system's habitable zone, where liquid water could exist on the surface, because the stars are cooler than our sun." Text credit: NASA

3AF MP: l'Association Aeronautique et Astronautique de France, Midi-Pyrenees chapter, www.3af-mp.fr. Our French sister section is 3AF MP. See our web page at www.aiaa-houston.org. Click on technical committees, International Space Activities Committee (ISAC). The ISAC is chaired by Ludmila Dmitriev-Odier. An update to the 3AF MP organization chart is on page 27 of our last issue.

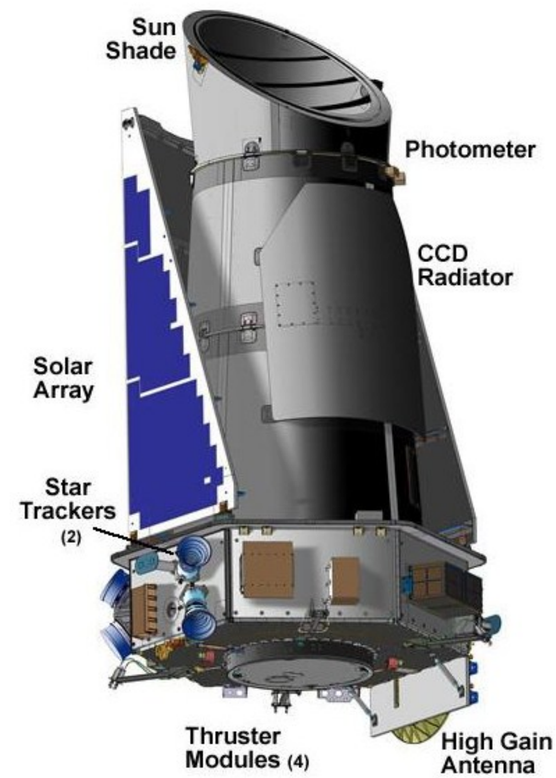
Lucas, Kepler and Tatooine

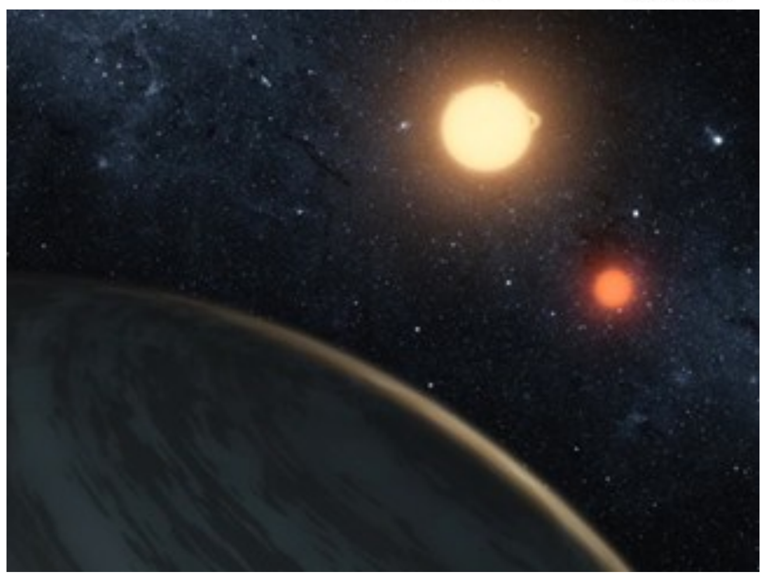
PHILIPPE MAIRET, 3AF MP

Kepler, the NASA Space Telescope, launched March 7, 2009, demonstrated the existence of a planet orbiting two suns. However, a dream of Star Wars filmmaker George Lucas (Tatooine, Luke Skywalker's home planet, orbiting two suns) is not quite a reality, as planet Kepler-16b is not habitable.

Kepler-16b is comparable in mass to Saturn. Being 30% more dense, it is a gaseous planet with a core of much more massive heavy elements. One star has a mass approximately equal to 70% of the mass of our Sun, and the other about 20%.

Let's hope that one day we will find a *habitable* planet orbiting two suns.





Above: In the Light of Two Suns. This artist's concept illustrates Kepler-16b, the first planet known to definitively orbit two stars -- what's called a circumbinary planet. The planet, which can be seen in the foreground, was discovered by NASA's Kepler mission. The two orbiting stars regularly eclipse each other, as seen from our point of view on Earth. The planet also eclipses, or transits, each star, and Kepler data from these planetary transits allowed the size, density and mass of the planet to be extremely well determined. The fact that the orbits of the stars and the planet align within a degree of each other indicate that the planet formed within the same circumbinary disk that the stars formed within, rather than being captured later by the two stars. Image credit: NASA/JPL-Caltech/T. Pyle

Use of the ISS for Exploration

Future of ISS

Dr. Steven E. Everett, Chair, AIAA Houston Section Guidance, Navigation & Control Technical Committee

On November 8, 2011, the GNC Technical Committee was pleased to host a lunch-and-learn featuring Boeing's International Space Station (ISS) Deputy Program Manager, Michael Raftery. He spoke on the use of the ISS as a base camp for exploration of the Moon, Mars and asteroids before an audience of about 25 AIAA members and guests over a catered lunch.

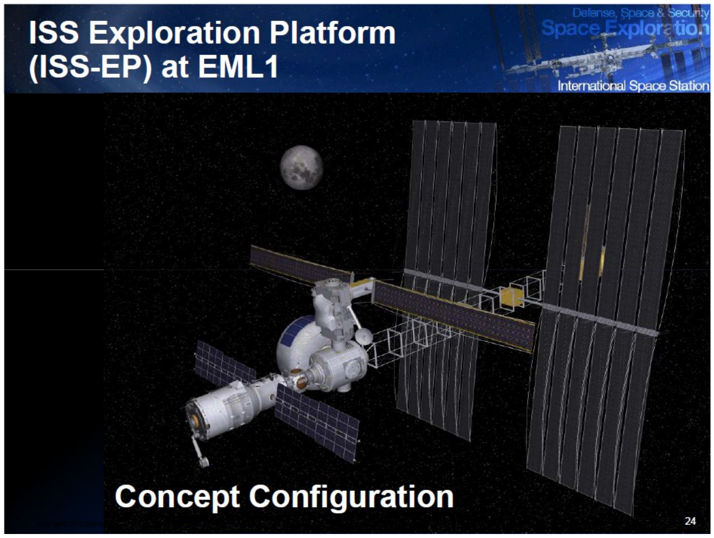
Mr. Raftery began by noting that the plans he would discuss outline one possible implementation of NASA's Global Exploration Roadmap, in which an attempt is made to chart the course for exploring the solar system. Potentially, the ISS would be used to support this plan as a testbed for new technology, as an analog for interplanetary vehicles, or as a "base camp" for exploratory vehicles; it was this latter use that was the focus of the talk.

This base camp would effectively be a detached module of the ISS which would either be built in LEO and transferred to the Earth-Moon libration point, or launched directly to that destination and assembled there. The delta-V roadmap was discussed, echoing the well-known saying that "low Earth orbit is halfway to anywhere in the solar system," and the topic of libration points in the Earth-Sun and Earth-Moon systems was reviewed. Mr. Raftery also stressed the importance of solar-electric as a propulsion system, noting that this approach is more appropriate for certain mission types than the more typical chemical propulsion. He then illustrated low thrust trajectory designs from one libration point to another, and from Near Earth Orbit (NEO) to an asteroid.

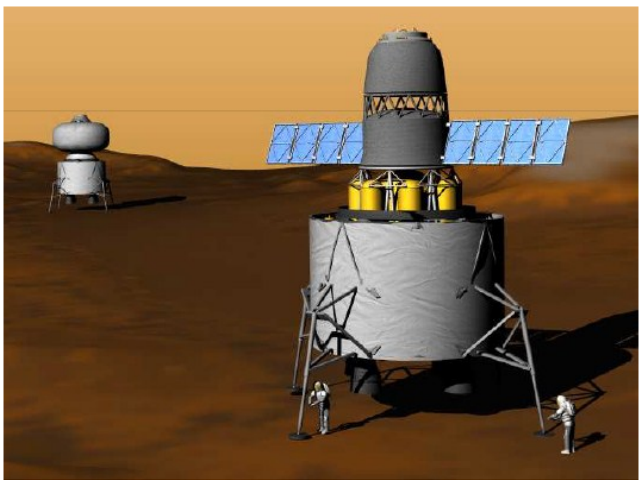
Applications to telescope servicing missions was mentioned, but Mr. Raftery spent most of his time discussing Lunar and Mars missions. For Lunar missions, a descent stage would be docked at the libration point base camp, and would shuttle between it and the Lunar surface. Under this architecture, only a single SLS launch would be required to support a Lunar landing. Mr. Raftery went on to discuss a Mars mission architecture slightly different from those typically proposed. Rather than rely on in-situ resource utilization, a cargo vehicle would be launched first, and then a crew vehicle with its own propellant would depart from the ISS libration point base camp and be targeted for the vicinity of the cargo module landing site. Thus the crew vehicle would have fuel to support an abort if necessary. An inflatable aeroshell would be used for descent, and upon return a ferry stage would shuttle the crew module from low to high Mars orbit.

Mr. Raftery illustrated the functional requirements for supporting the architectures he discussed, and defined which parts still required development. Once developed, this platform would be the primary destination for most international flights beyond LEO, and would support exploration as well as telescope servicing for years to come. The afternoon's lecture was an inspiring view of one possible future leading to the exploration of our solar system.

Above: Mr. Michael Raftery, Boeing ISS Deputy Program Manager



Above: ISS exploration platforms concept configuration.



Left: Mars cargo and crew vehicles on planet surface.

Public Lecture

Planet Formation: What's New with the Oldest Events in the Solar System, by Dr. Bill Bottke

WES KELLY, TRITON SYSTEMS, LLC

Cosmic Explorations: A Public Lecture Series

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10 November 2011

Since the space age began in the 20th century, we can summarize our changed understanding of solar system formation history by a succession of discoveries and new formulation ideas. From observing cratered surfaces of objects other than the Moon with Mariner and Voyager spacecraft, we came to appreciate impact events in planetary history. Returned lunar sample analysis helped provide a chronology. Forensic work on the ground on the iridium-rich Cretaceous Tertiary (K-T) boundary pointed to a major impact event 65 million years ago (undersea now) at Chicxulub in the Gulf of Mexico. Spurred by returned Apollo geochemical data, simulations showed how the Moon could have been formed from a glancing collision between the Earth and a Mars-sized planet early in solar system history. Then telescopic discovery of extra-solar planets already formed and evidence of on-going formation near young stars with circum-stellar discs of gas and dust illustrated how our own system of planets probably originated. This also suggested alternate paths. These are principal elements of 20th century solar system formation theory. But could 21st century contributions already be bearing down on us?

In an evening talk at the Lunar and Planetary Institute, Dr. William Bottke of the Southwest Research Institute (SwRI - Boulder, CO) introduced his audience to recent candidates for addition to the litany above. Having devoted much of his career to asteroid studies - composition, classification and evolutionary history - William Bottke and SwRI colleagues contributed in part to what has become known as the Nice Planetary Formation Model. Named for the French Mediterranean coastal city home of the institutional site (Observatoire de la Cote d'Azur) where many related meetings took place, the Nice model addresses solar system issues with an analytical and simulation approach similar to that applied to the Moon's origin. But while the lunar model is "local" in its solution, "Nice" has implications for planetary systems and the galaxy as a whole.

The Johnson Space Center astronomy luncheon group has a heritage of several decades going back to weekly "Brown Bag" talks in Building 31. In wide-ranging table talk at a recent meeting, Dr. Bottke's presentation came up in oblique fashion following comment on the PBS presentation "The Fabric of the Cosmos", Chandrasekhar and Leslie Nielsen's reported common penchant for off-color limericks (one source: "Forbidden Planet" co-star, Ann Francis) and an "art" film in no hurry to reach Houston, named for either a state of mind or a huge, Jupiter-sized planet rushing in from deep space to destroy the world: "Melancholia". Reportedly the planet Melancholia is a visual effect that draws down the curtains on the film's psychological explorations, but there is resemblance to the earlier Phillip Wylie1933 novel and George Pal's 1951 movie adaptation "When Worlds Collide", albeit by definition more resigned. Yet while Pal was more earnest about such an event than the current director Van Trier, judging from Dr. Bottke's talk, there's more of a conceptual case for colliding with worlds from interstellar space now than there was 60-80 years ago, simply because loose Neptune and Jupiter-sized planets have been observed and the solar system formation process appears capable of launching them. Though collision is not an imminent danger owing to interstellar space immensity, its slight prospect is still in striking contrast to what was thought before when no extra-solar planets were even known. Also noteworthy: that movies about the world's end could remind us of a lecture on how the world had begun. For in discussing "Melancholia", it was asked: "Did anyone else here see William Bottke's presentation last week at LPI?"

(Continued on page 19)

Public Lecture

(Continued from page 18)

Since both astronomers and astrodynamicists have performed multi-body backward integrations of the major and minor planets over more than 10^8 years, stability of the current solar system configuration has been demonstrated. With that question set aside, the next becomes, how had this stability come about? Categorization of asteroid and comet families plus simulation studies of planetesimals provided clues. Besides the main Asteroid Belt, two principal remaining concentrations of small icy bodies are the Kuiper Belt, starting in Pluto and Neptune's vicinity, extending 30-55 AUs from the Sun, and the Oort Cloud, of much greater expanse (more than 10,000 AUs), and much higher numbers of small, primitive bodies that are remnants of the circumsolar disk from which planets formed. Condensations from the disk in the inner regions were silicates, carbonates and metals; in mid regions, ices such as water; and in the depths of space, compounds we consider cryogenic such as methane, nitrogen and ammonia.

The Dutch astronomer Jan van Oort noted that eccentricities (e) of comets from deep space were not indicative of origin from interstellar space (e less than 1) but rather bodies tied loosely to the distant sun and jarred into near-parabolic approaches by small disturbances. Thus, it could be said that if comets did not come from interstellar space, we should not expect planets from other stars, especially if in Oort's time extra-solar planets were no more than an unproved hypothesis. (Having spent time in the 1970s in an astronomy department that studied stars intensively, I will attest to this based on then prevailing stellar formation theory.) But were they to arrive, the Oort Cloud would likely act as an alarm system with a precursor rain of disturbed bodies as well.

For example, two decades ago the Nemesis hypothesis examined whether the sun had a distant and very faint binary companion responsible for periodic rains of comets and catastrophic impact episodes at geological time intervals.

In 2009, along with some Nice model colleagues, Dr. Bottke published a report in the planetary science journal Icarus about how inner solar system planetesimals coagulated into larger bodies, acted on, at least in part, by perturbing influences of Jupiter. In the evening's presentation, an animation of the several million year process was included, similar to the figures below in Figure 1.

Remarkably the dynamic simulations, animations and charts supported "the idea that planetesimals formed big, namely that the size of solids in the proto-planetary disk 'jumped' from sub-meter scale to multi-kilometer scale,

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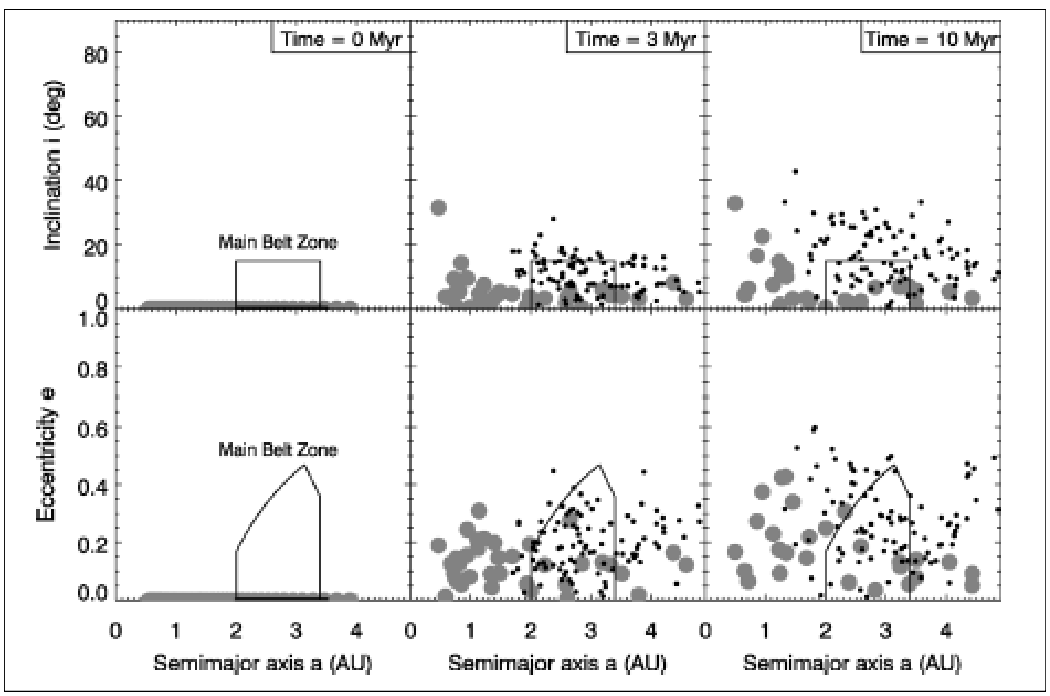
AU: astronomical unit, the distance from the Earth to the Sun.

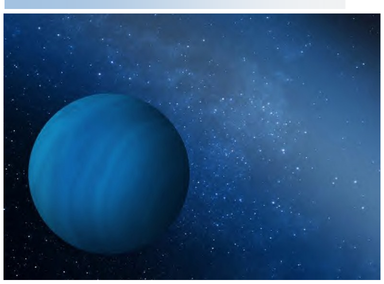


Left: Figure 1: Circum-Solar Disk Planetesimals Evolving into Main Belt Asteroids – 10 Million Year Simulation. Image credit: Dr. Bill Bottke.

Public Lecture

AU: astronomical unit, the distance from the Earth to the Sun.

From the next page:
The fifth gas giant is "ejected" completely from the solar system by a close encounter with Jupiter. "This possibility appears to be conceivable in view of the recent discovery of a large number free-floating planets in interstellar space, which indicates that planet ejection should be common.", concludes the study.



Above: Artist's impression of a planet ejected from the early solar system. Image credit: Southwest Research Institute

...within the first billion years of solar system history Neptune and Uranus change places with respect to distance from the Sun.

(Continued from page 19)
without passing through intermediate values… " From this, it can be said that piecing the solar system formation puzzle together, intermediate results often did not match with what was intuitive.

But surveys of populations, compositions and distributions of remaining solar system building blocks, plus crater impact chronologies, slowly provided clues about the mechanics of the Solar System's formation. For example, the Late Heavy Bombardment, an influx of objects into the inner solar system produced crater records on the Moon, Mars and Mercury that were not so clearly evident on the plate-tectonically active face of the Earth. They signified large scale events in the outer solar system in the first billion years of the system's existence. Also, as Dr. Bottke noted, it was hard to reconcile the formation of Neptune and Uranus at their present positions with the estimates of available disk material and the time available for coalescence before the disk would be dispersed. There was strong evidence that the giant outer planets had not formed where they are seen today. Some event or series of events had somehow re-arranged the newly formed planets into their current very stable form.

In the mid 1990s extra-solar planets were first discovered orbiting main sequence stars similar to the sun initially by Swiss (Mayor and Queloz) and American astronomers (Marcy and Butler). It was understood that due to Doppler sensing capabilities initial discoveries would be biased toward massive planets (e.g. at 51 Pegasi) very close to their primary stars, but results were more extreme than anyone had expected – except perhaps for theorist Douglas Lin and his colleagues at UC, Santa Cruz. They had been examining planet and disk dynamic interactions since the late 1970s. As noted above, for planets to form from a disk of varied condensates and gas, the disk itself must far exceed the total mass of the bodies eventually formed. Not all of this matter nucleates into a planet. Most is shunted aside in billions of encounters similar to present-day spacecraft flybys with a resulting exchange of angular momentum. For an individual spacecraft encounter with a planet (e.g., Voyager and Jupiter) we tend to neglect the effect on the planet. But in early solar system the effect was a fundamental process that caused genuine planetary migration. Depending on disk mass, distribution and planet location, migration could be inward or outward. And once a large planet is embedded in a disk, this process can continue to migrate the planet until it abruptly runs out of close encounter "fuel", the point where the musical chair game stops. As a string of extra solar "hot" Jupiters were discovered through Doppler-based studies, theorists worked initially to understand migration *inward*. If you had followed the discovery of extra-solar planets since the 1990s, you would anticipate much of the same in Bottke's presentation. It was quite the contrary.

When the Nice Model was first presented in 2005 in several papers by the team of Gomes, Levison, Morbidelli and Tsiganis, it was proposed that the four large gas giant planets (Jupiter, Saturn, Uranus and Neptune) resided between ~5.5 and ~17 AUs, more tightly packed than they are now, though not with Jupiter any closer to the sun. Beyond this a large, dense disk of small rock and ice planetesimals remained (~35 Earth masses), extending to 35 AUs. Over several hundred million years, as a result of encounters such as described, Jupiter edged slightly further toward the sun to its present position and the remaining planets moved farther out, scattering small bodies to their current general positions, as well as ejecting the majority deep into space. But when Jupiter and Saturn cross into a mutual 1:2 mean motion resonance, the entire system of outer planets becomes unstable, with increased eccentricities and eventual angular momentum exchanges, scattering most of the remaining primordial disk. In the inner solar system this sudden influx of matter was registered as the Late Heavy Bombardment.

It is noted that in ~50% of the Nice simulation cases, within the first billion years of solar system history Neptune and Uranus change places with respect to distance from the Sun. Simulations related to the Nice Model attempt to identify configurations of the early solar system which can best explain the stable configuration of planets and distribution of small bodies we perceive now. Thousands of initial configurations were tested for the early reports, as described above, and the process has continued to the pre-

(Continued on page 21)

Public Lecture

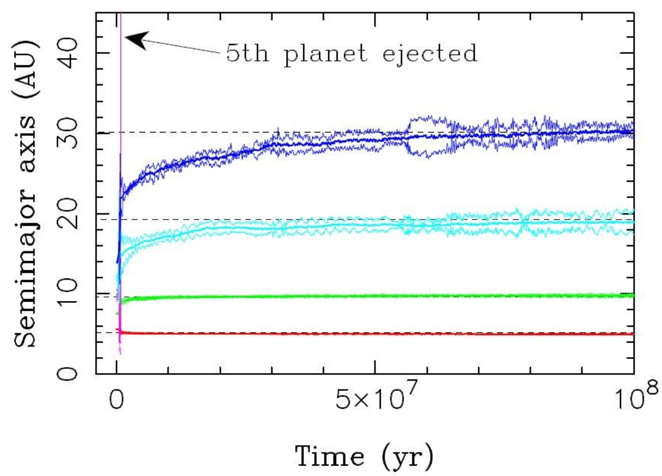
sent day. The result: we see a planetary migration mostly *outward*. (See Figure 2.)

The more recent findings reported by Bottke and by other investigators indicate that even better extrapolations forward to present day conditions can be obtained if a ***fifth*** giant planet is included in the early solar system set. As reported by David Nesvorny of SwRI, based on 6,000 simulations of the early solar system, with 5 giant planets, the end state was ten times more likely to lead to today's configuration of planets rather than in cases involving only four such bodies. The fifth gas giant is "ejected" completely from the solar system by a close encounter with Jupiter. "This possibility appears to be conceivable in view of the recent discovery of a large number free-floating planets in interstellar space, which indicates that planet ejection should be common.", concludes the study.

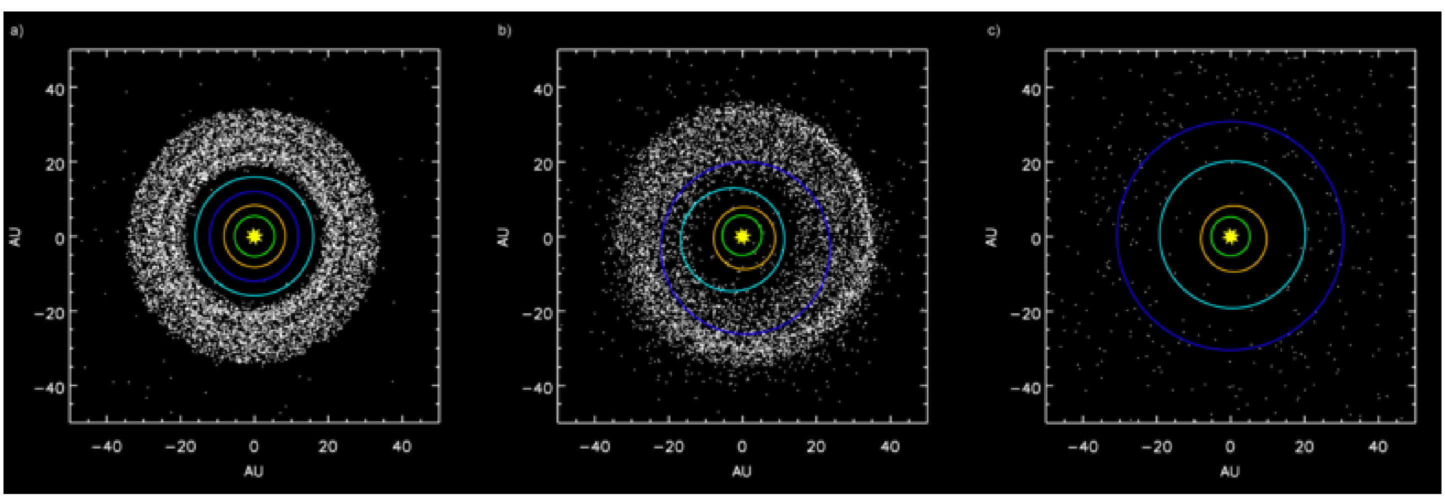
In Figure 3 are shown orbit histories of giant planets in one of the simulations with five initial planets. In this case the 5 planets were started in (3:2, 3:2, 4:3 and 5:4) resonances. $M_{disk} = 50\ M_{Earth}$ and R = 15 AU. After a series of encounters with Jupiter, the inner ice giant was ejected from the solar system at 8.2×10^5 year (purple path). The remaining planets were stabilized by the planetesimal disk, and migrated to orbits that very closely match those of the outer planets (dashed lines).

Going back to our opening premise, planetary science conclusions explaining small body distributions in the solar system, along with the stable configuration of the inner and outer planets, were the result of testing hypotheses with simulations, which required surprising initial assumptions: large motions and shifts of the outer planets, plus possible ejections of extra planets into interstellar space. Even for the 20th century findings on lunar origins or "death of the dinosaurs", the "forensic" arguments are not entirely closed cases; and with 21st century arguments based on simulations with numerous initial conditions, there should remain plenty more debate. During the evening's discussion, however, there were repeated questions about the fate of the putative, expelled Neptune-sized planet. "Where do you suppose it is now?" We do not know. Nor do we know if one of this extra Neptune's billions of cousins is in our vicinity.

Below: Figure 3: "5th Planet Ejected." Image credit: David Nesvorny.



*Below: Figure 2: **Simulation showing the outer planets and planetesimal belt: (a)** early configuration, before Jupiter and Saturn reach a 2:1 resonance; **(b)** planetesimals scattering into the inner Solar System after the orbital shift of Neptune (dark blue) and Uranus (light blue); **(c)** after ejection of planetesimals by planets. Image credit: public domain. Image author: AstroMark. Image source: Wikipedia (Nice model). Additional credit: Kleomenis Tsiganis.*



Astronomy

This 2008 book's author is Dr. Jeffrey Bennett. He appeared at the University of Houston at Clear Lake (UHCL) on September 22, 2011, as part of the Space Lecture series, hosted by Dr. David Garrison of UHCL. For more information, see www.jeffreybennett.com.

Beyond UFOs: The Scientific Search for Extraterrestrial Life, by Dr. Jeffrey Bennett

Douglas Yazell, Editor

Four hundred years ago the Copernican revolution was an example of one aspect of science: it brings broad agreement, nearly universal agreement. For the prior 2,000 years, the Earth was viewed as the center of the universe, often citing Aristotle. There were exceptions. More than 2,000 years ago, Aristarchus stated that Earth was a planet orbiting around the Sun. Fifty years after the trial of Galileo, no one argued about that any longer! Science brought agreement in this case after 2,000 years. Today people might say science puts us at odds with each other, but real science brings about agreement.

We don't know if there is life elsewhere in the universe. If life exists elsewhere, it requires a planet to start. Life might be found in interplanetary space, but if so, it will have found its start on a planet. Let's consider planetary, biological, and astronomical consequences.

Planetary

Sixteen years ago we had no evidence of extrasolar planets. Now we know of more than 1,000. The Kepler satellite program will deliver its next data dump in February of 2011. Planets are common around other stars. This Kepler mission may have found Earth-sized planets in the Goldilocks zone (a zone for planetary orbits at a distance from a star allowing life to exist), but the resolution is not good enough to know.

Biological

We will never know for sure how life started on our planet, but many experiments point to the same conclusion: it was not difficult to start life on Earth. Life probably also developed on similar planets orbiting other stars.

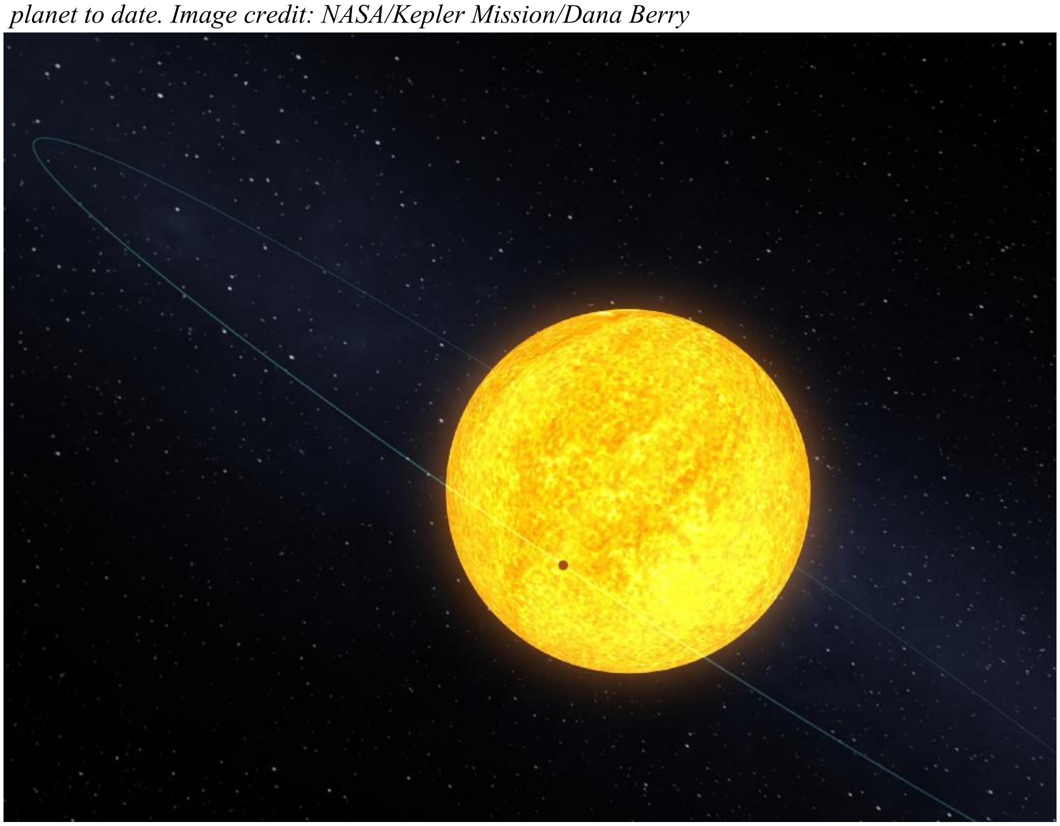
Astronomical

There are about 100 billion stars in our Milky Way galaxy, and about 100 billion galaxies in our universe. The number of grains of sand in all of Earth's beaches is about the number of stars in the observable universe. If there is no life elsewhere, then our grain of sand is unique. This uniqueness is not likely.

If we are already being visited by alien life, they are smart for two reasons. (1) They are not from our solar system. The near-

(Continued on page 23)

Below: Planet Kepler 10B Orbiting its Host Star. Kepler-10b orbits one of the 150,000 stars that the spacecraft is monitoring between the constellations of Cygnus and Lyra. We aim our mosaic of 42 detectors there, under the swan's wing, just above the plane of the Milky Way galaxy. The star itself is very similar to our own sun in temperature, mass and size, but older with an age of over 8 billion years, compared to the 4-and-1/2 billion years of our own sun. It's a quiet star, slowly spinning with a weak magnetic field and few of the sun spots that characterize our own sun. The star's about 560 light years from our solar system and one of the brighter stars that Kepler is monitoring. It was the first we identified as potentially harboring a very small transiting planet. The transits of the planet were first seen in July of 2009. The diameter of Kepler-10b is only about 1.4 times the diameter of Earth and its mass is about 4.5 times that of Earth. It is the best example of a rocky planet to date. Image credit: NASA/Kepler Mission/Dana Berry



(Continued from page 22)
est star system [is about 4 light years away]. They traveled at least that far. (2) They are 50,000 years ahead of us, assuming only 1 star in a million has a planet with a civilization. This assumption means we assume we have 100,000 civilizations created in our galaxy. Assuming 100,000 civilizations over 5 billion years results in 1 civilization every 50,000 years in our galaxy. If other civilizations exist outside of our solar system, then ours is the dumbest, because the others are 50,000 years older than us.

These aliens look like future versions of us, 50,000 years in our future. Any sufficiently advanced technology is indistinguishable from magic. These aliens have magic. If they are here, they will not accidentally drop pieces of metal in Roswell, New Mexico, USA. We cannot know how they might communicate with us.

The first step in astrobiology is studying our only example: life on Earth. We have new results from the last few decades. Plants and animals are part of one of three domains of life. This one domain is called Eukarya. Plants and animals are a tiny minority of life on Earth. Most life on Earth is tiny and would not be affected if we destroyed all plant and animal life on Earth.

Even extremophiles on Earth need liquid water. Alien life will require liquid to develop, and we know water works. Our own solar system probably has liquid on Mars, Europa (deep oceans under an icy crust), Titan, Enceladus, and Pluto. If we find life in one of those six locations, it will be microscopic, with the exception that we might find something like big fish on Europa.

Titan has methane and ethane lakes. It rains and it snows on Titan.

It will be surprising if we do not find microscopic life on Mars or Europa, but talking to aliens means we must talk across interstellar distances. Currently our only work in that area is the Search for Extraterrestrial Intelligence (SETI). Already SETI has been listening for signals purposely beamed strongly in our direction, since if the other star system had television like ours, we could not detect it. Imagine many SETIs among the stars with no one broadcasting. We have a responsibility to broadcast, and we have done a little of that. We aimed at globular cluster M13, at a distance of 21,000 light years from our Sun.

Physicist Stephen Hawking said we should not broadcast because aliens might detect our nice planet, kill us, and take over our planet. But we said above that aliens visiting here are so advanced, they have magic. If they kill us, it will be a reaction to our TV shows, not a reaction to our saying hello.

We do not know if alien life exists, but it probably exists. "Where is Everybody?", is the Fermi paradox. Let's respond with three possibilities.

(I) We are Alone.

Such a unique grain of sand is possible but not likely. This solitude requires that in a universe that started 14 billion years ago, self-awareness exists only here.

(II) 100,000 Civilizations Wiped Themselves Out.

Survival may be difficult beyond where we are today. Venus is 900 degrees F due to carbon dioxide in its atmosphere. On Earth we never had more than 300 parts per million (ppm) over the last 800,000 years, but now it is over 390 ppm, by 2015 it will be 400 ppm, and at this rate, it will be 500 ppm by 2030. We know we put it there and we know it causes planets to warm up. This is climate change. Life is a race between understanding and catastrophe.

(III) Galactic Civilizations are Out There Following Star Trek's Prime Directive.

Our civilization is an adolescent in the company of all of those adults. Ours is the first generation that can destroy humanity. If we overcome this danger, our descendants will enjoy life among these galactic civilizations of the stars.

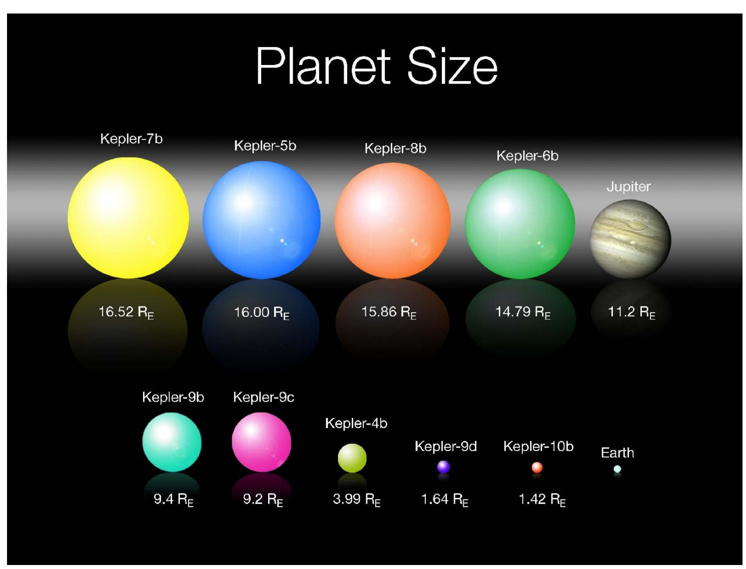
Will we prove that there is intelligent life on Earth?

Astronomy

Editor's note: Wikipedia has a nice, long article on the Fermi paradox, and that seems to be the subject of Dr. Bennett's excellent book and presentation. NASA's Kepler satellite mission is finding and abundance of planets outside of our solar system. This creates more interest in the Fermi paradox, as well as the 100 Year Starship Study, an initiative (2011-2111) from DARPA and NASA/Ames.

Beyond UFOs: http://jeffreybennett.com/

Below: Kepler 10b Planet Comparison. Image credit: NASA.



APR E-Publication

Aerospace Projects Review (APR) is presented by Scott Lowther, whose unique electronic publication is described as a "journal devoted to the untold tales of aero-spacecraft design." More information may be found at the following address:

Scott Lowther
11305 W 10400 N
Thatcher, UT 84337
scottlowther "at" ix.netcom.com
http://www.up-ship.com

LTV's Universal Hypersonic Test Vehicle

Scott Lowther

In the mid 1960's, a wide range of hypersonic cruise aircraft were being proposed... missiles, fighters, bombers, recon aircraft and passenger transports. But while such vehicles could be designed and even built, without experience with and understanding of hypersonic cruise flight, there was no possibility of designing such an aircraft and expecting it to actually function as desired. The X-15 had demonstrated that hypersonic flight was possible... but being rocket powered, its duration at those high speeds was strictly limited.

In late 1966, Vought Aeronautics began studying concepts for an unmanned hypersonic research vehicle in order to fill this gap in knowledge and experience. The vehicle was to be capable of testing a wide range of propulsion systems, from subscale components to full-scale operational engines; different fuels could be accommodated as well as various structural concepts and materials. While the vehicle was designed as an experimental test vehicle, it was sized with potential military applications in mind.

The Universal Hypersonic Test Vehicle (UHTV) could take off and land on normal runways, and cruise at Mach 8 and 100,000 feet in between. It was a reusable vehicle with podded airbreathing engines and a large volume lifting body fuselage, appropriate for low density fuels like liquid methane or liquid hydrogen. Recovery would reduce cost by reusing the hardware, and would allow data to be stored on-board rather than transmitted real-time.

The UHTV vehicle was invertible in flight. The main high-speed propulsion system was mounted on the topside of the aircraft, as it was sitting on its landing gear; after takeoff, it would roll so that the high-speed engine was on the underside. The new underside was shaped to provide precompression for the inlet at high speed. It would roll again prior to landing. The vehicle had verticals stabilizers dorsally and ventrally for stability and control in all configurations.

The UHTV was equipped with one main rocket engine (Aerojet LR-87-AJ-7, thrust range of 100,000 to 215,000

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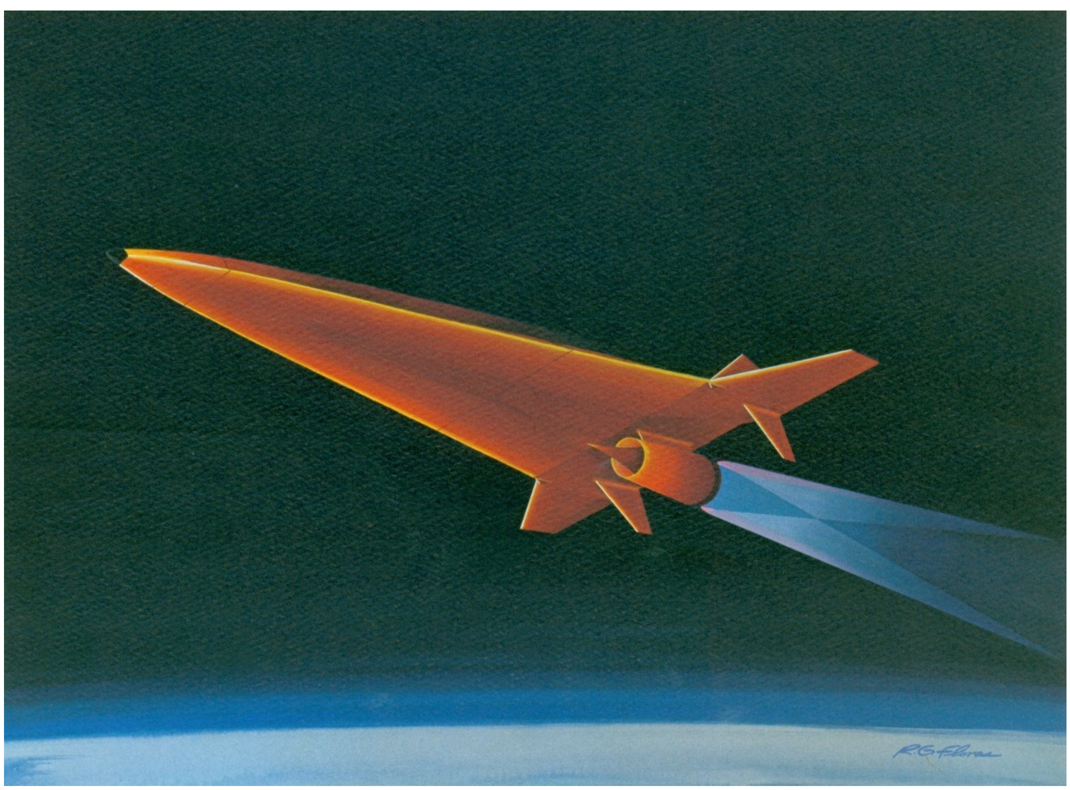
Right: LTV artwork depicting the UHTV at high speed with an ejector ramjet engine. Image credit: Scott Lowther.



APR
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(Continued from page 24)
pounds) and two sustainers (modified TRW Voyager Capsule Bus engines, from the Voyager Mars lander program, thrust levels of 1,000 pounds to 10,000 pounds). These would be used for conventional horizontal runway launches and acceleration to airbreathing engine startup; the sustainers could be used, if needed, for power at landing.

- The UHTV was a "rubber" design, with a range of sizes studied. Three particular designs were studied in greatest depth:
- UHTV 350: 50-foot body length, dry weight (sans airbreathing engine) of 15,200 pounds, gross weight of 52,000 pounds
- UHTV 355: 55-foot body length, dry weight (sans

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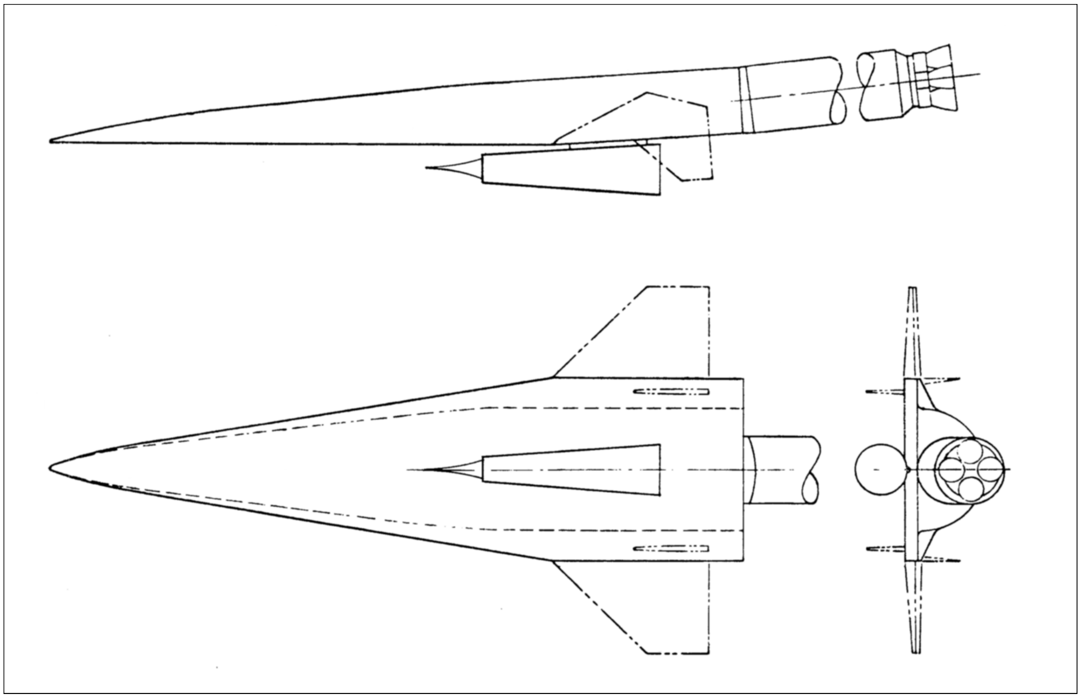
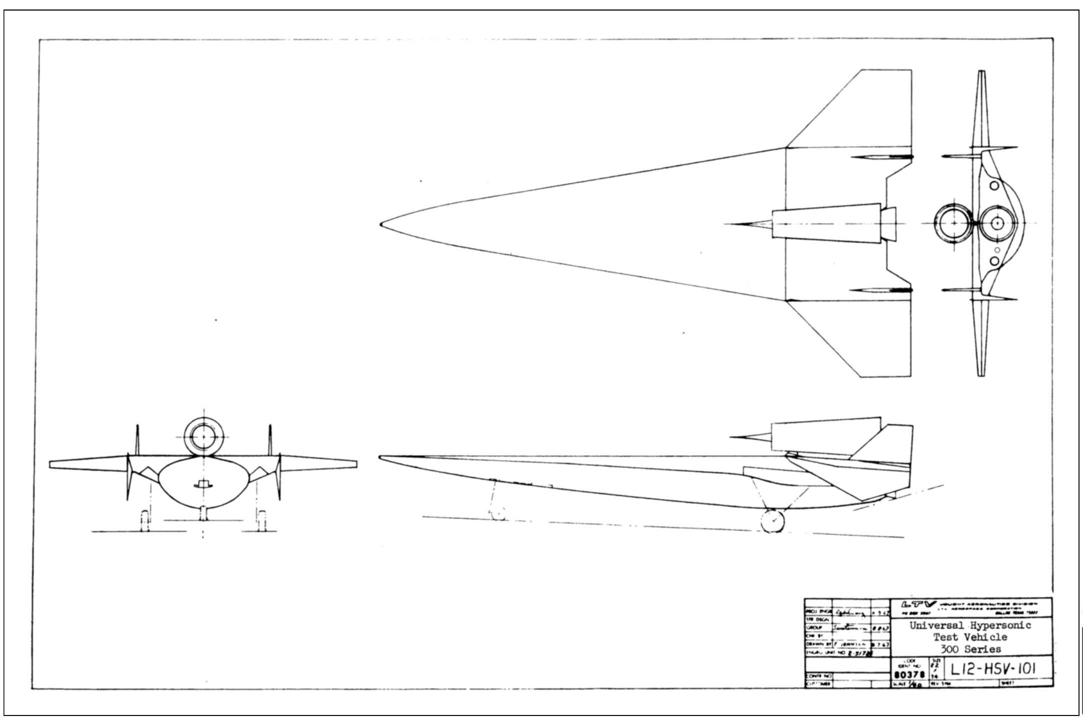


Left: An alternate configuration with the integral rocket engines removed and replaced with an external solid rocket motor for boost. This would maximize performance for the airbreathing test engine (LTV). Image credit: Scott Lowther.



Left: General arrangement of the UHTV "rubber design" (LTV). Image credit: Scott Lowther.

Aerospace Projects Review

APR
E-Publication

"Vought was bought by James Ling in 1962, forming the new conglomerate Ling-Temco-Vought (LTV)." Text credit: Wikipedia Vought article.

(Continued from page 25)

airbreathing engine) of 17,700 pounds, gross weight of 62,000 pounds

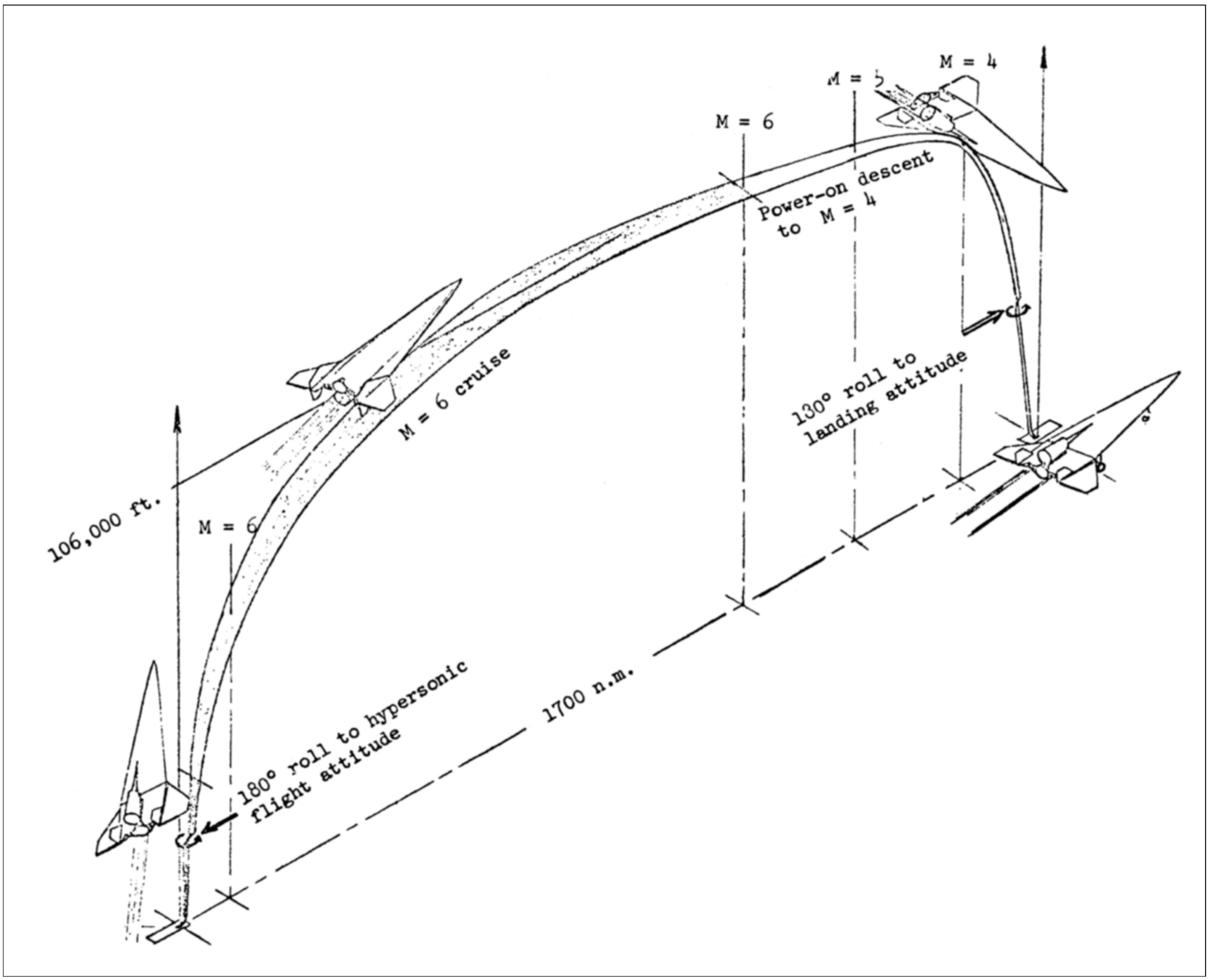
- UHTV 360: 60-foot body length, dry weight (sans airbreathing engine) of 22,000 pounds, gross weight of 77,000 pounds

While all sizes had their advantages, the UHTV 355 was the most studied design. It had an overall length of 695 inches and a span of 396 inches.

The UHTV could accommodate turboramjets, ejector ramjets, supercharged ejector ramjets, scramjets and scramLACE systems, as well as potential mixes of propulsion systems (data on the performance of such systems was provided to LTV by Marquardt Corporation). The airframe could be modified to get rid of the rocket engines and fully integrate the airbreathing propulsion system into the vehicle. The airbreathing engine pods could be replaced with non-propulsive experiment pods to help develop systems like electronic counter measures and communications systems.

Aerospace Projects Review

Below: UHTV mission profile (LTV). Image credit: Scott Lowther.



EAA and EAA Chapter 12 Information

Chapter Mission

The Experimental Aircraft Association's Chapter 12, located at Ellington Field in Houston, 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!

Ideas for a meeting? Contact Richard at rtsessions “at” earthlink.net, Chapter web site: www.eaa12.org
Experimental Aircraft Association web site: www.eaa.org

Scheduled/Preliminary Chapter 12 Event/Meeting Ideas and Recurring Events:
Monthly Meeting: Chapter 302, 2nd Saturday, 10 AM, Lone Star Builder’s Center, Lone Star Executive, Conroe TX
1st Saturday of each month – La Grange TX BBQ Fly-In, Fayette Regional (3T5)
1st Saturday – 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 Saturday – Lufkin TX Fajita Fly-In (LFK)
2nd Saturday – New Braunfels TX Pancake Fly-In
3rd Saturday – Wings & Wheels, 1941 Air Terminal Museum, Hobby Airport, Houston TX
3rd Saturday – Jasper TX BBQ Lunch Fly-In (JAS)
3rd Saturday – Tyler TX Breakfast Fly-In, 8-11, Pounds Field (TYR)
4th Saturday – Denton TX Tex-Mex Fly-In
4th Saturday – Leesville LA Lunch Fly-In (L39)
4th Saturday – Shreveport LA Lunch Fly-In (DTN)
Last Saturday – 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 probably appear in our next issue. This series was suggested by Richard Sessions of EAA Chapter 12.

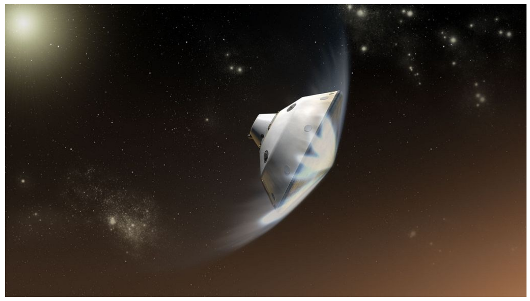
EAA is the Experimental Aircraft Association. The Houston Chapter is #12, one of the earliest created among the hundreds of chapters.

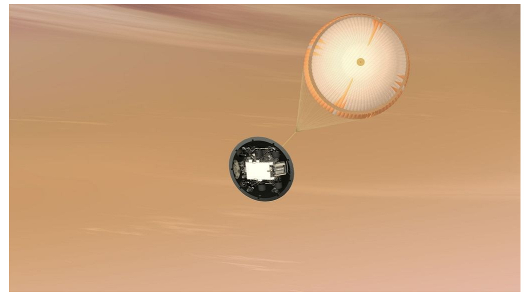
www.eaa12.org.

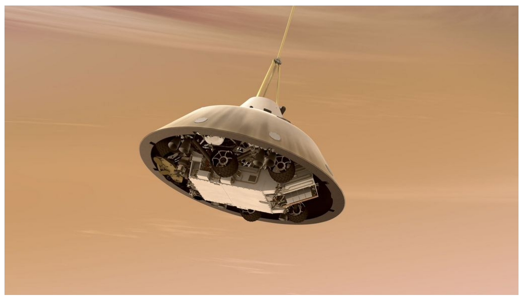
Left: The EAA Chapter 12 web site opening page, a cropped image capture from the web page at www.eaa12.org.

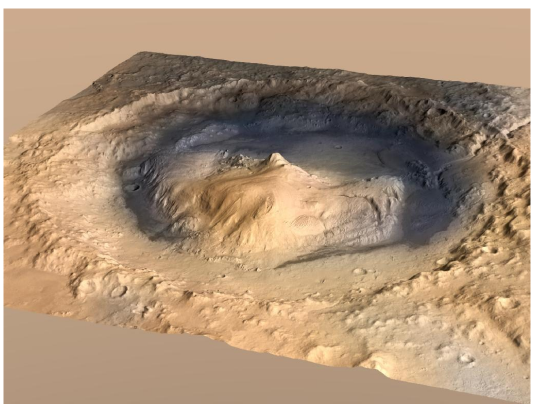
Current Events

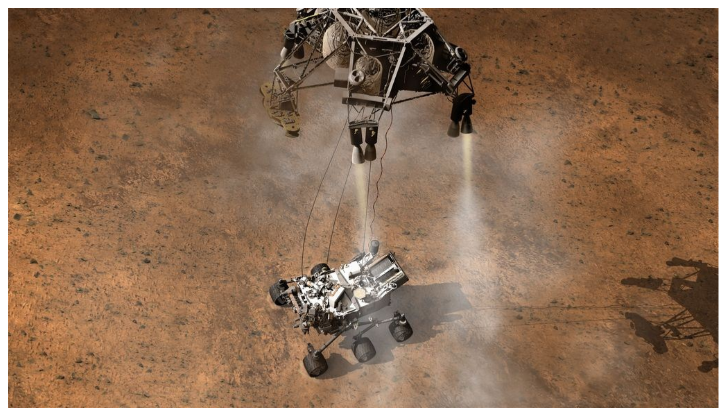
Right: NASA's Mars Science Laboratory launched successfully on an Atlas V rocket from Florida on Saturday, November 26, 2011. Its arrival at Mars is scheduled for 8 months from now. Images show the arrival of the Mini Cooper-sized rover Curiosity in the Gale crater. Congratulations to Houston resident Dr. Dorothy Oehler. In November of 2011, just before launch, her proposal was one of 29 selected for The Mars Science Laboratory Participating Scientist Program. Horizons will list those 29 scientists once the selections are announced in a NASA press release. Image credits: NASA/JPL-Caltech.



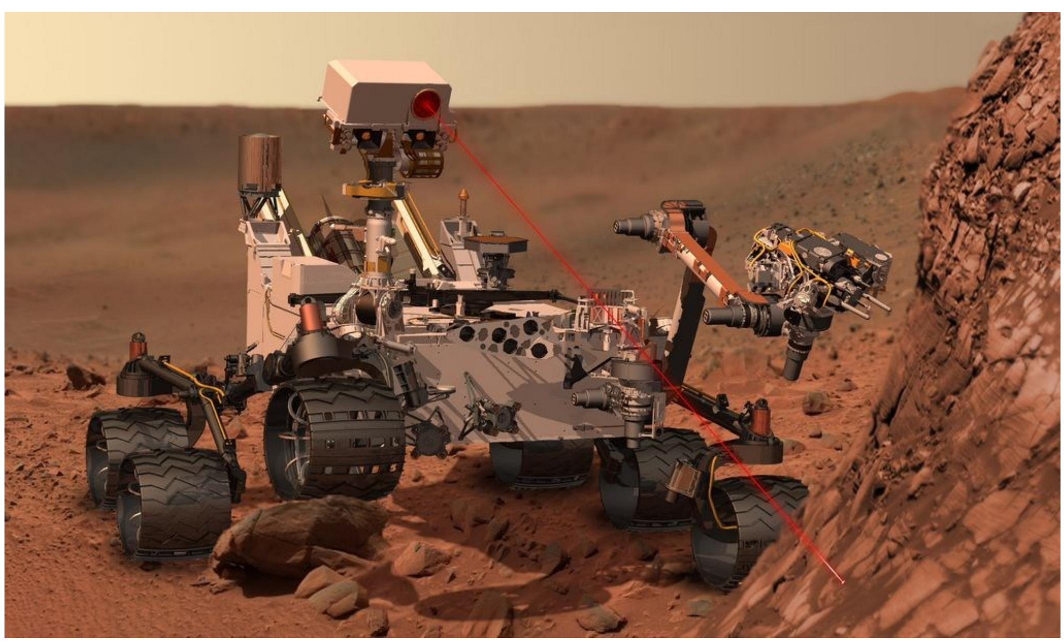








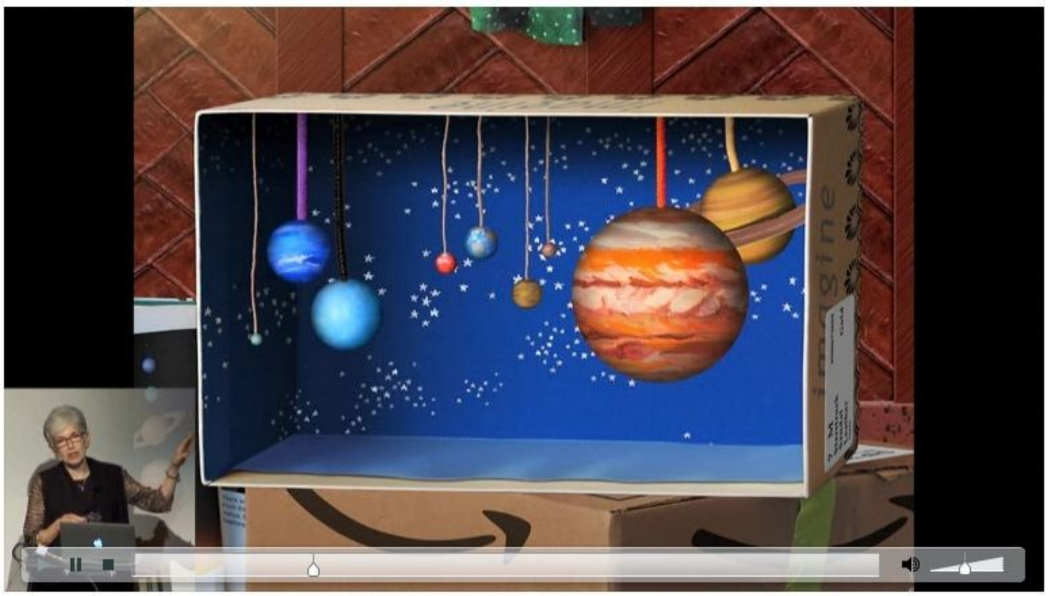
Above: Gale Crater, Mars, with vertical exaggeration. Image credit: NASA/JPL-Caltech/ESA/DLR/FU Berlin/MSSS



Current Events

Former NASA Administrator Michael Griffin was the banquet speaker at the national conference of the American Astronautical Society (AAS) in Houston on November 16, 2011. "Do we as a nation want a NASA which is going to be a mission agency?" The agency mission is human spaceflight. The Horizons newsletter team created and transcribed an audio recording that will be published as a PDF document as soon as possible on the AAS web site (www.astronautical.org) or the AIAA Houston Section web site (www.aiaa-houston.org, in the "A Closer Look" section).

Left: Former NASA Administrator Michael Griffin. Image credit: NASA



Left: The Lunar and Planetary Institute (LPI) offers Cosmic Explorations: A Speaker Series. Dava Sobel spoke on 9/22/11, Humanity's Changing Relationship with the Solar System. Dava Sobel's best known book is Longitude, about the famous prize offered by the British government and awarded first to John Harrison in the 18th Century. Watch the video online at http://www.lpi.usra.edu/education/lectures/videos/sobel/. Image credit: Screen capture by Douglas Yazell.

Left: French President Nicolas Sarkozy addressed the Centre National d'Etudes Spatiales (CNES) in Toulouse, in the Midi-Pyrenees region, on the occasion of the 50th anniversary of CNES on November 22, 2011. http://www.dailymotion.com/video/xmi1tu_nicolas-sarkozy-au-cnes-le-22-novembre_tech. See page 16 for notes about our French sister section work. Image credit: Screen capture by Douglas Yazell.

Staying Informed

From The American Astronautical Society (AAS). Selected questions and answers following a speech by John Holdren on April 4, 2011, at the 2011 AAS Goddard Memorial Symposium. The video was online at http://astronautical.org as of Saturday, November 5, 2011. Charles F. Bolden, Jr., is NASA Administrator. John Holdren is Director of the Office of Science and Technology Policy.

Below: Constellation Ares V (left) and Ares I (right). Image credit: NASA

Question: Some people believe that the President's remark, "Been there. Done that.", places the Moon off limits for future exploration activities. I'd like to believe he was referring to planting more flags and making more footprints. Could you clarify that for us? Is the Moon off limits for future exploration?

Bolden:
No. The Moon is not at all off limits. No one can say what the President meant by his statement. But knowing him, as John has said, he is a dreamer. I think he understands. I would say that you are right. We don't need to plant any more flags. Technology has taken us to the point now that it would be foolish for us to waste assets in building habitations on the surface of the Moon, when Mars and places more distant are our ultimate destination. We have actually been testing for a number of years now, a two-person rover that we can put on the surface of the Moon. Astronauts can live in it, work out of it. The spacesuits are attached to the back, without even having to go through an elaborate process that we do today for an EVA. The astronauts walk into the suit, lock themselves in, go do… whatever they are going to do. We can traverse all over the surface of the Moon, and we don't have to have a habitation… Understand that the President is thinking forward, and not backwards. We have been there, done that, but we will need the Moon as a place for research. When you go to Mars, right now, we are talking 8 months or so. We would love to see it cut in half, but there are still lots of answers we just don't know. I refer to The International Space Station as our new Moon because it is a place that is reachable today. It is the only place that we can do long term microgravity research. And until we can return to the surface of the Moon to do some additional research there, that will be needed to help us facilitate a journey on to Mars, we'll be using everything in between, asteroids, Lagrange points, you name it.

Holdren:
I could add to that. I believe I do know what the President meant, though that is always dangerous. And it is very much what Charlie said. We will go back to the surface of the Moon with people when we have capabilities to take advantage of being there in ways that we didn't before. The question was… Do we need to rush back there to make sure we get there again before the Chinese or the Indians or somebody else does it for their first time? And the President rightly pointed out… We were there already in 1969. We don't have to prove to anybody that we can get humans to the Moon first. That's what we did. But when we're ready to do new things on the Moon that will help us in the broader exploration of space, we'll do them.

Question: For the upcoming SLS program, can you describe what NASA's role will be? Will it be a vendor-delivered system? Will Marshall be doing the integration?

Bolden:
I imagine that when we go beyond Low Earth Orbit, it will not be as we did when we went to the Moon, where it was an all-NASA operation. There was no international involvement. There will definitely be heavy international involvement in any exploration that we do. We may end up with a system that has foreign components in the SLS. That has not been decided yet.

Question from a student: I would like to come back to the topic of the Moon. What exactly were the reasons for the cancellation of the Constellation program? As I understood it, the idea was to set up bases, understand the environment, and apply that to Mars.

Bolden:
The dominant reason for the termination of the Constellation program was, you took a look at where we were, in terms of what was affordable, sustainable, and realistic. The Vision for Space Exploration was the birthplace for the Constellation program. It was a vision that was going to have us going beyond Low Earth Orbit. That was the centerpiece of the VSE. If you will go back and look at how Constellation developed in time, unfortunately, because of fiscal problems, other kinds of challenges, it's all water under the bridge, the program evolved, or devolved, to something that was lunar-centric, not what we wanted, without a lander, not what we wanted, and without the capacity to do the types of exploration that you wanted to do. And we also needed The International Space Station. We had no idea, when that decision was made, we had no idea that the fiscal climate was going to be what it is today. So somebody was probably clairvoyant there. Given the fiscal situation when the decision was made to terminate the Constellation program, it was unaffordable <u>then</u>. […] We do risky stuff. That's why I come to work every morning. I tell people all the time. You can say I am naïve or whatever it is. I love coming to work, because I love doing the same kind of stuff I did when I was a kid. I had a reputation as a kid of being a risk taker. And I want all my NASA employees to be risk takers. […] Hopefully, that answers your question. It was the only thing we could do.

Staying Informed

"We have to continue to benchmark industry, to listen to industry, as a government enterprise, and look for those opportunities to really embrace modern manufacturing, modern collaboration, environments and tools. One of the struggles we had, just within NASA, with Constellation was the great debate over English versus metric units. And we have law that says thou shalt use metric units, but yet I had a portfolio, part of which was designed back in the 1960s or 70s, based in English units. I knew I was gonna have a mixed-units program. The agency leadership desperately wanted us to go metric, but the NASA institution wasn't tooled to do so. And it was gonna be a pretty big bill to be able to do that. The feedback we were getting from industry was that industry didn't necessarily… They would be more than happy to do things in metric, if there was gonna be an additional cost, in part because the supply chain is not set up to really go metric in a lean and efficient way.

English vs. metric units

"So that's just one example. But I think there is a lot we *can* do to embrace the best of the best that's out there, with this goal toward, again, of reducing the fixed cost of our business."

[…] "Do you think that the SLS team and the MPCV team, as well as headquarters and management have learned these lessons in current programs?"
Hanley: "Great question. To varying degrees. I think there is an appreciation of many of them. There are numerous conundrums involved in the circumstance we find ourselves in. And we have not really figured out how to get ourselves past them yet. The fixed cost topic would be the top one on my list. The economics of what we do is basically, you know, the rule of thumb is $10 million will pay for about 50 folks. So a billion dollars is gonna pay for 5,000 folks. So how many folks does this nation want that are gonna be smart on doing business off the planet? What level of investment is the right number of people? When you look at it from a number of people perspective… Dollars are too diffuse in terms of the connectivity between the dollar value and the work to be done… Too many variables. And really I tend to appreciate it more in terms of the number of people that it takes to do a certain thing. And so what's wonderful about the commercial development side of things is that there are great experiments to see if we really can do this business with a lot fewer people. Are we that far along… as a spaceflight community? Such that it really doesn't take as many people as it used to? That's a great experiment to attempt. And then there's the fact that the enterprise… was sized for the Apollo program, was downsized for shuttle, but still largely stayed intact. From Apollo to shuttle, many capabilities were let go across this agency and across the industrial base. But now we're at another one of those moments of, how much more do we need to cut it and still retain the ability to do what we do? That's the preeminent question. So lots of questions. I think, appreciation for the lessons, but not necessarily the answers yet."

Jeff Hanley, American Astronautical Society national conference, Celebrating Achievements, Celebrating the Future, NASA/JSC Gilruth Center, Houston, Texas, November 16, 2011.

For more details on this conference, see pages 8, 9, 29, and 36. For the charts (soon), see the web site for The American Astronautical Society (AAS), www.astronautical.org.

Mr. Hanley ended with a quote from J. R. R. Tolkien,
"All that is gold does not glitter,
Not all those who wander are lost;"

The full poem from Tolkien's The Lord of the Rings is:

All that is gold does not glitter,
Not all those who wander are lost;
The old that is strong does not wither,
Deep roots are not reached by the frost.

From the ashes a fire shall be woken,
A light from the shadows shall spring;
Renewed shall be blade that was broken,
The crownless again shall be king.

Calendar

AIAA Houston Section events & other events related to aeronautics & astronautics.
This Nov. / Dec. 2011 issue of Horizons will be online by Wed., Dec. 7, 2011.
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.
Location: NASA/JSC Gilruth Center
Monday, December 5, 2011,
Monday, January 9, 2012,
Monday, February 6, 2012, &
Monday, March 5, 2012.

Tuesday, December 13, 2011:
Lunch-and-learn presented by AIAA Houston Section astrodynamics technical committee.
Speaker: H. "Sonny" White of NASA/JSC
Subject: Presentation from the 100 Year Starship Symposium, *Warp Field Mechanics 101*

Friday, May 18, 2011:
AIAA Houston Section Annual Technical Symposium (ATS 2011, see page 3)

AIAA National & International Conferences

9 - 12 January 2012 50th AIAA Aerospace Sciences Meeting including the New Horizons Forum and Aerospace Exposition
11 January 2012 Engineers as Educators
Location: Nashville, Tennessee, Gaylord Opryland Resort & Convention Center
24 - 26 Jan 2012:
AIAA Strategic and Tactical Missile Systems Conference (SECRET/U.S. ONLY)
AIAA Missile Sciences Conference (SECRET/U.S. ONLY)
Location: Monterey, California, Naval Postgraduate School
15 - 16 Feb 2012:
15th Annual FAA Commercial Space Transportation Conference, Type: AIAA Conference
Location: Washington, DC, Walter E. Washington Convention Center
20 - 21 Mar 2012: Congressional Visits Day
Location: Washington, DC, Venue: Capitol Hill, Type: AIAA Conference
26 - 28 Mar 2012:
10th U.S. Missile Defense Conference and Exhibit, Type: AIAA Conference
Location: Washington, DC, Venue: Ronald Reagan Building and International Trade Center
23 - 26 Apr 2012: 53rd AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference 20th AIAA/ASME/AHS Adaptive Structures Conference 14th AIAA Non-Deterministic Approaches Conference 13th AIAA Gossamer Systems Forum 8th AIAA Multidisciplinary Design Optimization Specialist Conference
Location: Honolulu, Hawaii, Venue: Sheraton Waikiki

CLASP: Clear Lake Association of Seniors Programs at UHCL

Jan. 5, 2012:
"The Space Shuttle in Retrospect" by Space Shuttle Program Manager John Shannon and Chief of the Flight Director's Office at NASA Johnson Space Center John McCullough;
Feb. 2, 2012:
"Lunar Detective Work: Meteorites Reveal the Moon's Early History and Evolution" by Lunar Planetary Institute Postdoctoral Fellow Julianne Gross;
Info: www.uhcl.edu/clasp, clasp@uhcl.edu, 5:30 - 7:00 PM, UHCL (room TBD), probably Bayou Building, 2700 Bay Area Blvd, free & open to community friends of all ages, Visions in our Midst lecture series, University of Houston at Clear Lake (UHCL), 281-283-2041, 281-283-2021

Cranium Cruncher

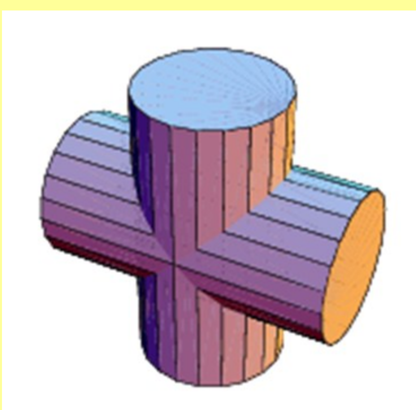
Challenge

DR. STEVEN E. EVERETT

*The puzzle in the last issue was one concerning time. The reader was challenged to find the instant at which hands on Earth and Mars clocks were simultaneously aligned. We can determine how often an Earth clock has its hands aligned by noting that this event happens 11 times during a 12-hour period, i.e., once every 12/11 hours. The Mars clock, which we noted runs at the rate such that the hour hand makes 2 revolutions every 24 Mars-hours, will have its hands aligned at the same frequency in Mars-hours. Since 24 Mars hours takes 24.6 Earth hours, its hands are aligned every 12.3/11 hours. Thus, hands on both clocks are aligned simultaneously at every instant in time which is evenly divisible by both 12/11 and 12.3/11, i.e., every 492/11 Earth-hours (41*12/11 and 40*12.3/11). If the hands on both clocks read 12:00 at the beginning of day 0, they will next be aligned on Earth on Day 1 when that clock reads 08:43:38-2/11 (PM), and on Mars on Day 1 when that clock reads 07:38:10-10/11 (PM).*

In the bonus question, the reader was asked how to modify the pendulum on an Earth clock so it measured Mars time, given that Mars gravity is 38% of that of Earth. The period of a pendulum is proportional to sqrt(L/g). If we want the period to be 12.6/12 longer, then the length of a Mars pendulum should be 41.9% of that of one on Earth.

The reader is presented with a solid geometry problem this issue. An intern, a young engineer, and an experienced machinist are discussing the propellant lines in a new spacecraft under development. A certain fitting consisted of two cylindrical pipes, both having an internal unit radius and 4 unit length, intersecting at right angles, as shown below. They were presented with the problem of computing the volume of propellant in this fitting. The intern stated, “I can get that solution by writing some code to solve for this volume numerically given some solid models. It should only take me a day.” The young engineer said, “Don’t you remember how to integrate on paper? I should be able to write out the integration equations and have that answer for you in an hour.” The experienced machinist, after considering the shape for a few moments said, “I don’t know how to write a program, and I’ve never taken a calculus class, but I do remember the area of a circle is πr^2 and the volume of a sphere is 4/3 πr^3.” With that information only, he was able to calculate the volume in his head. What was the volume and how did he do it?



E-mail solutions to steven.e.everett “at” boeing.com.

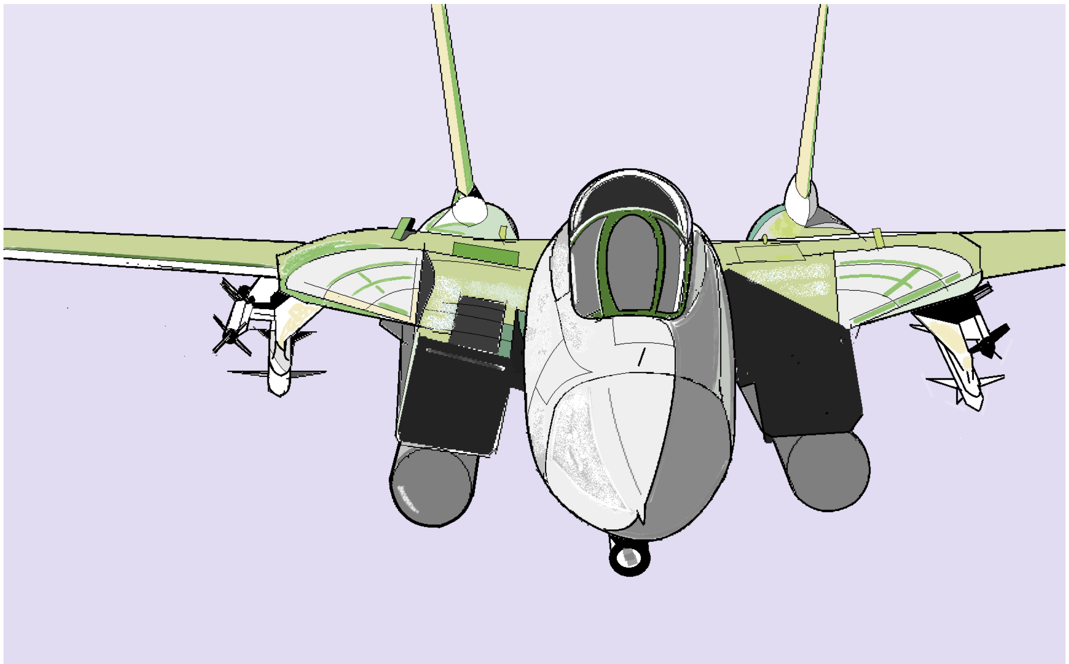
Art by Don Kulba

F-14 Tomcat

DON KULBA, CONTRIBUTOR

Right: An F-14A Tomcat aircraft from Fighter Squadron 101 (VF-101) gains altitude after takeoff, its landing gear still down. VF-101 provides F-14 readiness training for Atlantic fleet units. Location: NAVAL AIR STATION, OCEANA, VIRGINIA (VA) UNITED STATES OF AMERICA (USA). Date Shot: 1 Aug 1989. Camera Operator: PH2 BRUCE TROMBECKY, USN. Source: Wikipedia. Image credit: public domain.

Right: F-14 Tomcat, illustrated by Don Kulba

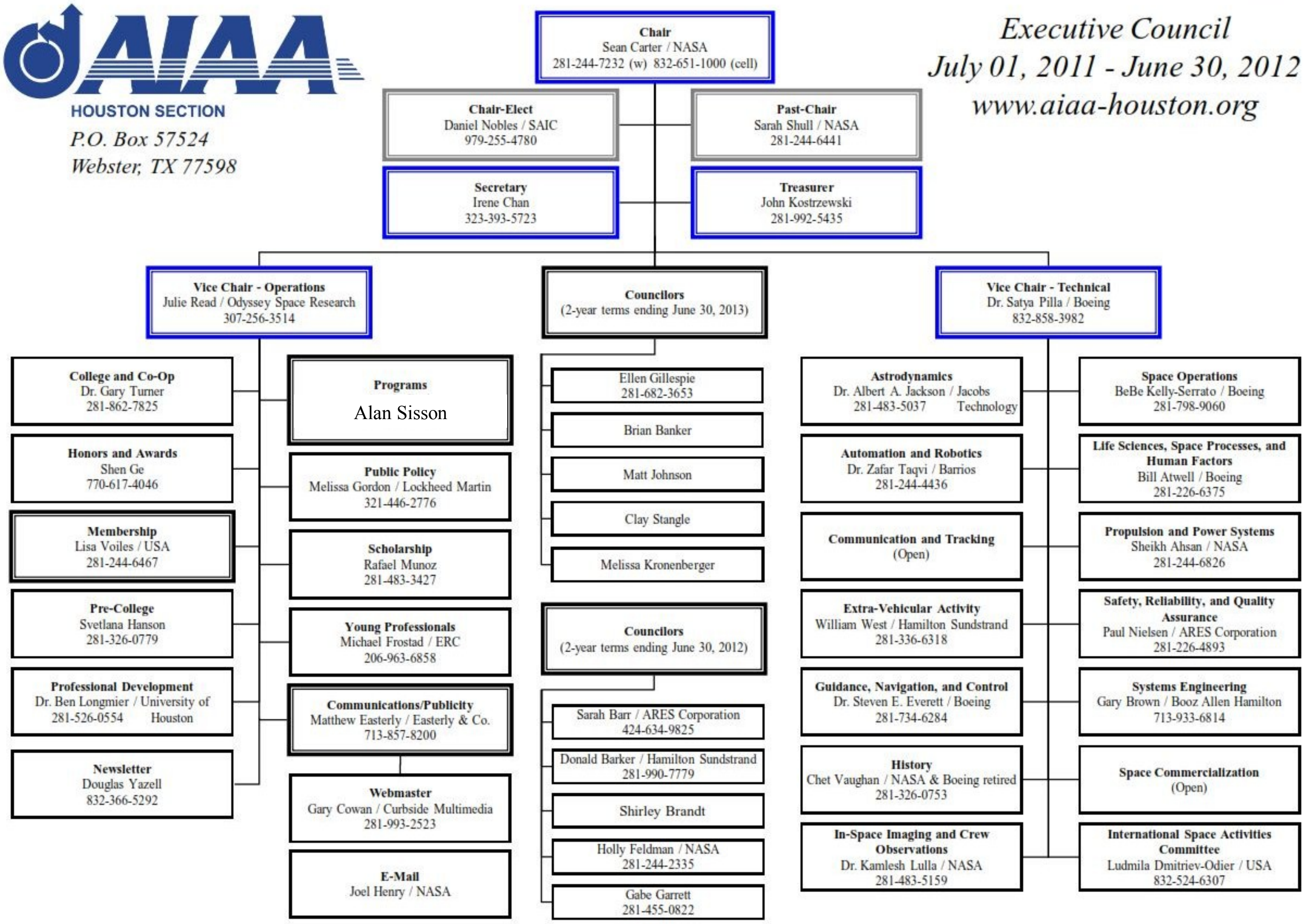


The American Institute of Aeronautics and Astronautics

Section News

HOUSTON SECTION
P.O. Box 57524
Webster, TX 77598

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



Updated July 1, 2012, Executive Council Voting Members (20) are identified by:

As this is issue is being written, a dinner meeting is scheduled for November 29, 2011, with guest speaker Dr. Nicholas Johnson, NASA/JSC, talking about the subject of orbital debris.

Since the AIAA year starts on July 1 for most purposes, our section's busiest time is always April and May, when events planned for the entire year will finally take place.

This year every technical committee in our technical branch is working hard to present at least one lunch-and-learn (LnL) and to host a one-hour session at our section's Annual Technical Symposium (ATS 2012, on May 18, 2012, at the NASA/JSC Gilruth Center).

Every other year our section hosts the AIAA Region IV Student Paper Competition, and this year is our turn again. It's a big job and it's in good hands again this year with leadership from Irene Chan and Daniel Nobles.

Three Booker T. Washington high school students and their teacher came to our November 2011 monthly council meeting to report in person about their excellent work in the rocket launch competition (aiming for 100,000 feet altitude) and their appreciation for our section's support this year and next year. Our previous issue of Horizons contains a related article, and a prior issue had a cover story about their superlative work.

AIAA Houston Section
P.O. Box 57524
Webster, TX 77598

TOC

Left: From left to right: James Kirkpatrick, AAS Executive Director, Frank Slazer, AAS President. Image credits: D. Yazell

Right: From left to right: Ellen Ochoa, Brewster Shaw (keynote speaker). Image credits: D. Yazell

Above: Selected snapshots from day 1 of 2 days of this AAS national conference in Houston, Nov. 15-16, 2011, at NASA/JSC Gilruth Center Alamo Ballroom. This conference of The American Astronautical Society (AAS) was called Celebrating Achievements, Celebrating the Future. See www.astronautical.org. Middle row: Left to right: John Shannon (Panel Moderator, Space Shuttle Program - 30 Years of Accomplishments), Wayne Hale, Kirk Shireman, (missing a photo of Jean Haensly), Bill Reeves, Milt Heflin. Tara Ruttley (ISS Utilization Update presentation). Bottom row: Kathy Nado (Panel Moderator, Then and Now - COTS / CRS Update), Alan Lindenmoyer, (missing a photo of Frank Culbertson), Brian Bjelde, Pamela Melroy, Daniel McCleese (Panel Moderator, Robotic Exploration of the Solar System), Jim Adams, (missing a photo of John Grotzinger), Don Yeomans, and Paul Spudis. Note that Pamela Melroy now works for the FAA with George Nield. Mr. Nield is the only person to serve twice as Chair of AIAA Houston Section, something to note as our section celebrates its 50th year, the year ending on June 30, 2012. Image credits: Douglas Yazell

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