Horizons

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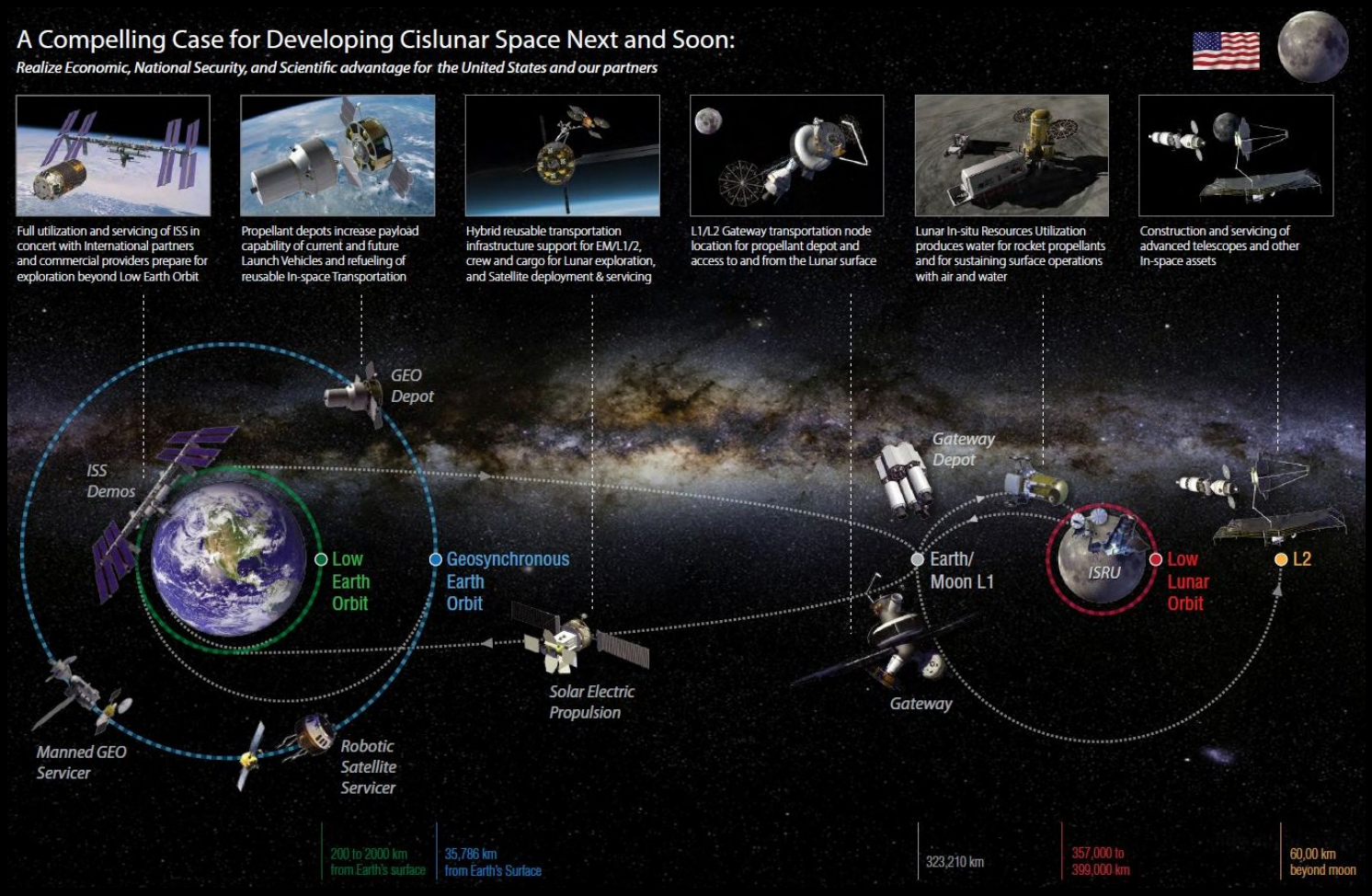
Develop Cislunar Space Next

Paul D. Spudis



AIAA HOUSTON
American Institute of Aeronautics and Astronautics

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Douglas Yazell
Editor
Past Editors: Dr. Steven E. Everett
Editing team: Don Kulba, Ellen Gillespie, Robert Beremand, Alan Simon, Dr. Steven Everett, Shen Ge
Regular contributors: Dr. Steven Everett, Don Kulba, Philippe Mairet, Alan Simon, Scott Lowther
Contributors this issue: Paul D. Spudis, Sean Carter, Daniel R. Adamo, BeBe Kelly-Serrato, Shen Ge

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March / April 2012

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Horizons and AIAA Houston Section Web Site
AIAA National Communications Award Winner

2005 2006 2007

Cover: Develop Cislunar Space Next. Image credit: John Frassanito & Associates, reproduced with permission and thanks.

2012 AIAA Congressional Visits Day (CVD)

From the Chair

SEAN CARTER, CHAIR

March 21, 2012

Houston Section Attendees: Brian Banker, Joe Mayer, Sean Carter

AIAA Houston members recently traveled to our Nation's Capital and participated in the AIAA's Congressional Visits Day (CVD). Each year, AIAA members – including scientists, engineers, researchers, educators, and technology executives – come to Washington, D.C. to take part in AIAA CVD, meeting with national decision makers to discuss critical issues in civil aeronautics, civil astronautics, and defense.

What's Our Goal?

Through face-to-face meetings with members of Congress, congressional staffers, key Administration officials, and other decision makers, Congressional Visits Day raises awareness of the long-term value that science, engineering, and technology bring to America. After all, AIAA is the world's largest technical society dedicated to the global aerospace profession. We represent over 30,000 professional who vote. The AIAA National Public Policy Committee plans the event throughout the year to ensure that our voice is heard throughout the halls of Congress.

This year's Key Issues, as determined by the AIAA Public Policy Committee, were:

1. Assuring the Viability of the US Aerospace and Defense Industrial Base
2. Dealing with Counterfeit and Malicious Hardware
3. Supporting an Evolving and Adaptive Cybersecurity Policy
4. Lessening the Impact of Export Controls on the Domestic Aerospace Industry
5. Sharing Stewardship of the Federal Aeronautics RDT&E Infrastructure
6. Developing a Robust Next Generation Air Transportation System
7. Strengthening the National Commitment to Aerospace Research and Development
8. Facilitating Assured, Cost-Effective Human Access to Space
9. Recruiting, Retaining, and Developing a World-Class Aerospace Workforce
10. Increasing Emphasis and Funding for Technology and Engineering in STEM

All of the members from Region IV worked together as TEAM TEXAS by visiting the offices of the following Members of Congress:

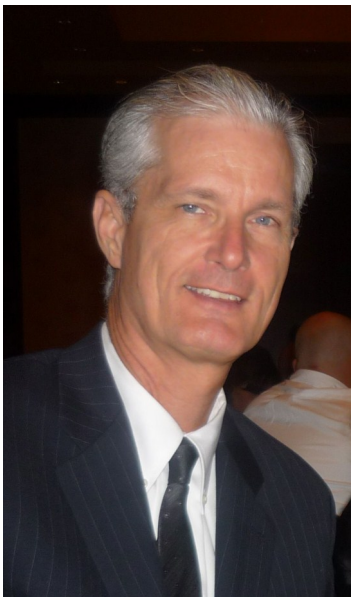
Charlie Gonzalez (TX-20)
Ralph Hall (TX-4)
Pete Olson (TX-22)
Lamar Smith (TX-21)
John Culberson (TX-7)
Francisco Canseco (TX-23)
Senator Kay Bailey Hutchison (TX)
Senator John Cornyn (TX)

Left: Back Row, L to R: Thomas Moore, Sean Carter, Congressman Ralph Hall, Joseph Mayer, Paul Giangarra. Front Row: Brian Banker. Thomas & Paul are from the Southwest Texas Section. Sean, Joseph, & Brian are from Houston Section. Congressman Hall is the Chairman of the House Committee on Science, Space, and Technology.

From the Editor

The Next Logical Step

DOUGLAS YAZELL, EDITOR



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

Our web site www.aiaa-houston.org includes Horizons back issues to 2005 or earlier. For earlier issues (an incomplete archive being slowly updated) click here.

Paul D. Spudis supplies an excellent cover story for this issue, and the outstanding illustrations are provided by John Frassanito & Associates. Some might call this The Next Logical Step, but Paul Spudis uses the title Develop Cislunar Space Next.

It might seem that we canceled Constellation because of its cost (also because it was too Moon-centric), then replaced it by what the Augustine Committee called a Flexible Path, an equally expensive option. Are the appearances deceiving? Is the current path for NASA the best possible path given the funding available?

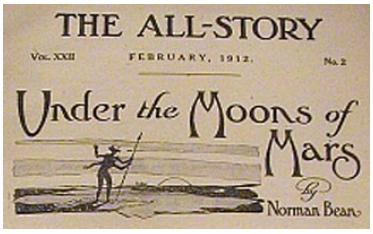
Is it realistic to call for a crewed mission to an asteroid in 2025 when the mission is announced in 2010?

As our astronauts train for asteroid rendezvous, we keep in mind the chances of an asteroid hitting the Earth again, an asteroid something like the dinosaur killer from 65 million years ago. A publicly available report quantifies that danger: *Defending Planet Earth* (2010).

Scott Lowther's APR article in this issue is especially nice. It is also a good fit with our NASA/JSC aerospace community here in the Houston area. The color painting by renowned British aviation artist Douglas Ettridge of a space shuttle orbiter being dropped by Virtus is excellent.

Robert Heinlein said that Edgar Rice Burroughs wrote good science fiction for his time, such as A Princess of Mars from 1912, featuring the princess Dejah Thoris. The hero, John Carter of Virginia, becomes a hero on Mars not long after our American Civil War. If you are one of the ten or twenty people who reportedly saw the new Disney John Carter movie, I hope you noticed that among her many tattoos, the right arm of Dejah Thoris displays a Mickey Mouse tattoo: three circles, two side by side for the ears and one just below them to represent his head. I recall that those novels described planet-wide danger due to trouble with their atmosphere-maintaining machinery. That is a coincidence, since "...there is almost no disagreement among climate scientists that the planet is [warming], and will continue to warm due to human emissions of greenhouse gases." That is an April 2012 quote from the Houston Chronicle science/space/weather journalist Eric Berger.

Our next issue might contain an article about the 50th anniversary of AIAA Houston Section, an event we will celebrate in late June 2012. Instead of publishing that issue by June 30, 2012, we might publish a few weeks earlier.



Above: 100 years ago, February 1912. Image credit: Public domain. Image source: Wikipedia (cropped).

Wikipedia article excerpts: A Princess of Mars:

Burroughs began work on A Princess of Mars in the summer of 1911 when he was 35. He wrote most of the first half of the novel while working for his brother in a stationery company, penning the words on scratch pads produced by the business. He had been struggling for some time to establish himself as a businessman, so far with little success, and with a wife and two children to support, turned to writing in desperate need of income. Despite failure in his business affairs, he had accumulated a wealth of unusual experiences from working a variety of jobs which had brought him into contact with miners, soldiers, cowboys, and Native Americans.

When Burroughs received his acceptance letter from Thomas Metcalf of The All-Story, Metcalf said that the serial would be published under the title In the Moons of Mars. However, when the first part of the serialization appeared in the February 1912 edition of The All-Story, it bore the title "Under the Moons of Mars." For serial publication, Burroughs used the pen name "Normal Bean," chosen as a type of pun to stress that he was in his right mind, as he feared ridicule for writing such a fantastic story. The effect was spoiled when a typesetter interpreted "Normal" as a typographical error and changed it to "Norman."

Cover Story

Develop Cislunar Space Next

PAUL D. SPUDIS

The retirement of the Space Shuttle, our national space transportation system, accentuates the absence of national leadership in the American civil space program. Since the Vision for Space Exploration was discarded by the current administration in 2010, confusion and uncertainty reign as the agency is mired in building a launch vehicle they do not want in order to implement human missions of undefined rationale and scope beyond low Earth orbit to destinations whose outstanding characteristic is that they have not yet been visited. Meanwhile, our aerospace industrial infrastructure and human workforce dissipates into nothingness as the vacuum of leadership intensifies. We depend on foreign assets for access to and from the International Space Station, a transportation system whose reliability is in question on the basis of several recent mishaps. With no clear long-term strategic objectives and squabbling over the roles government and commercial sectors, confusion rules supreme.

In an era of limited resources, our challenge is to create a worthwhile space program with a rate of expenditure that falls at or below a supportable level; recent history suggests that approximately 0.5% per year or less of the discretionary federal budget is the level that is politically sustainable. Given this stringent fiscal reality (regardless of assertions about either the desire or intent for deep space destinations), it is highly likely that destinations in cislunar (Earth-Moon) space will be the sphere of human space operations for the foreseeable future. What are we doing in space and why are we doing it? Attempting a series of space exploration "firsts" (flags-and-footprints forever) implies one set of activities and missions. Incrementally developing a permanent space transportation infrastructure, one that creates an expanding sphere of human operations, suggests a different approach.

The Real Debate

The real debate should not be about launch vehicles or spacecraft or even destinations, but about the long-term purpose of our civil space program. Different rationales have been proposed, including: scientific knowledge, technology development, creating enthusiasm for science and math education, societal inspiration and many others less tangible. Fundamentally, all of these rationales (not all of them mutually exclusive) may have merit to a greater or lesser extent, but in times of national fiscal uncertainty, only those projects providing clear practical value and understandable societal benefit have any reasonable expectation of long-term political and fiscal support.

Long-term aspirations, such a human missions to Mars or space settlement, get gener-

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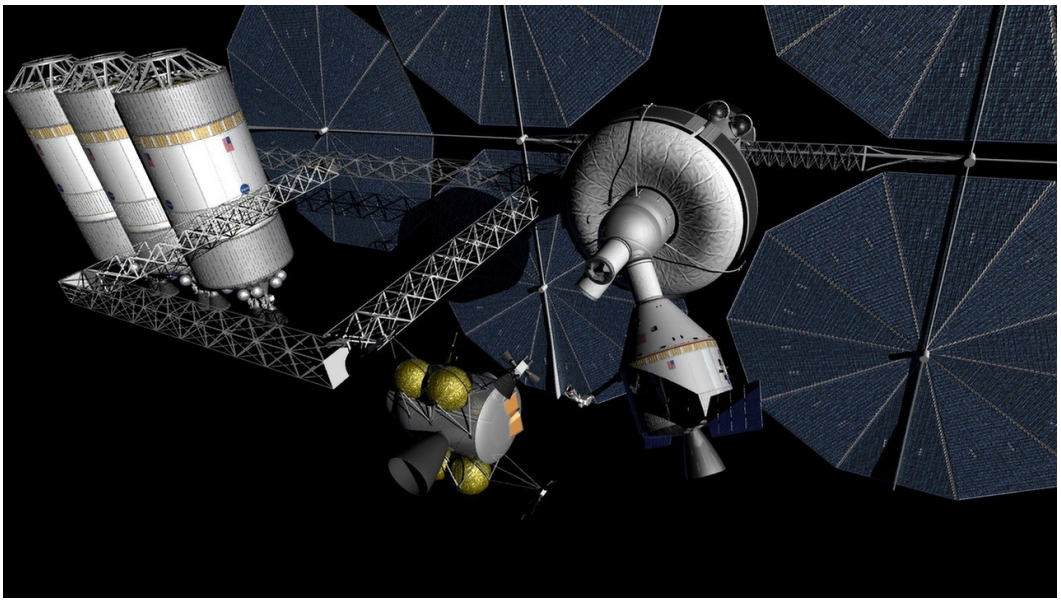

Left: Depot and staging node in cislunar space. Propellant is initially supplied from Earth, but goal is to supply LOX and LH_2 propellant from the poles of the Moon. Image credit: John Frassanito & Associates, reproduced with permission and thanks.

Cover Story

(Continued from page 5)

ous and eager news coverage but they are too distant in both time and technical readiness (on the scale of a decade or a presidential term of office) to serve as rationales for the civil space program. Because Mars may harbor former or existing life, NASA has presumed it to be our "ultimate destination" in space. In effect, the human spaceflight effort is rationalized as "The Quest for Life" (which means maybe finding a fossil or bacterium, not ET). The debate about what to build, where to go and how to do it is always formulated towards massively expensive missions to Mars. This unspoken assumption has been at the root of most studies for space program objectives for the past 20 years.

Mars was the end point of President George H.W. Bush's Space Exploration Initiative, President George W. Bush's Vision for Space Exploration, of former Lockheed Martin President Norm Augustine's two reports, and a myriad of space groups and societies. From the 1990s to the present, a multi-billion dollar robotic campaign has sent mission after mission to Mars, with each "discovering" for the first time that the red planet once had liquid water. The mania for Mars and our preoccupation with searching for life has limited our perceptions of the purpose for a space program – distorting our reality of what is possible or attainable on reasonable time scales with available resources. The simple fact is that Mars is presently unreachable in both technical and fiscal terms and will remain so for the foreseeable future.

A better approach to space exploration would: use existing assets to the maximum extent possible, rely on in-hand technology, and extend our reach incrementally. Ultimately we seek the ability to go everywhere and do everything. That objective is currently unattainable because we do not posses the infrastructure needed to routinely travel throughout the medium of interplanetary space. Given this restriction, it makes sense to develop a space system in a slow, incremental manner whereby each new step works in tandem with previously emplaced pieces, creating an integrated system extending beyond LEO. It can be built up as slowly or as quickly as is needed or permitted by exigent circumstances – in lean budget years, we go slower, but can pick up the pace if more funding becomes available.

Real Goals and Objectives

At the end of the 1960s, when the Apollo mission objective of man-Moon-decade was satisfied, the nation attempted to return to a logical, incremental sequence of increased spaceflight capability. Laid out by Wernher von Braun over 60 years ago, this sequence first envisions routine access to and from LEO, followed by a space station to serve as a platform for missions beyond, a Moon tug to travel to and from the Moon and other localities in cislunar space, and finally, interplanetary missions, including human missions to Mars and

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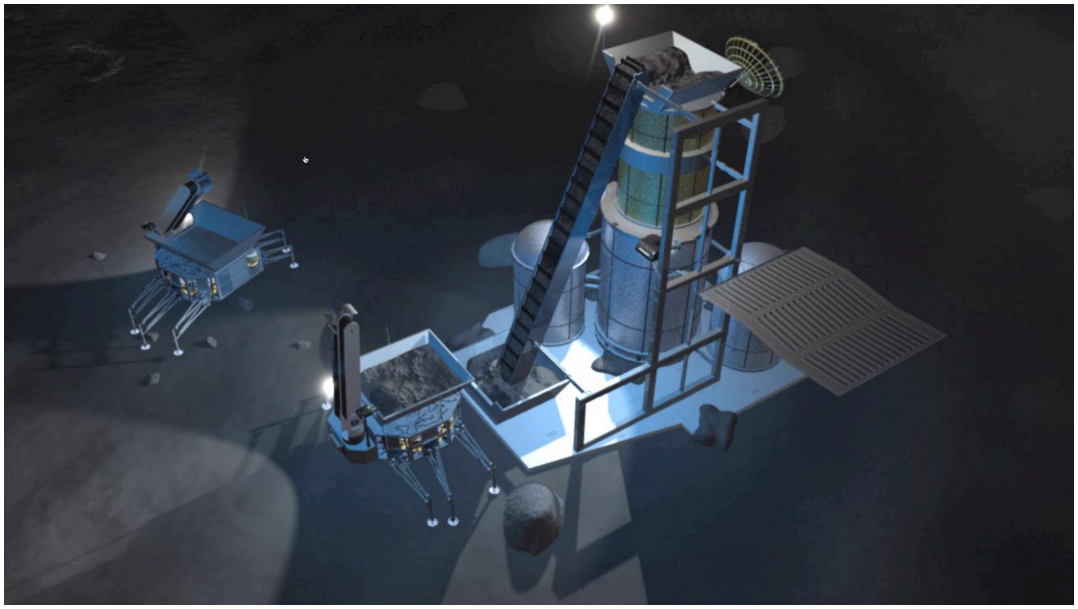

Right: Robotic ore haulers bring ice-rich soil to processing machines for water extraction and subsequent propellant production. Image credit: John Frassanito & Associates, reproduced with permission and thanks.

Cover Story

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beyond.

The Space Shuttle and International Space Station programs were attempts to implement the first steps of this template. For a variety of technical, programmatic and political reasons, these programs developed along non-optimum lines, only partly serving as a working space system. But the basic concept of incremental extension of human reach into space is still valid. As we have a working Space Station, the logical next step is to increase human reach to the Moon, with routine access to the lunar surface and all places in cislunar.

In implementing such an objective, we must reconsider and revise the existing paradigm of spaceflight, which holds that we design custom-built spacecraft, launch them on expendable vehicles, operate them for a time, and then abandon them as space debris. This interminable "Groundhog Day" process continues with each new mission starting from scratch, requiring new development, testing and fabrication. A new template would develop and launch flight elements designed for continuous service and re-use. We would assemble and maintain large distributed space systems and service them with robotic and human assets throughout cislunar space. With such a system in place, the size and capability of Earth orbital satellite assets are literally unlimited. That such an operational principle is possible is demonstrated by such past missions as the Hubble Space Telescope servicing and the building of the International Space Station.

This is a very different kind of space program than the one we are currently attempting to implement. Instead of individual missions in custom-designed spacecraft to distant destinations (for science or to plant the flag) we instead develop a robust, reusable space faring system that can be adapted to a wide variety of potential missions – to build, to service and maintain, to explore, or to live. We satisfy all objectives and impulses to explore space by designing and building a reusable, extensible system for space travel. Just as the American West was opened for development and settlement by the building of the transcontinental railroad, the construction of a cislunar space transportation system will open up and spawn the utility of a vast space frontier.

We Need a Navy to "Sail on the Ocean of Space"

If our goal is to "sail on the ocean of space," we need a fleet. Navies don't operate with just one class of ship because one class isn't capable of doing all the various and necessary jobs. Not all ships will look or operate the same because they will have different purposes and destinations. Needed are transports, way stations, supply depots, Space Station, and ports. In space terms we need the means to get people and equipment to different orbits: Low Earth Orbit (LEO), to and from points beyond LEO, to way stations and outposts at Geosynchronous Earth Orbit (GEO), to stable Libration

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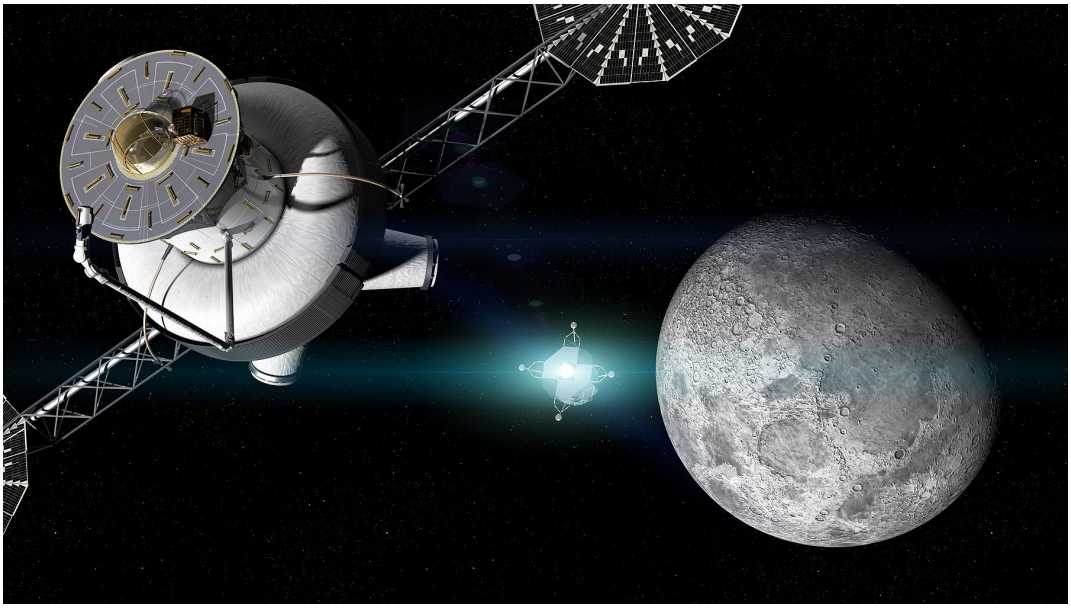

Left: Spacecraft departs Earth-Moon L1 node for lunar surface mission. Image credit: John Frassanito & Associates, reproduced with permission and thanks.

Cover Story

(Continued from page 7)

Points that are located at the equilibrium of the Moon and Earth gravity, to low lunar orbit, and to the lunar surface. In order to fuel and provision this space fleet, staging nodes and supply and propellant depots are required in various places in cislunar space, including such possible locations as LEO, the Earth-Moon L1 and L2 libration points, low lunar orbit and on the lunar surface. Ports of call are all the places we may go. Initially, those ports are satellites in various orbits that require service, maintenance and replacement with larger, more capable systems. Later, our harbor will be the surface of the Moon, to harvest its resources, thereby creating more capability as well as developing the ability to provision ourselves and the expanding transportation network by utilizing what is found in space. Reliable and frequent access to any place in the solar system, not singular trips to a couple of destinations, should be our ultimate goal.

In the past few years, a series of international missions to the Moon has demonstrated that the lunar surface contains significant deposits of water ice near both of its poles and at certain pole locations offers near-permanent sunlight. The Moon is close enough to Earth so as to permit nearly instantaneous remote control of robotic machines from operators on Earth. These facts allow us to set up remotely controlled, robotic resource-processing outposts on the Moon and begin the production water, the most useful substance in space. Water can support human life, serve as a medium for energy storage, and is the most powerful chemical rocket propellant known. Thus, the Moon serves a critical role in the development of cislunar space – it is our first "offshore supply base" for our emergent space navy.

Custom designing and building mission-specific vehicles and elements forfeits the option of going everywhere and doing everything. By adopting an incremental, cumulative space faring model, we *enable* missions to Mars and many other destinations. This affordable model will sustain repeated trips by using the infrastructure and propellant resources provided by a space-faring navy. Building a series of one-off spacecraft – huge launch vehicles to dash to Mars for expensive, unsustainable stunts – will keep us locked into our current predicament.

The space program needs rethinking

It is the mindset of the space program that needs rethinking – not the next destination, not the next launch vehicle, and not the next spacecraft. How do we exit this endless discussion loop? First, we need to understand and articulate true choices so people can understand and evaluate the different approaches and requirements. Second, we need to develop architectural approaches that fit the requirements for fiscal and political "sustainability." Finally, we need to get such plans in front of the national leadership.

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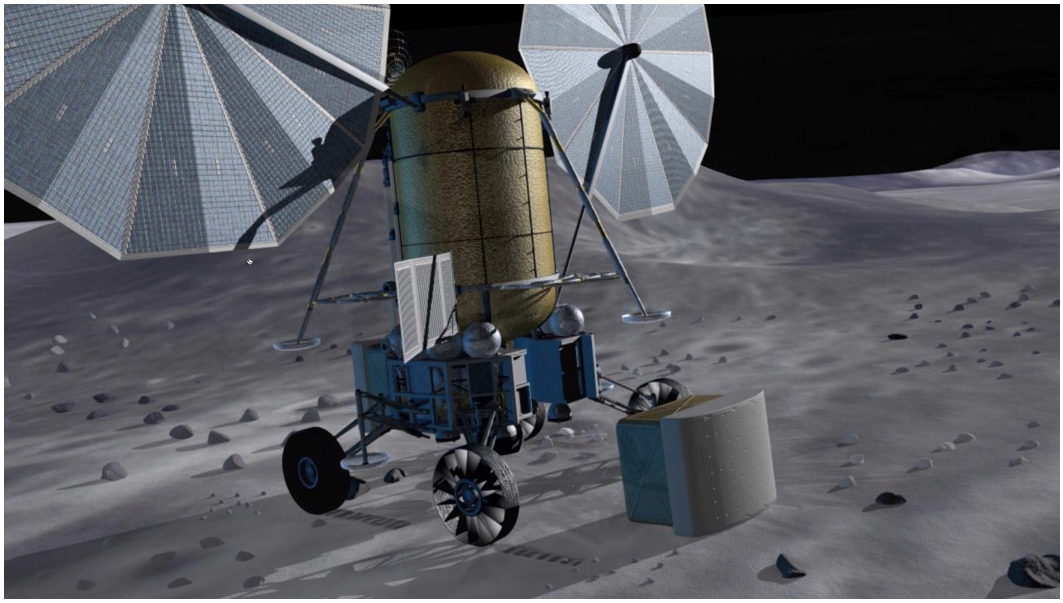
Right: Robotic spacecraft lands and delivers payload to lunar surface. Lander deploys solar arrays and becomes fixed surface power generation asset. Image credit: John Frassanito & Associates, reproduced with permission and thanks.



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A cost-effective, sustainable human spaceflight program must be continuous, incremental and cumulative. It must continually expand our reach, creating new capabilities over time, while contributing to compelling national economic, scientific and security interests. Building a lasting and reusable space transportation system based around the development and use of lunar resources does that, whereas a series of singular destination missions will not. The original intended purpose of the Space Shuttle system was to incrementally move into the Solar System – first a Shuttle to-and-from LEO, then a Space Station as a jumping off platform, and then going beyond LEO into cislunar space. The Shuttle-derived heavy-lift cargo variant was always envisioned to go beyond LEO and on to the Moon. Decommissioning the Shuttle, the only proven operational heavy lift human launch capability, with no replacement in hand to get U.S. astronauts into and back from space was a mistake. The first step in rectifying that mistake is to use this crisis to adopt a new approach to the problem of human spaceflight.

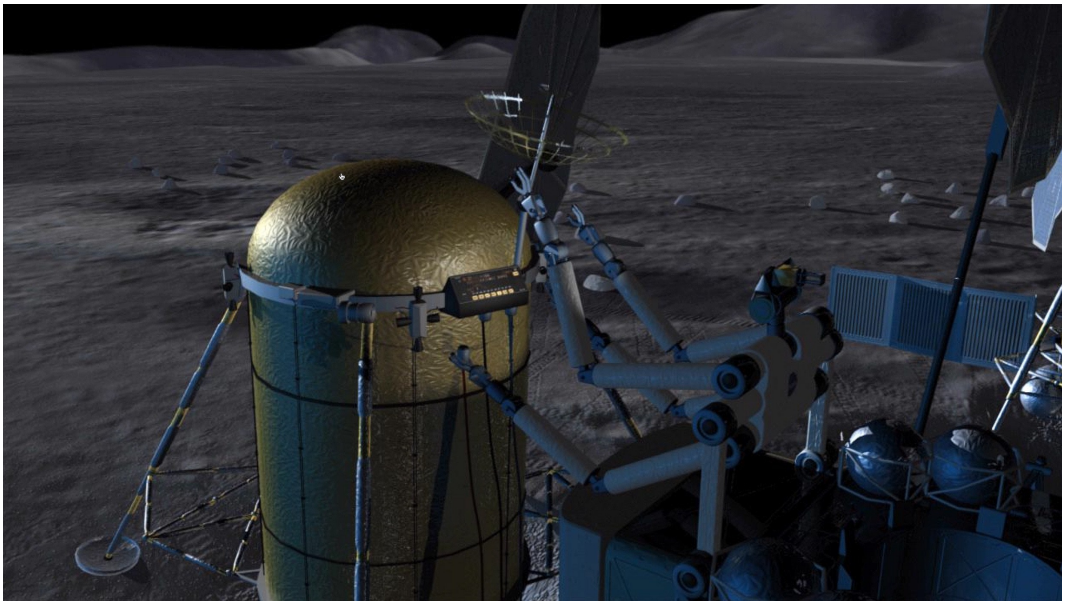
The right answer

The right answer is to adopt the principle that we are going somewhere with the purpose of gradually yet continuously expanding human reach in space. Initially, we develop an architecture using smaller launch vehicle assets, launching more frequently, and making these pieces work together to build up new and expanded capabilities throughout cislunar space. By taking these steps, America can fly spacecraft, create new commercial markets, access and protect the International Space Station and expand human reach beyond LEO.

It is not only important for America to lead in space, but to be seen to lead. Other space faring nations are pursuing expansion beyond LEO into cislunar space; some of these powers do not share our values or belief in free markets and democratic pluralism. If such economic and political paradigms do not exist on the new frontier, there is no assurance that they will emerge spontaneously. Having America actively involved in human expansion into space is likewise no guarantee that such values will prevail here, but such a system is more likely to develop and take hold if we are present and active in this grand and necessary endeavor. We may not worry about this now, but the future is always in question. By developing cislunar space next, our values and the societal paradigm of free markets, rule of law and democratic pluralism is much more likely to prevail on the new frontier of space.

To stand down the development of cislunar space for the better part of a decade is detrimental not only to our national interests, but to the future interests of the world and to generations yet unborn. By ceding this territory to others, we endanger our future by forfeiting technological advancement and economic development of the solar system to those who understand its potential and who are willing to lead.

For more information:
www.cislunarnext.org



Left: Robotic servicing systems, teleoperated by controllers back on Earth, operate and maintain a propellant production plant on the Moon. Image credit: John Frassanito & Associates, reproduced with permission and thanks.

NSRC 2012

Next-Generation Suborbital Researchers Conference (NSRC) 2012, February 29 - 29, 2012.

NSRC 2012 in Palo Alto, California

SHEN GE, CONTRIBUTOR

Palo Alto, California has always been a magnet attracting visionaries, sometimes from the fringes of society but usually firmly grounded in reality. Three years ago, a number of mavericks with a lot of bravado but not that much to show for it gathered at a hotel to attend a conference called the Next-Generation Suborbital Researchers Conference (NSRC). There were over a hundred attendees for that first event, and attendees included some with engineering and science skills, some with money, and some interested bystanders who wanted to know where this was going.

Right: Neil Armstrong (right) spoke about the X-15. At left is planetary scientist Alan Stern. Image credit: David Klaus.

Late February 2012 marked the third annual occurrence of the NSRC, and though it's still packed full of mavericks, there were also quite a number of NASA managers, and not just from nearby NASA Ames. These NASA officials chose to come not because of proximity but rather because of opportunity. Credibility can hardly be more substantial when Neil Armstrong opens the talks with a blast from the past about his experience with a suborbital program which was funded by the government and called the X-15.

Right: Dr. Ryan L. Kobrick with Neil Armstrong. Image credit: Dr. Ryan L. Kobrick.

Right: Dr. Ryan L. Kobrick with Neil Armstrong. Image credit: Dr. Ryan L. Kobrick.

The NASA Flight Opportunities Program (FOP), a substantial NASA presence aside from the Ames Research Center, was a good indication that NASA leaders are interested in the NSRC and the NSRC is no longer a maverick-focused show. NASA's FOP had a substantial booth for the three and a half days of the conference, with its neat NASA table set up already on Sunday night, the evening of a social event before the actual three-day conference.

NASA clearly meant to sup-

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port suborbital spaceflight through being the customer of spaceflight companies such as XCOR, which, by the way, had a huge presence at the conference, and was one of the primary sponsors. The NASA FOP provides this support to suborbital flight by supporting research from universities or institutions that require a payload to be launched on one of these new suborbital vehicles, such as the XCOR Lynx, which is currently in development.

The natural question here is why suborbital flight is getting so much attention among researchers, as opposed to orbital flight. Aren't there already microgravity experiments being conducted on the International Space Station (ISS)? Doesn't suborbital flight provide only a few minutes of weightlessness? How can anyone do experiments in that suborbital flight environment?
Suborbital flights are substantially cheaper than orbital flights, and they face fewer bureaucratic hurdles to fly payloads. XCOR's Lynx ticket will cost a bit less than $100K, still a significant amount for a private citizen, but a reasonable amount for a well-endowed institution or university. Furthermore, researchers using orbital flights sometimes wait for months before launch before being informed that their research was not accepted for launch. Room for experiments on the ISS is limited. Turnaround time for experiments on ISS is slow. Suborbital flights from new providers such as XCOR and Armadillo Aerospace provide a new model. Reusability and rapid turnaround time for customers are strongly emphasized. This attracts researchers (customers) and ensures steady revenue streams for private space companies.

Some experiments are better suited to the suborbital (not orbital) flight condition. For instance, there was a professor at NSRC 2012 from the University of Florida whose experiments dealt with gene changes in plants as they transition from our daily Earth environment to the orbital environment. Flying those plants to Low Earth Orbit (LEO) will not help with the experiments since after arrival on the ISS, the plants will already have changed their genes.

A NASA/JSC project dealt with a lunar particulate matter experiment which required detection with a specific radiation tracer. How long does this lunar particulate matter with a specific half-life in the presence of radioactive decay stay in existence in reduced gravity? This question is difficult to answer now, since parabolic flight does not provide enough time in the microgravity environment, while orbital flight takes so much time that the decay is complete early in the flight and a significant amount of expensive on-orbit experiment time is wasted.

A NOAA experiment co-investigated by Brian Shiro, a NOAA researcher and the CEO of Astronauts4Hire (A4H), is detecting ionized atom concentration at a specific suborbital altitude to predict impending earthquakes. The theory is that before an earthquake, the Earth's crust opens enough so that charged particles are ejected from beneath the Earth and fly to a certain altitude, interacting with the particles there. These ionized particles only rise to a certain altitude, and detection can best be done by flying to those suborbital altitudes.

In addition to the researchers, the suborbital companies held center stage. A quick rundown on some of the more interesting highlights will suffice for now:

- Blue Origin's Mr. Brett Alexander said that asking NASA to develop justification for flights is like asking AT&T to develop justification for apps such as Angry Birds. He made an analogy as such:

	Wireless	Space	Cost to Develop ($)
Network/ Infrastructure	AT&T, Verizon, etc.	USG (NASA/USAF), Russia, China, Europe	Billions
Platforms	iPhone, Android, Kindle, etc.	Blue Origin's New Shepard, etc.	Millions
Applications	Hundreds of thousands of apps including Angry Birds	Flights for research, tourism, etc.	Thousands to hundreds of thousands

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NSRC 2012

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- Armadillo Aerospace plans to team up with Space Adventures in creating Hyperion, a manned suborbital craft that will enable lifting 200 kg up to an altitude of 100 km.
- XCOR's Lynx should be flight ready later this year and if not, at latest next year. XCOR also gave a free ticket in a lottery drawing to all conference attendees not involved in the conference organization. I did not win or this would have been a different article entirely.
- Virgin Galactic is a spaceline and not an engineering company. To prove that it is a spaceline, William Pomerantz ended the talk with a slide showing an aircraft with Virgin Airlines emblazoned on its side landing at the San Francisco Airport along with White Knight 2 carrying SpaceShipTwo with Virgin Galactic logo emblazoned on its side.
- Masten Systems expressed its uniqueness by saying that it is the only orbital space company at NSRC 2012 that does not aim at producing human-rated spacecraft, giving it a distinct advantage in cost and reliability for payloads.
- Near Space Corporation is the only suborbital space company signed up with NASA's FOP that uses lighter-than-air craft, i.e. balloons, to go up. They also have small Unmanned Aerial Vehicles (UAVs) as an option to carry the payload back to precise locations.

Affiliated support organizations for the private space companies, researchers, and NASA were also present. For instance, there was a significant presence of Astronauts4Hire, an organization that recruits and trains qualified scientists and engineers for spaceflight with their own booth and multiple presentations. There were small aerospace consulting companies such as Astrowright. Also to be not understated, there were also a number of small startups and other rocket companies which haven't reached a point to rear their heads just yet. They attended NSRC 2012 see what the leaders in private space industry are doing before announcing their entrance into the industry.

The education segment in the conference was emphasized as well. Dr. June Scobee Rodgers, the founding director of the Challenger Center, an educational institution, was one of the keynote speakers in the opening ceremony. Many of her statements were inspiring, and one resonated especially strong with the crowd, "The greatest risk is to take no risk."

NSRC 2012 was a mix of private space industry entrepreneurs and engineers, university and institutional researchers and engineers, NASA managers and engineers, educators and journalists, and a few people on or over the borderline of the fringes of our society. Quite a few visionaries are creating a new business in space, a new space age, taking an incremental path by starting with suborbital space, a small step on the way to more important destinations. Maybe those on the fringe today will be the most respected visionaries in the near future. Next year's NSRC will be in Colorado so we'll be sure to know more by then.

Below: A logo from the web site for Astronauts for Hire. They have a newsletter of their own at this address: http://issuu.com/Astronauts4Hire/docs/a4h_newsletter_issue_2.

Lunch and Learn

Cargo Resupply to the International Space Station (ISS): A New Commercial Contract with NASA, by Carl E. Walz, Orbital Sciences Corporation

BeBe Kelly-Serrato, Chair, AIAA Houston Secition Space Operations Technical Committee

A wealth of information was presented in our section's first lunch-and-learn for 2012, presented by Carl Walz, Vice President of Human Spaceflight Operations at Orbital Sciences Corporation. Mr. Walz, a former NASA astronaut, supported both the Space Shuttle program (on three flights) and Expedition 4 on board the International Space Station (ISS). He also served at NASA headquarters before taking this post with Orbital.

Mr. Walz provided an overview of Orbital Sciences Corporation and a current program status for the Commercial Orbital Transportation Services (COTS) and the Commercial Resupply Service (CRS) programs. He stated that Orbital had a diversified multi-market customer base, with a business breakdown in 2011 of 37% Department of Defense and intelligence agencies, 35% NASA, other civilian agencies and universities, and 28% Commercial and international satellite operations. Mr. Walz described a high-caliber workforce of 3,700 employees, including 1,850 engineers and scientists. He described employees at Orbital's four major operating locations in the USA. Mr. Walz broke down Orbital's 725 space missions since 1982 into several groups including 69 commercial satellites, 68 government satellites, 40 space payloads, 70 space launch vehicles, 185 interceptor vehicles and 301 sounding rockets.

The company's launch experience covers a variety of space systems including small and medium payloads as well as special-purpose vehicles. Mr. Walz presented launch statistics for the last ten years which showed a 96% success rate for 108 launches.

After Mr. Walz related the history of Orbital, he described the current status for their COTS and CRS programs. Orbital's cargo resupply vehicle is Cygnus, an advanced maneuvering space vehicle, and is designed to meet the high safety standards and requirements for ISS space operations. Orbital's Antares launch vehicle is the "cost-effective" ride for Cygnus and will resupply the ISS under the CRS contract. ISS resupply was previously based largely on the Space Shuttle program. Orbital's Cygnus spacecraft will join JAXA's HTV, ESA's ATV and Russian Progress capsules to provide ISS resupply now that the Space Shuttle program has ended.

Mr. Walz discussed the components of the Cygnus resupply vehicle and how it would berth with the ISS. He also presented an overview of the launch and mission operation facilities, including the hardware process flow for both the Cygnus resupply vehicle and the Antares launch vehicle.

Left: Carl Walz of Orbital Sciences Corporation at the NASA/JSC Gilruth Center for this event. Image credit: Douglas Yazell.

Charts used by Mr. Walz in this presentation are or will soon be available on the web page of our Space Operations Technical Committee, along with the publicity flyer for this event. Meanwhile, the publicity flyer and charts are available to the public temporarily via Dropbox.

Below: Guest of honor Carl Walz and host BeBe Kelly-Serrato at the entrance to the NASA/JSC Gilruth Center, in front of the recently installed mural by artist Pat Rawlings. Image credit: Douglas Yazell.

Dinner Meeting

NASA/JSC: Leading the Next 50 Years of Exploration, by Douglas Terrier

SHEN GE, CONTRIBUTOR

On March 27, 2012, Douglas Terrier, Deputy Director of NASA Johnson Space Center, Strategic Opportunities and Partnerships Development (SOPD), came to the NASA/JSC Gilruth Center to be our guest of honor and dinner speaker. His talk connected the first efforts of humanity looking skyward to what's happening today. The efforts of Copernicus, Brahe, Kepler, and Newton, and this century's Hubble, have pushed the frontiers of what we know.

From the dawn of mankind, we have continually built machines that extended the perception of our reach. Galileo used the telescope to see the heavens and discovered new wonders. Yet, a central message that must be iterated and is especially relevant to NASA today is that progress in spaceflight and space instruments were always dependent on geopolitical factors.

Galileo was not paid to make a telescope; he was paid so that the device could allow Venice, the preeminent maritime power of the day, to have a longer warning time in case of attack from the sea, since the visibility had been extended. John F. Kennedy did not send us to the Moon because he was a visionary inspiring leader who saw a future in space. In a letter dated April 20, 1961, he said [on going to the Moon] "…otherwise we shouldn't be spending this kind of money since I'm not that interested in space." Clearly, he was working hard to find *anything* that would create and maintain international faith in the technical abilities and prestige of the United States of America in the era of the Cold War.

In the early 1990s after the collapse of the Soviet Union, Bill Clinton teamed up with the Russians in developing the International Space Station, not due to an interest in exchange of technical knowledge, but rather because NASA could be used as an instrument of peaceful foreign policy. NASA was solving geopolitical issues then and it still is now. There were 25 programs cancelled in the last 25 years since few administrations can agree on the importance of programs that can last for years.

The solution lies in international collaboration and external bipartisan agreements. NASA cannot be like IBM which failed to understand the game had changed and still kept building mainframe computers though people wanted

Below: Guest of honor Douglas Terrier.

Below right: Norman Chaffee (NASA, retired) asking a question. Image credits: Douglas Yazell.

Right: A snapshot of the audience at NASA/JSC Gilruth Center Alamo Ballroom as our guest answers questions. Image credit: Douglas Yazell.

personal computers. By not taking the young game-changing entrepreneurs from Palo Alto seriously they almost made themselves obsolete. NASA must not find itself in the same boat and must define itself as relevant to the people of the USA or those outside of our space community will continually question the $18 billion of the NASA budget that seemingly just goes into a sinkhole. To take the case of Orion, it has tremendous capability, but it will never be as cost-effective as something like the SpaceX Dragon capsule, but that's fine since Orion has interplanetary capabilities which the Dragon capsule does not. This needs to be made clear to people so that Orion is not perceived as a waste of resources.

Through collaboration with international partners such as the International Space Exploration Coordination Group (ISECG) and industry such as BP and Shell, NASA can demonstrate its relevance and garner support. NASA JSC's vision has been four-fold for a while:

- Lead human exploration.
- Lead internationally.
- Excel in leadership.
- Expand relevance to life on Earth.

One question from the audience related to ITAR, the International Traffic in Arms Regulations, mentioning Shell and BP as foreign-owned companies. Another question from the audience asked about NASA communicating with China. The questioner mentioned that he attended a recent IEEE conference on global communication which was dominated by Chinese attendees, especially in the encryption presentations. Terrier explained that statutes exist prohibiting such contact with China, which is like telling NASA of the 1990s they are not allowed to talk with Russia. Terrier explained that NASA leadership is based on the fast-changing nature of the geopolitical arena.

After his talk and a number of questions, I talked to Douglas Terrier and asked him about the importance of technical areas regardless of policy. Douglas responded that from personal experience, he has seen that as he climbed higher the corporate ladder, policy became more prevalent. When he was a young engineer, he did things because "they were cool." When he moved up at Lockheed, he was told by his manager that he should do things because they need to see airplanes coming out of that hangar. When he moved up further, he was told that he was responsible for making more money. Shen replied that though policy was important, there shouldn't be a lack of focus in the actual technical advancements being made. Douglas concurred but he also stressed the need for clear understanding of policy since when your actions can affect the entire country or the world, you cannot escape from the political and economic issues of your decisions. To quote him, "NASA managers aren't dumb monkeys. It's just that the issues are so complex that from the outside sometimes the decisions don't seem to make sense."

Dinner Meeting

Below: Roy Meinke asks a question while Wes Kelly looks on.

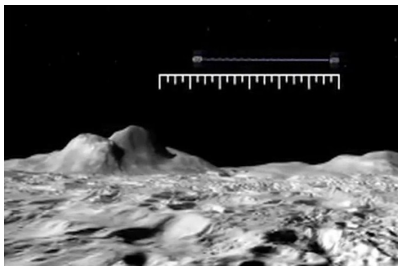
Below left: James C. McLane III (left) and Wes Kelly (right).

Below right: AIAA Houston Section Programs Chair announcing door prize winners. Image credits: Douglas Yazell.

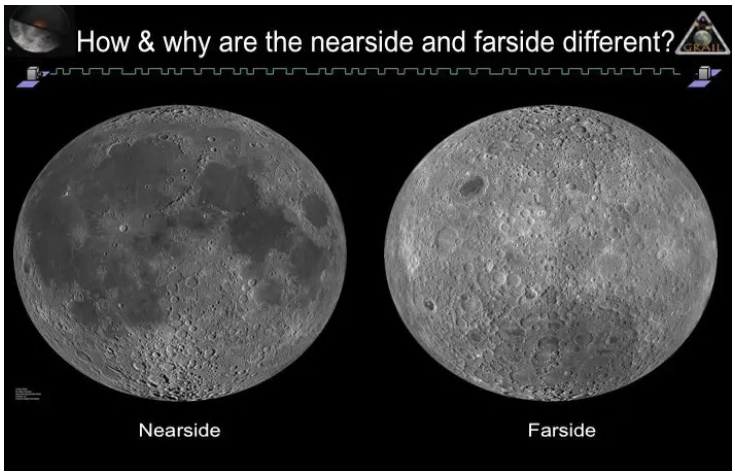
LPI: Cosmic Explorations

The GRAIL Mission and New Understanding of the Moon, by Dr. Maria Zuber, MIT

DOUGLAS YAZELL, EDITOR



Another overflow crowd enjoyed the latest in the Lunar and Planetary Institute's Cosmic Lecture series on February 2, 2012. Dr. Maria Zuber of MIT spoke about NASA's Gravity Recovery and Interior Laboratory (GRAIL) mission to the Moon. She is the Principal Investigator for that recently launched mission, and she is very much involved in four other current missions, Messenger at Mercury, MRO at Mars, Dawn at asteroid Vesta, and LRO at the Moon.



Since the video of this presentation is available at the URL given below in the caption, this article will be short.

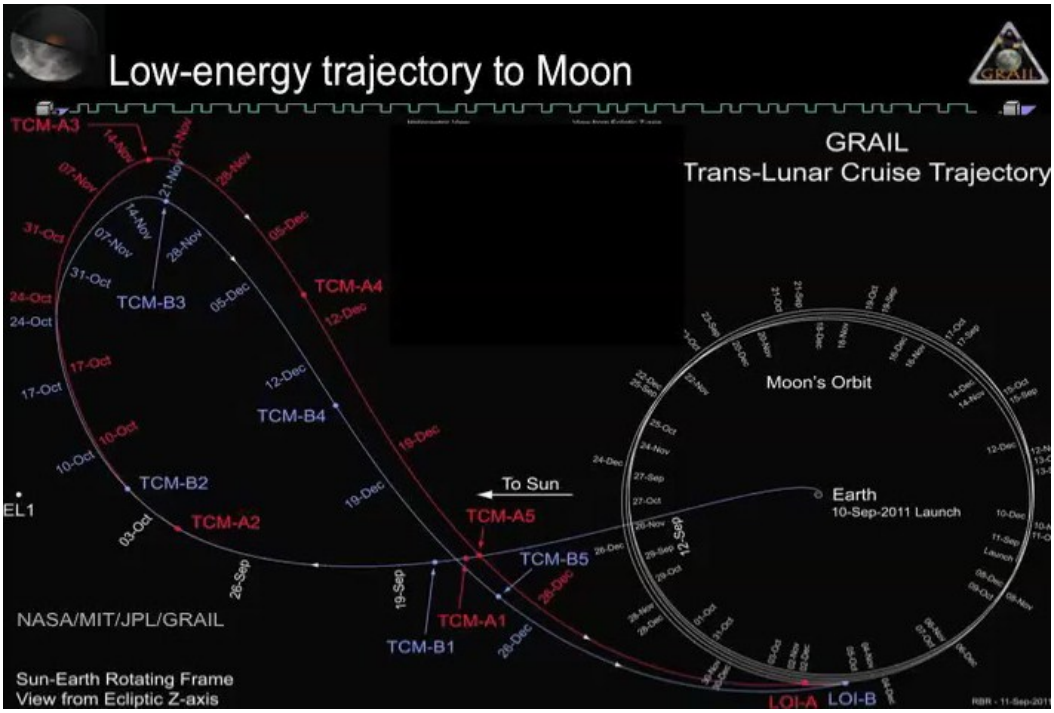
How and why are the Moon's nearside and farside different? After 109 missions to the Moon, we still don't know, so Zuber's team decided to look inside the Moon.

The Moon probably formed when a Mars-sized planet hit the Earth early in our planet's formation. A recent theory suggests that a second Moon was created by that impact, one third the size of our Moon, and in the same orbit as our Moon. The hypothesis says that these Moons collided at subsonic speeds, with the smaller Moon spreading itself over the Moon we know, thus creating more mountains on our Moon's farside. GRAIL can test that theory. A more important GRAIL goal is improving the lunar gravity knowledge by a factor of 100 on the nearside and 1,000 on the farside.

GRAIL relies on measuring distances between the two GRAIL satellites, named Ebb and Flow by a fourth grade class from Bozeman, Montana. Accuracy is key. Solar photons hitting the solar panels are the biggest error source. Another error source is the drift of Earth's tectonic plates which support the satellite tracking stations.

Enjoy the video!

Images: Screen captures from the video. This popular public lecture series from the Lunar and Planetary Institute is called Cosmic Explorations. The next in the series is tentatively set for spring 2012, "The DAWN Mission and New Understanding of Asteroid Vesta".



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LPI: Cosmic Explorations

Roy W. Meinke is celebrating his 50th AIAA membership anniversary this year, at about the same time that AIAA Houston Section is celebrating its 50th anniversary. Our section started in 1962 with IAS and our first Chair was Professor Alan Chapman of Rice University.

Roy suggested we include the photograph at left and the following quote:

"It is anticipated as the spacecraft gets nearer to the surface of the Moon, i.e., about ten miles above it, new discoveries will be made by the seventh grade students and their mentors about the Moon and its structure and development. This can well pave the way to renewing interest in space programs in the coming generation. We can all be thankful for this opportunity given to these students by the GRAIL engineers and scientists."

Above: MoonKAM Looks Homeward

This image of the far side of the lunar surface, with Earth in the background, was taken by the MoonKAM system onboard the Ebb spacecraft as part of the first image set taken from lunar orbit from March 15 – 18, 2012. A little more than half-way up and on the left side of the image is the crater De Forest. Due to its proximity to the southern pole, DeForest receives sunlight at an oblique angle when it is on the illuminated half of the Moon.

MoonKAM (Moon Knowledge Acquired by Middle school students), is led by Sally Ride, America's first woman in space, and her team at Sally Ride Science, in collaboration with undergraduate students at the University of California in San Diego. Over 2,700 schools in 52 countries have signed up to participate in MoonKAM.

NASA's Jet Propulsion Laboratory in Pasadena, Calif., manages the GRAIL mission for NASA's Science Mission Directorate in Washington. The Massachusetts Institute of Technology, Cambridge, is home to the mission's principal investigator, Maria Zuber. The GRAIL mission is part of the Discovery Program managed at NASA's Marshall Space Flight Center in Huntsville, Ala. Lockheed Martin Space Systems in Denver built the spacecraft. The California Institute of Technology in Pasadena manages JPL for NASA.

Information about MoonKAM is available online here. . For more information about GRAIL visit here. .

NASA/Caltech-JPL/MIT/SRS

Dream Chaser

Dream Chaser, Sierra Nevada, by John Curry

DOUGLAS YAZELL, EDITOR

Above: A photograph of John Curry at an American Astronautical Society conference in Houston in late 2011. Image credit: Douglas Yazell.

John Curry delivered a memorable presentation February 10, 2012, about Dream Chaser, the exciting new crewed spacecraft in work from Sierra Nevada Corporation. The host for the lunch-and-learn at Perry's Italian restaurant was The Society of Cost Estimating and Accounting (SCEA).

Now we have no way to get to the International Space Station (ISS) on our own, so now we have the Commercial Crew program, while we pay $63M per seat to the Russians. We canceled the space shuttle program, then canceled the Constellation program.

Dream Chaser is on a fixed price contract! Select a dollar amount and a schedule and stick to them. ."We can be timely or good, and I choose good.", as Michael Griffin said. Dream Chaser is not competition for Orion.

Dream Chaser will launch from an Atlas V, which has 97 successful launches in a row. Dream Chaser has a shape that works, but it did not come from NASA, SpaceDev, or Sierra Nevada. Dream Chaser C will dock to the back end of ISS, like a car in reverse.

The Russians "obtained" the HL-10 from NASA/Dryden. The Russians orbited that vehicle four times. NASA/Langley was given pictures of those orbital flights to analyze that vehicle and reverse engineer that vehicle, and that led to the NASA HL-20 vehicle. For a while, that was the future space shuttle follow-on vehicle, but a decision was made to allow NASA/Johnson Space Center to run that program with the X-38 (JSC, not Langley), so SpaceDev took over the HL-20. Dream Chaser adds an abort motor to the HL-20. Sierra Nevada bought SpaceDev, Starsys, and MicroSat.

Dream Chaser uses the same motor technology as SpaceShipOne from Virgin Galactic (VG), but Dream Chaser has two motors in the back, not just one. The motor for Dream Chaser is green and safe, using rubber and nitrous oxide.

Conops, Concepts of Operations: Launch from Florida, Complex 41, just as the Atlas V does today. Rendezvous with ISS on day 2. Land at the same place as launch. Dream Chaser is seven-crew-capable. NASA astronauts: four of them up and down. Their health can deteriorate over 210 days, so their return seats can be or are recumbent. Dream Chaser uses runway landings. Staying docked at ISS, Soyuz is six months capable. Uphill: Dream Chaser is not shrouded for launch. Up to seven degrees off-axis is OK during launch. Autoland is available in case of incapacitated crew. Dream Chaser always lands on a runway. East coast Trans-Atlantic Abort Landing, or Trans-Ocean Abort Landing (TAL) to Europe has some overlap, so Dream Chaser is never in the water, based on analysis.

Dream Chaser has no toxic hazard, no hydrazine, and that leads to many benefits. That is key for the business case. NASA Commercial Crew Development 2 (CCDEV2) is milestone driven. CCDEV1 was only about four months. Two milestones are coming up in February. All have been met on time and within budget so far.

When will Dream Chaser fly? That is money dependent. One flight is to 100,000 feet and back to the ground. One test is Pad Abort from ground. The big cost is Atlas V from United Space Alliance (ULA). How many launches per year? The schedule says Dream Chaser will be operational in 2015. Does that mean ISS

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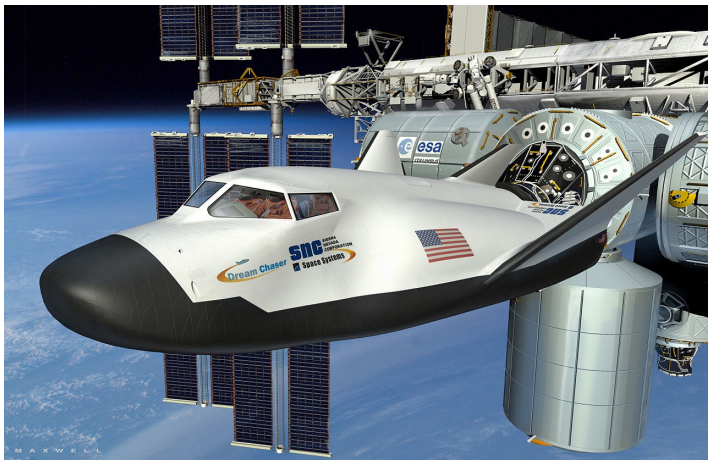


Right: A 2010 Artist's illustration of the Dream Chaser crew transportation vehicle docked to the ISS. Image credit: Sierra Nevada Space Systems.

(Continued from page 18)
operational? Turnaround is 45 to 60 days. The ULA rocket will limit that, not Dream Chaser.

Space suits for launch and entry: Ken Stroud is Sierra Nevada for the Crew Systems Team. He put out an Request for Information (RFI) and got responses from five vendors and NASA, five companies and the NASA "company." The suit design is not picked yet.

Philosophy: Build fast as opposed to analyzing. Use heritage hardware, at a specified Technical Readiness Level (TRL), even if not optimal. Hamilton Sundstrand is doing Environmental Control & Life Support System (ECLSS) on Orion, so they are doing that on Dream Chaser, too. The management team includes Jim Voss and Merri Sanchez.

John Curry sought lots of Space Act Agreements (SAAs) from various NASA centers. Orbital debris assessment came from NASA/JSC. Paying JSC, NASA is paid like a subcontractor. John encourages that. The expertise is wonderful.

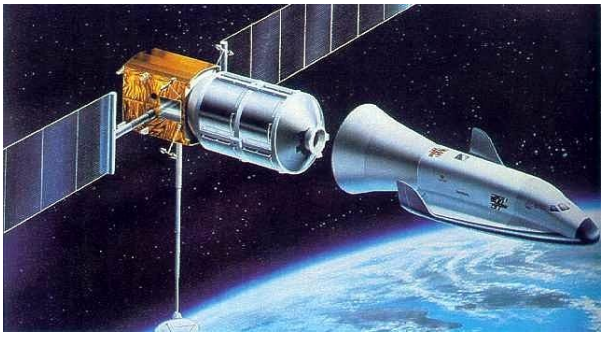
We will see a flight test soon. Dream Chaser has a skid on the front. The main landing gear is refurbished from the Dryden X-34. Dream Chaser will land later this year. It will be supported by captive carry by VG's WhiteKnight 2. Does Dream Chaser prepare for lightning or launch only in good weather? (The latter, since Dream Chaser aims at a sensible price.)

John expected only 10 pages of requirements. Instead, there are two books of requirements, one for ISS and one for Commercial Crew. Smaller NASA centers like Dryden are better about that. NASA has been stacking requirements in an unreasonable manner, as if to say, "Delay an extra two orbits, dock, then go into ISS safe haven mode for one day, then relocate to another ISS port, undock, delay landing by 24 hours, then do the landing with no power, thanks to the long time in ISS safe haven mode." But the Russians are not held to such standards.

How will Sierra Nevada man-rate the Atlas V? It will be easier than with the SpaceX Falcon 9, since the Falcon 9 has not flown very often.

Using captive carry from WhiteKnight2, Dream Chaser can only reach 100,000 feet altitude, not orbit.

Dream Chaser



Above: Columbus and Hermes. The Hermes spaceplane was designed by the French (CNES) from 1977 and later by ESA. The program was canceled in 1992. The Columbus science laboratory module, ESA's largest single contribution to ISS, was launched in 2008 on STS-122. Image credit: Public domain. Illustration by ESA and adapted by Marcus Lindroos.

Left: This 2010 image is an artist's conception of the Dream Chaser Space System in the launch configuration. Image credit: Sierra Nevada Space Systems.

Left: This 2010 image is the Dream Chaser spacecraft primary structure undergoing testing at the University of Colorado, Boulder during CCDev1. Image credit: Sierra Nevada Space Systems.

Astrodynamics

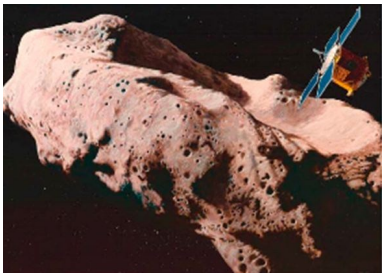
A Review of R.W. Farquhar's *Fifty Years on the Space Frontier: Halo Orbits, Comets, Asteroids and More*

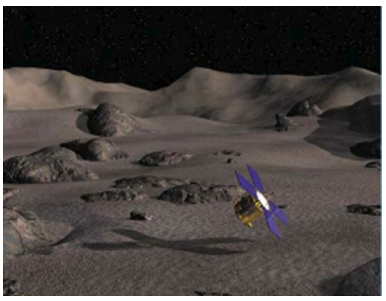
DANIEL R. ADAMO, ASTRODYNAMICS CONSULTANT

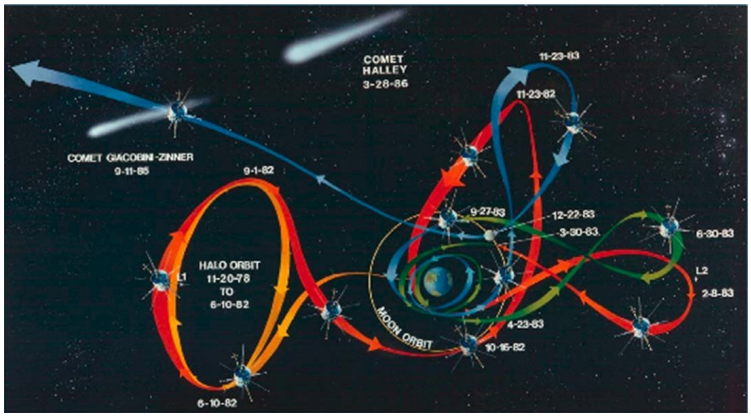
With his prolific and pivotal contributions to astrodynamics over the past 5 decades, Dr. Robert W. Farquhar has made an indelible mark on this field. Nearing the age of 80, he had contemplated writing an account of his career in space exploration for several years, but receiving the Charles A. Lindbergh Fellowship from the National Air and Space Museum in 2007 provided an ultimate impetus for publishing the book reviewed by this article.

In producing this memoir, Dr. Farquhar intends its readers to be "aerospace professionals and space history scholars" (p. i). Although these demographics are well targeted by the book, others with more general space exploration interests should not be intimidated by the technical nature of Dr. Farquhar's career. Readers will have to search for equations, meaningful illustrations and imagery are prolific, and jargon is generally well explained. Although the book was not professionally edited, this reviewer has to wonder if the few typographic errors corrected by that process would have been accompanied by a more diplomatic and whitewashed portrayal of a career permeated by organizational politics and personal conflict.

Below: Image credits: Robert W. Farquhar.







Fifty Years… has a copyright date of 2011. A 19 February 2012 poll of Amazon.com shows the book is available in two versions: a hardcover edition with color illustrations throughout for $86.95, and a paperback with color confined to its cover for $28.95. This reviewer is reporting on a hardcover version with color confined to its cover purchased for $33.88 on 20 September 2011, but it is apparently no longer in print. This early version is identified as "V 2.0" under the copyright notice, and it suffers from a minor flaw throughout its text. All uppercase delta "Δ" symbols were apparently mapped to an incorrect font during publication and appear as default " " characters. By late 2011, a version "V2.0 R2.1" correcting the "Δ" mapping problem was in print.

To fully enjoy *Fifty Years…*, readers may want to use two bookmarks. A "DOCUMENTS" section occupies pages 303 through 416, consisting chiefly of NASA memos, email, and other correspondence. Each document is cited in the text and is best read in context with the text, much as a sidebar in a magazine.

Each of the book's 15 chapters typically cites one to two dozen references, nearly all of which identify relevant technical papers and books by Dr. Farquhar and many other authors. Researchers in astrodynamics or space history will find this bibliography alone justifies purchase of *Fifty Years…*

An amusing personal theme Dr. Farquhar recounts throughout his memoir is his association of "12" with luck and success in spaceflight. This habit took hold when the International Sun-Earth Explorer-3 (ISEE-3) spacecraft, the first in history to stationkeep near a libration point, was launched "precisely at 12 minutes and 12 seconds after the hour on August 12" in 1978 (p. 58). Dr. Farquhar recalls being "quite relieved to learn that [the Near-Earth Asteroid Rendezvous mission] NEAR would be launched on Delta #232" because 2 x 3 x 2 = 12 (p. 151). Post-encounter tracking of NEAR's flyby of asteroid (253) Mathilde, the first such encounter in history, "showed that the spacecraft passed the asteroid at 1212 km. A double 12, this is as good as it gets!" (p.157).

Chapter 15, "STEPPING STONES TO MARS", is distinct from others in *Fifty Years…* because it looks to the future; not the past. In it, Dr. Farquhar relates how libration points in Earth's vicinity are likely to play critical enabling roles in future space architectures. These architectures would support human-serviceable space telescopes or reusable interplanetary human transports.

Despite a few minor shortcomings, which are apparently confined to early editions not currently in print, *Fifty Years…* is a very informative book. A copy belongs in any practicing astrodynamicist's library. Virtually anyone with an interest in astronautics, even a peripheral one, will learn from reading Dr. Farquhar's memoir and enjoy the experience.

1940 Air Terminal Museum at Hobby Airport An AIAA Historic Aerospace Site

DOUGLAS YAZELL, EDITOR

Museum

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

1940 Air Terminal Museum
8325 Travelair Street
Houston, Texas 77061
(713) 454-1940

A bimonthly column about the museum. The museum is restored and operated by the non-profit Houston Aeronautical Heritage Society.

The Wings & Wheels for March 2012 (the third Saturday of most months) used a theme of Grumman aircraft. Only one such airplane was on display, since the threat of bad weather kept several others away.

It was Saint Patrick's Day, so Michael Bludworth made a presentation about that day's connection to the museum after his monthly presentation on the 1940 Air Terminal's inspiring history. Two men were discussed, with plenty of hard-to-find photographs to illustrate their connection to aviation and Houston. My source for these details is Wikipedia.

Frank Hawks (1897 - 1938) was a world famous racing and record-setting aviator who used that occupation and other qualities to support a second career in movies. He lived in Texas for a large part of his US Army career in aviation.

"Glenn Herbert McCarthy (December 25, 1907 - December 26, 1988) was a wildcatter and a charismatic oil tycoon. The media often referred to him as 'Diamond Glenn' and 'The King of the Wildcatters.' McCarthy was an oil prospector and entrepreneur who owned many businesses in various sectors of the economy. McCarthy founded the Shamrock Hotel in Houston, which gained him national fame and inspired the fictional character Jett Rink in Edna Ferber's 1952 novel Giant along with its 1956 film adaptation which starred James Dean in the role."

McCarthy's family history was Irish, as we can see from the name of his famous Houston institution, The Shamrock Hotel. It opened on Saint Patrick's Day of 1949 and the year of the last Saint Patrick's Day with the hotel open to the public was 1986.

Mr. Bludworth mentioned that McCarthy bought an airplane from the famous Houstonian Howard Hughes, and the airplane was later turned into a houseboat. Some details about that story are here: *http://www.buoyantlife.net/index.php?option=com_content&view=article&id=148&Itemid=149*.

The theme for the monthly Wings & Wheels lunch program of Saturday, April 21, 2012, is yet to be determined. Admission for adults is only $7, and a good, affordable lunch meal is always available. This monthly event is usually held on the third Saturday of the month.

Left: The Eliminator! Image credit: Museum web site's page for the March 2012 Wings & Wheels, used with permission.

Left: Linda Street-Ely in front of her and her husband's plane, the Eliminator. Linda and her husband Mike have recently become involved in air racing. Image credit: Museum web site's page for the March 2012 Wings & Wheels, used with permission.

3AF MP

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 September / October 2011 issue.

Two ESA Astronauts Training in Star City

PHILIPPE MAIRET, 3AF MP, AND DOUGLAS YAZELL, EDITOR

At the beginning of 2012, Thomas Pesquet and Timothy Peace, two European Space Agency (ESA) astronauts trained in the Hydro lab the Yuri Gagarin Training Center (Gagarin Cosmonaut Training Center) in Star City near Moscow. These images are five of the six photographs used in a blog entry by Tim Peace here: *http://blogs.esa.int/astronauts/* (Blog entry: Learning to Spacewalk, February 12, 2012).

(Continued on page 23)

Right: Thomas Pesquet. Image credit: http://blogs.esa.int/astronauts.

Right: "Feels like caving again." writes Tim Peake. Image credit: http://blogs.esa.int/astronauts.

Right: "Tim and Thomas, just hanging around." writes Tim Peake. Image credit: http://blogs.esa.int/astronauts.

Right: "Thomas goes into the airlock." writes Tim Peake. Image credit: http://blogs.esa.int/astronauts.

(Continued from page 22)

From Wikipedia, the Shenanigans are Samantha Cristoforetti (Italy), Alexander Gerst (Germany), Andreas Mogensen (Denmark), Luca Parmitano (Italy), Timothy Peace (United Kingdom), and Thomas Pesquet (France).

3AF MP

Left: "Think like a robot– note the Shenanigans patches." writes Tim Peake. Image credit: http://blogs.esa.int/astronauts.

Right: The patch for the ESA astronaut class of 2009, the Shenanigans. A collectSPACE.com web site entry here (http://www.collectspace.com/ubb/Forum18/HTML/000893.html) has more information. The patch is visible in a picture on the next page. Image source: Wikipedia. Author: Thomsep. Filename: Vincent Gibaud.jpg.

Below: From the ESA web site, this charta is the source for the Latin words in the Shenanigans patch, Sapientia, Populus, Audacia, Cultura, Exploratio (SPACE).

Charta of the European Astronaut Corps

Our Vision

Shaping and Sharing Human Space Exploration
Through
Unity in Diversity

Our Mission

We Shape Space by bringing our European values to the preparation, support, and operation of the space flights that advance peaceful human exploration.
We Share Space with the people of Europe by communicating our vision, goals, experiences, and the results of our missions.

Our Values

Sapientia: We believe that Human Space Exploration is a wise choice by and for humankind. Sapientia reflects our commitment to pursue our goals for the advancement of humanity.

Populus: We put people first, in two ways: First, the purpose of our mission is to contribute to a better future for people on Earth. Second: Populus serves as a reflection of our respect for the people with whom we work: that we value their opinions, praise their work and compliment them for their support.

Audacia: We acknowledge that Spaceflight is a dangerous endeavour. While accepting the risks inherently involved in space travel we work to minimise these risks whenever we can. Audacia reminds us that the rewards will be unparalleled if we succeed.

Cultura: We continue the exploration started by our ancestors. Conscious of our history and traditions, we expand exploration into space, passing on our cultural heritage to future generations.

Exploratio: We value exploration as an opportunity to discover, to learn and, ultimately, to grow. We are convinced that humankind must embrace the challenge of peaceful human space exploration. We, the European Astronauts, are willing to take the next step.

Cologne, this fifteenth day of August two thousand one anno domini

3AF MP

Russian-American-European Crewed Lunar Exploration?

PHILIPPE MAIRET, 3AF MP, AND DOUGLAS YAZELL, EDITOR

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.

On 19 January 2012, Roscosmos, the Russian space agency, started talking to Americans and Europeans about a scientific research base on the Moon. The head of Roscosmos, Vladimir Popovkin, led a discussion with officials from NASA and the European Space Agency (ESA) about a permanent lunar base. "We do not want the man to take just one step on the Moon." said Mr. Popovkin in an interview produced by a Russian radio station.

We know there is water in the polar areas of the Moon. Also, Russia is now debating about the "how" of starting the exploration of the Moon with NASA and ESA. According to Mr. Popovkin, there are two possibilities: installing a base on the lunar surface, or putting a laboratory in lunar orbit.

Recall the contributions of Russians to lunar exploration, and in particular the Russian Luna missions. Similarly, let us remember the initial U.S. crewed Apollo missions and the subsequent U.S. Apollo lunar missions. More recently and more modestly, recall the lunar mission of the European spacecraft SMART-1.

The lunar goddess of Greek mythology is Selene (suh lee' knee). In 2010 the U.S. cancelled NASA's lunar exploration and the related "Constellation" of new American spacecraft, keeping only the Orion crew capsule as they aim farther out than the Moon, though they include the Moon as one of several possible destinations on their flexible path. If our future includes a Russian-American-European crewed lunar exploration program, maybe it will use the name Selene?

Right: The Moon-goddess Selene accompanied by the Dioscuri, or Phosphoros (the Morning Star) and Hesperos (the Evening Star). Marble altar, Roman artwork, 2nd century CE. From Italy. Image source: Wikipedia. Public domain. Image credit: Jastrow (2006). Location: Louvre Museum.

The Experimental Aircraft Association (EAA)

EAA Chapter 12 Mission

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

This organization brings people together with an interest in recreational aviation, facilitating social interaction and information sharing between aviation enthusiasts. Many of the services that EAA offers provide valuable support resources for those that wish 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 12 web site: *www.eaa12.org*. Another email contact: *eaachapt12[at]gmail.com*. As of April 13, 2012, EAA Chapter 12 is meeting on the first Tuesday of month, based on the calendar on the web site.

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

Scheduled/Preliminary Chapter 12 Event/Meeting Ideas and Recurring Events:
1st Saturday of each month – La Grange TX BBQ Fly-In, Fayette Regional (3T5)
1st Saturdays – Waco/Macgregor TX (KPWG), Far East Side of Field, Chap 59, Pancake Breakfast with all the goodies 8-10 AM, Dale Breedlove, *jdbvmt[at]netscape.com*
2nd Saturdays – Conroe TX Chapter 302 10 AM Lone Star Builder's Ctr, Lone Star Executive
2nd Saturdays – Lufkin TX Fajita Fly-In (LFK)
2nd Saturdays – New Braunfels TX Pancake Fly-In
3rd Saturdays – Wings & Wheels, 1941 Air Terminal Museum, Hobby Airport, Houston TX
3rd Saturdays – Jasper TX BBQ Lunch Fly-In (JAS)
3rd Saturdays – Tyler TX Breakfast Fly-In, 8-11, Pounds Field (TYR)
4th Saturdays – Denton TX Tex-Mex Fly-In
4th Saturdays – Leesville LA Lunch Fly-In (L39)
4th Saturdays – Shreveport LA Lunch Fly-In (DTN)
Last Saturdays – Denton Fly-In 11AM-2 PM (KDTO)

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

Above: A new logo for EAA Chapter 12 from their web site as of April 13, 2012.

Left: A picture from the EAA Chapter 12 web site as of April 13, 2012. The caption says this picture was taken just before the Aluminum Overcast (EAA's own B17) flew to its next stop in Louisiana.

APR
E-Publication

Aerospace Projects
Review

Virtus

SCOTT LOWTHER

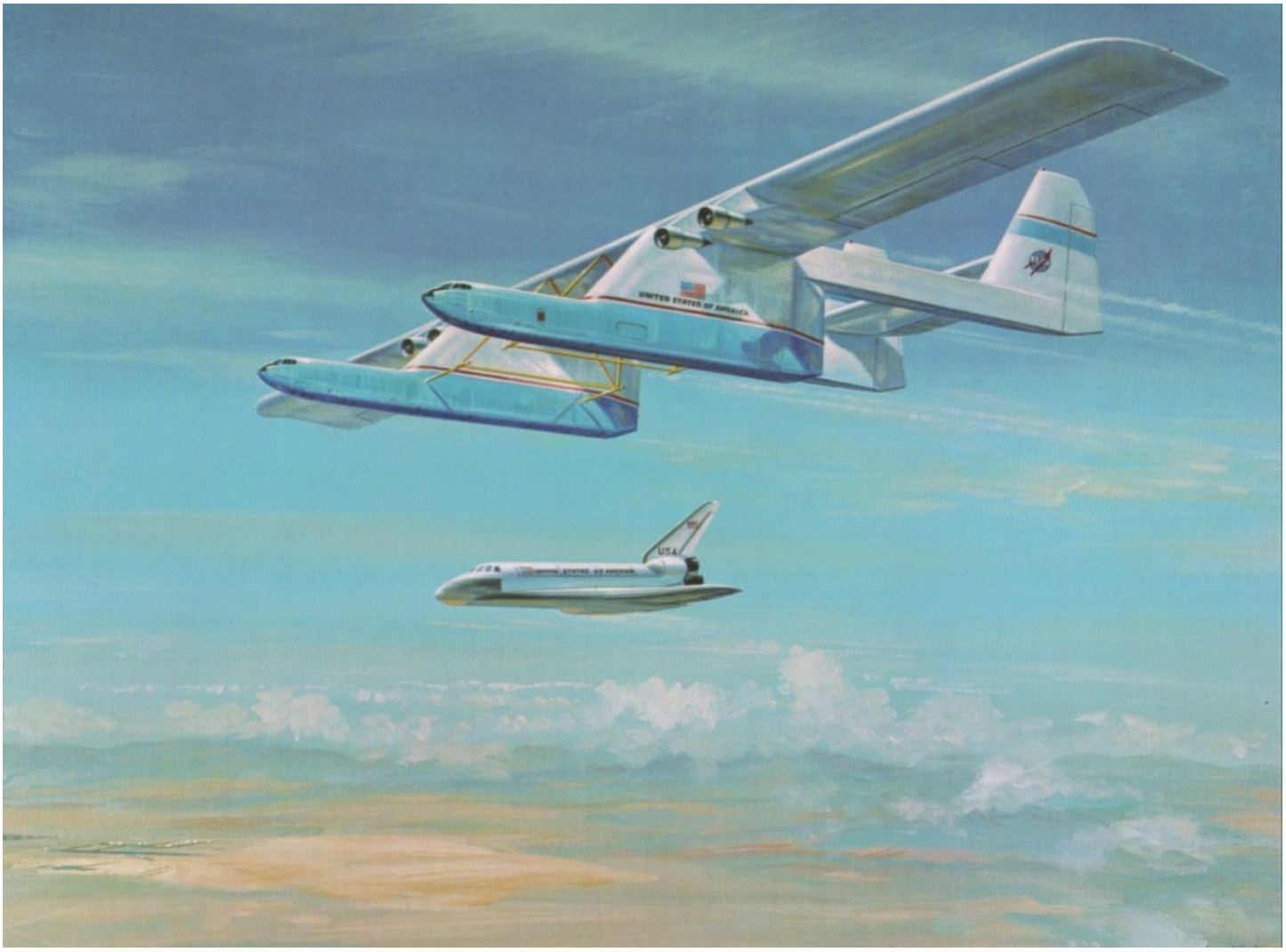
From the beginning, the point of the Space Shuttle was that it could land like an airplane on a conventional runway. It did not need to be a runway at Kennedy Space Center; it could be a runway in California, or in Spain, or even on Easter Island if circumstances called for it. But to be launched again, the Shuttle would need to be returned to KSC. For most of the development period of the Shuttle, the answer was clear: the Shuttle orbiter would use turbofan engines to fly itself back to KSC. If these were not the jet engines that the orbiter would carry onboard throughout the mission for crossrange extension or go-around capability, then they would be engines that could be bolted to the orbiter.

The problems with this plan were many and, in the end, insurmountable (or at any rate not worth the bother of surmounting). So an orbiter that could fly itself was off the table; no jet engines would be carried onboard or would have mounting attachments. Instead, the orbiter would be transported by a large carrier aircraft.

In the end, the Boeing 747 was selected as the Shuttle carrier aircraft, and served in that role successfully for decades. Lockheed, unsurprisingly, proposed to use their C-5 Galaxy cargo jet for that role. Both Lockheed and Boeing also proposed highly modified twin fuselage variants of their C-5 and 747 carriers; the twin fuselage versions would have greater lift capability and would suspend the orbiter

(Continued on page 27)

Below: Painting by Douglas Ettridge depicting the Virtus dropping an Orbiter. Image credit: Turbo-Three Corporation via the NASA Headquarters History Office.



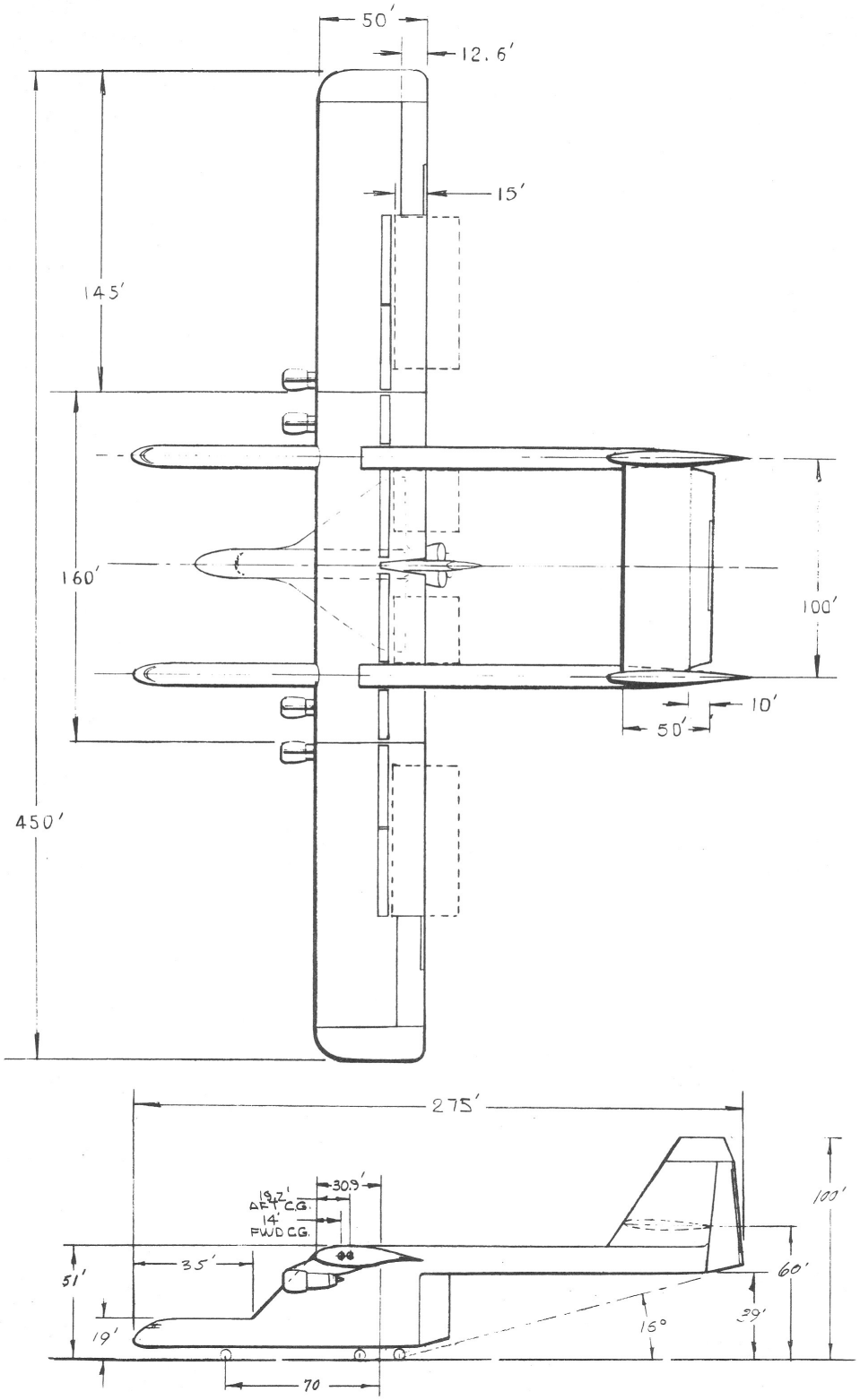
(Continued from page 26)
underneath the wing center section. This arrangement had the advantage of letting the carrier simply drop the orbiter during development tests. The sudden loss of weight would cause the carrier to spring upwards while gravity dragged the orbiter downwards; separation would be assured, and was presumed to be safer than releasing the orbiter off the top. Additionally, by suspending the orbiter, the need for additional lift equipment would be reduced. Instead of a massive crane to place the orbiter atop the aircraft, winches inside the carrier aircrafts wing center section could simply haul the orbiter up.

Lockheed and Boeing were not the only ones to realize the potential advantages of the multi-body approach for the Shuttle carrier aircraft. Another such design was put forward by John Conroy, designer and builder of the "Guppy" series of aircraft. The "Mini Guppy," "Pregnant Guppy" and "Super Guppy" were products of Conroy's Aero Spacelines Corporation, and were Boeing 377's with greatly modified fuselages. These planes were built for the space program of the 1960's, and were used to haul Gemini, Saturn and Apollo hardware. Formed about 1960, Aero Spacelines only lasted to 1967, when it was sold. Conroy formed another company, Conroy Aircraft, which converted a Canadair CL-44 by adding a larger diameter fuselage, much as was done with the Guppy series, creating the "Conroy Skymonster." Conroy Aircraft also delved into the turboprop

(Continued on page 28)

Below: Two-view drawing providing basic dimensions. Image credit: Turbo-Three Corporation via the NASA Headquarters History Office.

APR
E-Publication



APR
E-Publication

Aerospace Projects
Review

Aerospace Projects Review (APR) is presented by Scott Lowther, whose unique electronic publication is described as a "journal devoted to the untold tales of aerospacecraft design." More information may be found at the following address:
Scott Lowther
11305 W 10400 N
Thatcher, UT 84337
scottlowther@ix.netcom.com
www.aerospaceprojectsreview.com

Below: Cutaway illustration. Image credit: Turbo-Three Corporation via the NASA Headquarters History Office.

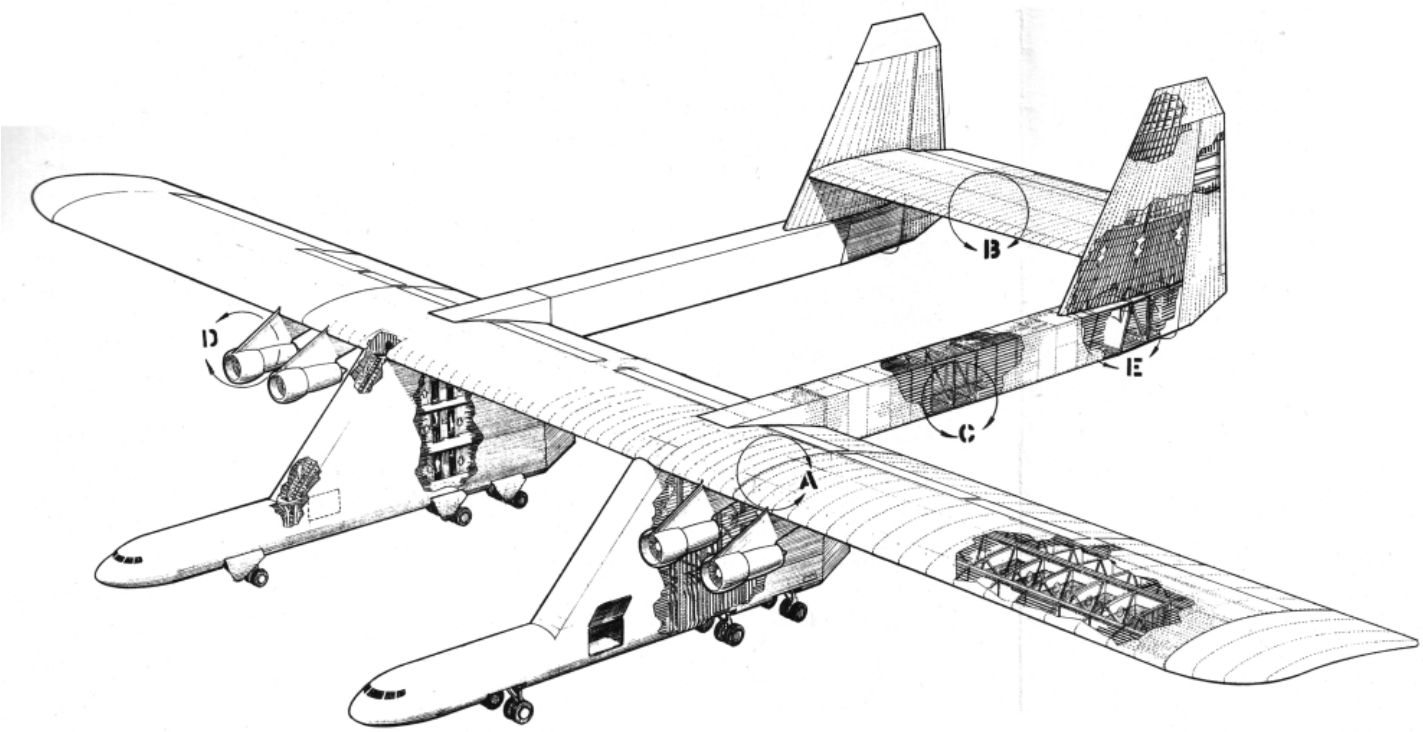
(Continued from page 27)
conversion of numerous piston engined aircraft, but this company went out of business in 1972. One of the conversions was of the Douglas DC-3, forming the "Turbo Three." This aircraft gave the name to yet another company founded by Conroy, the Turbo-Three Corporation. It was at this company in 1974 that Conroy proposed his most audacious aircraft conversion project: The Conroy Virtus.

While several versions of the Virtus were drawn up, the design that seems to have been studied in greatest detail used major fuselage elements from Boeing B-52s. Giants of the sky in their day, in the Virtus they would end up as little more than landing gear pods. These would be connected, by means of very stout pylons, to a large rectangular wing of 450 feet span (aspect ration of 9, surface area 22,166 square feet), and to a twin-boom tail. The Shuttle orbiter, External Tank, two solid rocket motor cases or a dedicated cargo pod could be carried under the center of the wing, between the pylons.

Ceiling for the Virtus was 35,000 feet; cruise speed was 300 mph, with a maximum range of 3,000 miles. Four Pratt & Whitney JT9D-3A turbofans provided 160,000 pounds of thrust. Maximum payload was 375,000 pounds; gross takeoff weight was 850,000 pounds.

The Virtus would have been easily capable of either ferrying the Shuttle Orbiter from place to place, or hauling it up to 35,000 feet for drop tests. Unlike the 747 carrier aircraft, for those tests the Virtus would not need to dive out from underneath the orbiter; it would simply drop it. Additionally, the large volume between the pylons would

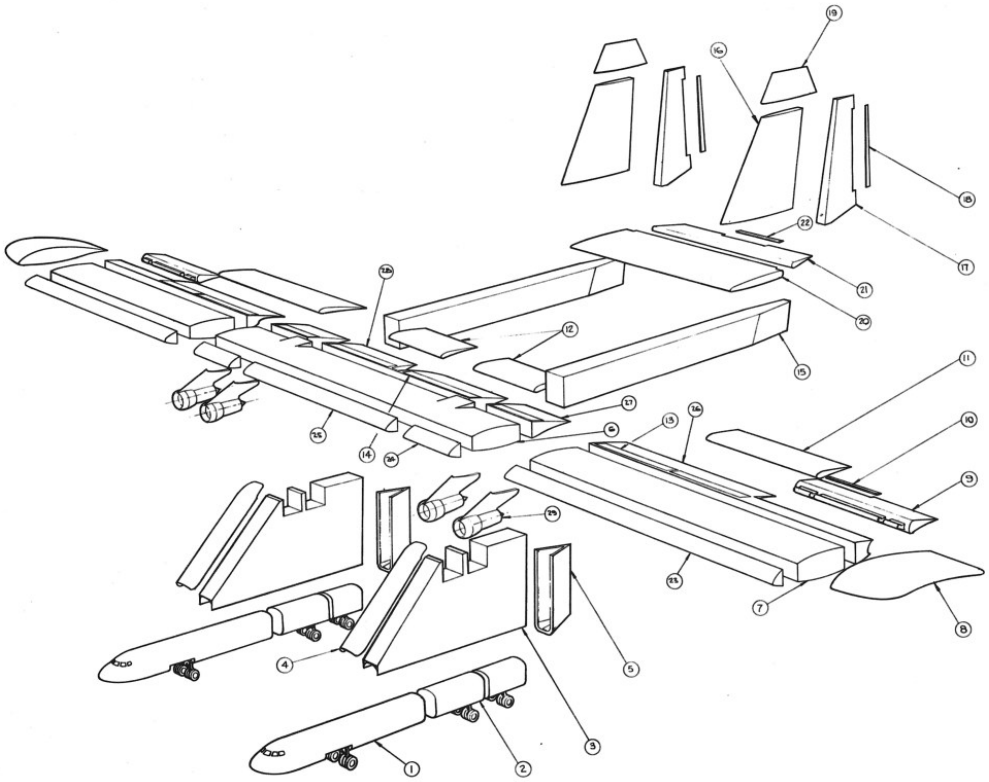
(Continued on page 29)



(Continued from page 28)
permit the transport of all manned of outsize cargo that could not otherwise get proper transportation. A special cargo pod could be carried; shaped much like the Shuttle External Tank, the pod had an interior diameter of 35 feet and an overall length of 184.8 feet. It could comfortably fit the External Tank within. Empty weight of the pod was 60,000 pounds; it could contain 315,000 pounds of cargo.

At the time the Virtus received some publicity and even spent time in a NASA-Langley wind tunnel as a 0.0293 scale model, but nothing more than that came of it. Despite the advantages, the negatives were quite large… an essentially all-new, gigantic aircraft is going to be trickier than simply modifying an existing jetliner. Around 1990, the Myasishchev Design Bureau produced the M-90 series of outsize cargo lifters that followed much the same design practices, but these, too, were never built.

Below: Basic assemblies of the Virtus. Image credit: Turbo-Three Corporation via the NASA Headquarters History Office.



29 ENGINES & PYLONS PRATT & WHITNEY JT 9D-3A TURBOFAN
28 WING TRAILING EDGE CENTER SECTION
27 WING TRAILING EDGE CENTER SECTION LEFT & RIGHT HAND SIDE
26 WING TRAILING EDGE OUTBOARD PANEL LEFT & RIGHT HAND SIDE
25 WING LEADING EDGE CENTER SECTION
24 WING LEADING EDGE CENTER SECTION LEFT & RIGHT HAND SIDE
23 WING LEADING EDGE OUTBOARD PANEL LEFT & RIGHT HAND SIDE
22 ELEVATOR TRIM TAB
21 ELEVATOR
20 HORIZONTAL STABILIZER
19 VERTICAL STABILIZER TIP LEFT & RIGHT HAND SIDE
18 RUDDER TRIM TAB LEFT & RIGHT HAND SIDE
17 RUDDER LEFT & RIGHT HAND SIDE
16 VERTICAL STABILIZER LEFT & RIGHT HAND SIDE
15 BOOM LEFT & RIGHT HAND SIDE
14 WING SPOILERS CENTER SECTION LEFT & RIGHT HAND SIDE
13 WING SPOILERS OUTBOARD PANEL LEFT & RIGHT HAND SIDE
12 WING FLAPS CENTER SECTION LEFT & RIGHT HAND SIDE
11 WING FLAP OUTBOARD LEFT & RIGHT HAND SIDE
10 AILERON TRIM TAB LEFT & RIGHT HAND SIDE
9 AILERON LEFT & RIGHT HAND SIDE
8 WING TIP LEFT & RIGHT HAND SIDE
7 WING OUTBOARD PANEL LEFT & RIGHT HAND SIDE
6 WING CENTER SECTION
5 PYLON FAIRING AFT LEFT & RIGHT HAND SIDE
4 PYLON FAIRING FORWARD LEFT & RIGHT HAND SIDE
3 PYLON SUPER STRUCTURE LEFT & RIGHT HAND SIDE
2 B-52 LANDING GEAR SECTION MODIFIED LEFT & RIGHT HAND SIDE
1 B-52 FWD FUSELAGE MODIFIED LEFT & RIGHT HAND SIDE

Calendar

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

AIAA Houston Section council meetings: for info, email secretary[at]aiaa-houston.org
Time: 5:30 - 6:30 PM usually
Day: First Monday of most months except for holidays.
Location: NASA/JSC Gilruth Center is often used. The room varies.
Monday, May 7, 2012 & Monday, June 4, 2012. The new AIAA year starts July 1, 2012.

Friday, May 18, 2012: ATS 2012. See www.aiaa-houston.org.
AIAA Houston Section Annual Technical Symposium (ATS 2012)
Keynote speakers:

- Mark Geyer, NASA/JSC (Orion MPCV)
- Christopher Ferguson, Commander, STS-135, the final space shuttle mission

June 2012, on a weeknight (Monday - Thursday) in the latter half of the month: Annual honors and awards dinner meeting. See *www.aiaa-houston.org*.
Speaker: Norman Chaffee, NASA/JSC retired
Additional speakers include: Guy Thibodaux, NASA/JSC retired, James C. McLane, Jr., NASA/JSC retired.
Location: TBD (probably the 1940 Air Terminal Museum at Hobby Airport, *www.1940airterminal.org*)
Celebrating the 50th anniversary of AIAA Houston Section.

AIAA National & International Conferences

9 May 2012: The 2012 Aerospace Spotlight Awards Gala, Washington, DC
22 - 24 May 2012: Global Space Exploration Conference, Washington, DC
7 June 2012: Aerospace Today… and Tomorrow - An Executive Symposium
Location: Williamsburg, Virginia
19 - 21 June 2012: Infotech@Aerospace 2012, Garden Grove, California
25-28 June 2012: AIAA Fluid Dynamics and Co-Located Conferences and Exhibit
Location: New Orleans, Louisiana
15 - 19 July 2012 San Diego, California
42nd International Conference on Environmental Systems
30 July - 1 August 2012 Atlanta, Georgia
48th AIAA/ASME/SAE/ASEE Joint Propulsion Conference & Exhibit and 10th International Energy Conversion Engineering Conference

Cranium Cruncher

Dr. Steven E. Everett

Challenge

In last month's puzzle, an engineer was tasked with connecting the ends of a pile of 100 electrical cables, each with a male and a female end. The following question was posed: if the ends are connected randomly, what is the expected value of the number of loops he has created?

Let e(r) be the expected number of loops of length r where r <= n. Each such loop contains r cords. So the expected number of cords which are in a loop of length r is r*e(r). The probability of a random cord being part of a loop of length r is r*e(r)/n.

We can calculate this probability a different way. Start with a random cord: It will be in a loop of length 1 if it connects to itself, with probability of 1/n. It will be in a loop of length 2 if it connects to a different cord which then connects to the first, probability (n-1)/n x 1/(n-1) = 1/n. In general the probability of being in a loop of length r is
(n-1)/n x (n-2)/(n-1) x (n-3)/(n-2) x … x (n+1-r)/(n+2-r) x 1/(n+1-r) = 1/n. So the probability of a random cord being in a loop of length r is always 1/n. Interestingly this doesn't depend on r (except that r must be less than or equal to n).

Before we showed that this probability was r*e(r)/n, so we have r*e(r)/n = 1/n and so e(r) = 1/r. The expected number of loops of length r is 1/r. This time the answer doesn't depend on n (except that r must be less than or equal to n). The expected number of loops is the sum of the expected number of loops of each size which is
e(1) + e(2) +e(3) + … + e(n) = 1 + ½ + 1/3 + … + 1/n.

Thus, given 100 cables initially, we can expect that there will be about 5.19 loops on average.

This month, picture yourself in a familiar situation, listening in on a telecom with colleagues Alex and Benny while staring at a clock in a windowless conference room thinking of all the work you could be getting done if you were at your desk. Alex is sitting in a similar conference room at a location 1.875 miles directly north of you, and Benny is in yet another conference room 2.5 miles east and 1.042 miles south of you. During the telecom, a violent thunderstorm erupts in the area. Just as the second hand on your clock reaches the 12:00 position, over the phone you hear a crash of thunder and Benny's voice say, "Wow! That one was close!" Still watching the clock, you hear the same crash of thunder outside the building just at the moment that 7 seconds have passed since everyone heard the initial crash. After an additional 3 seconds have passed, you hear the same crash of thunder again over the phone speaker.

Assuming that the speed of sound is 1100 ft/sec and that the sound transmission over the phone lines is virtually instantaneous, when and where (relative to your location) was the lightning strike?

Send solutions to steven.e.everett at boeing.com

Section News

AIAA Houston Section
Annual Technical Symposium
(ATS 2012)

www.aiaa-houston.org

Friday, May 18, 2012

Walk-ins are welcome.

Please reserve
in advance when possible.

Meal reservation deadline:
Friday, May 11, 2012

Keynote Speakers
(Update, April 23, 2012):

Morning:
Mark Geyer, Orion Multi-Purpose Crew Vehicle (MPCV) Status

Luncheon
(Two Consecutive Speakers):

- *Christopher Ferguson/ Boeing, STS-135 Commander*
- *Andrew S.W. Thomas, NASA Astronaut Office*

AIAA
American Institute of Aeronautics and Astronautics
Houston Section

Annual Technical Symposium

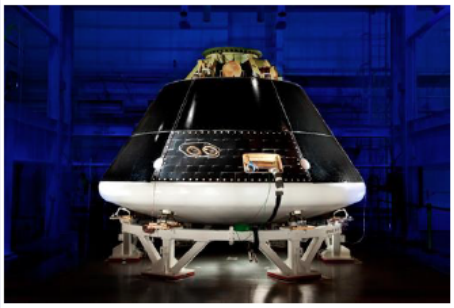


Image Courtesy of www.americaspace.org

INCOSE
International Council on Systems Engineering

May 18, 2012 (Friday)
Gilruth Center
NASA/JSC
Walk-ins Welcome

Invited Speakers

Kickoff Speaker
NASA/Mark Geyer
Orion MPCV Status

Luncheon Speaker
Boeing/Chris Ferguson
NASA/Andrew S.W. Thomas
Future of Human Spaceflight

Schedule

0745	Registration (*open all day*)
0815	Speaker: Mark Geyer
0900	Morning Sessions
1230	Speakers: Chris Ferguson Andrew Thomas Lunch (provided by Gilruth) Optional but requires reservation by Thursday, 5/11/12 (A limited number is available after that time)
1330	Afternoon sessions
1630	End of Symposium

Deadlines

April 30, 2012 (Monday)
Abstracts due online
May 7, 2012 (Monday)
Abstract acceptance notices sent out
May 11, 2012 (Friday)
Reserve optional lunch
May 18, 2012 (Friday): ATS
Registration all day:
Pay for registration at check-in

Proposed Topics

Space Exploration
Space Commercialization
Systems Engineering
Astrodynamics
Avionics and Software
Structural and Mechanical Engineering
Robotics
Guidance, Navigation, and Control (GN&C)
Extra-Vehicular Activity (EVA)
Aerospace Technologies
Space History

Symposium Plans

Registration all day at the Gilruth Center 0745-1630
$15 for attendees (lunch included)
Register Online: www.aiaa-houston.org, pay at check-in.
Advance reservations are required for those selecting the optional lunch buffet (see deadlines)
Civil Servants should register through Satern (search "AIAA" in the catalog). CS registration fee will be paid if registering through Satern.

Presenters: see deadline for abstract submission

AIAA membership and JSC badging not required

Presentations limited to 30 minutes
Laptop computers and computer projectors provided

No paper required
Only abstracts will be published. Presenters to submit presentation at the registration desk.

Complimentary coffee, beverages, and snacks

Lunch buffet available
Reserve online in advance
Buffet includes vegetarian option

All are encouraged to attend or present

Take advantage of this opportunity to present your current efforts and to showcase your company or organization

Contact

Satya Pilla, General Chair
vicechair-tech@aiaa-houston.org

www.aiaa-houston.org

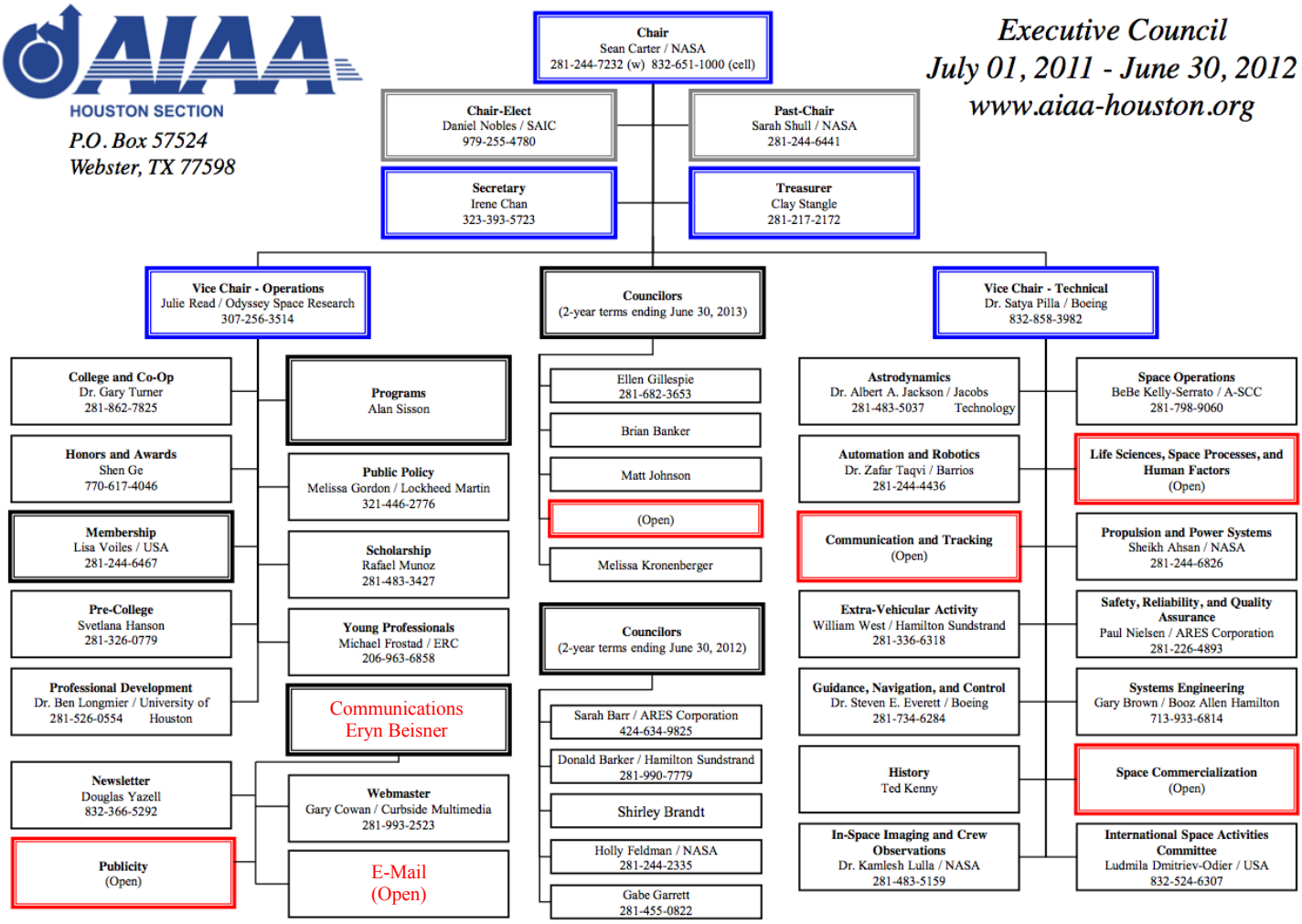
The American Institute of Aeronautics and Astronautics

Section News

HOUSTON SECTION

P.O. Box 57524
Webster, TX 77598

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



Updated November 8, 2011, Executive Council Voting Members (20) are identified by:

The Region IV (a four-state region) Student Paper Conference took place here in Houston a week or two ago, and our next issue will contain an article about it. Our section hosts that every other year.

Yuri's Night Houston 2012 took place recently, focused on celebrating April 12, 1961, the launch of the first person into space (and into orbit), and April 12, 1981, the first launch of the space shuttle. Our section is still supporting at least some the Yuri's Night Houston activities.

Our section's Annual Technical Symposium (ATS) will take place on Friday, May 18, 2012, in the NASA/JSC Gilruth Center. Mark Geyer (NASA/JSC Orion MPCV) and Christopher Ferguson (Commander of the last space shuttle flight, STS-135) are the keynote speakers.

We are penciling in our section's annual honors and awards dinner for late June 2012. That event will also celebrate our section's 50th anniversary.

The new Communications Chair is Eryn Beisner, as shown above. That is updated for this newsletter. Let's welcome her to this role. The E-Mail Chair is also updated above to show that post is open. We need to fill that post and the Publicity Chair. Please contact us in any of several ways, including secretary[at]aiaa-houston.org, if you care to volunteer in one of these two roles.

www.aiaa-houston.org

Current Events

From AIAA Daily Launch, a daily e-mail news summary.

AIAA Daily Launch archives

Who is on ISS now? Sunday, April 15, 2012:
Expedition 30:
Anton Shkaplerov
Dan Burbank (Commander)
Anatoly Ivanishin
André Kuipers
Oleg Kononenko
Don Pettit
Expedition 31 starts with the Soyuz TMA-22 undocking, now scheduled for Friday, April 27, 2012.

China Launches Another Beidou Satellite. China's Xinhua (2/25)

China Plans To Launch 12 Meteorological Satellites This Decade. China's Xinhua (3/4)

ISS Partners Open To Adding More Countries. The Canadian Press (3/2, Rakobowchuk)

China's Female Astronauts Training, But May Not Launch Yet. China org cn (3/7, Lin)

Glenn Orbited Earth 50 Years Ago. NBC Nightly News (2/19, story 8, 2:25, Holt)

Rare Amateur Video Of Challenger Turns Up. The New Scientist (2/22, Ceurstemont)

Tellurium Detected In Three Stars Discovery News (2/22, O'Neill)

UAVs Could Lead To Updated Privacy Protection.
Alexis Madrigal, in an article for The Atlantic (2/22)

Exoplanet Found To Be Water World. The CBS Evening News (2/21, story 10, 0:20, Pelley)

Space Could Be A Problematic Issue For Obama. The Houston Chronicle (2/23, Powell)

Officials Debate Role Of NASA, FAA In Commercial Spaceflight Regulations.
Jeff Foust at Space Politics (2/22)

Astronomers Discover Large Amount Of Buckyballs In Space. Space (2/23)

Dawn Takes Image Of Sunrise At Vesta. Jason Major at Universe Today (2/22)

Ames Opens Flight Simulator To Sierra Nevada. The KTVU-TV San Francisco (2/24)

SLS Program Already Applying Lessons From Constellation.
NASASpaceFlight (2/24, Bergin)

B-17 Memphis Belle Being Restored. The AP (2/27)

Researchers Gathering For Suborbital Researchers Conference. Space (2/25, Wall)

NASA Meets With "Upset" Scientists To Discuss Mars Program.
In continuing coverage about the recent budget proposal that would cut NASA's planetary science program, the AP (2/28, Chang, Borenstein)

NASA Monitoring New Possible Asteroid Threat. In his column for Space (2/27)

New Spacesuit Under Development. Nextgov (2/27, Fairchild) reported, "Engineers at the Johnson Space Center are working to develop a new kind of spacesuit, one for the astronauts who will potentially walk on Mars or spend time in deep space." The article noted that developers are consulting ISS astronauts "to find out what attire works and doesn't work while in orbit." The website posts a series of videos showing an interview with spacesuit engineer Amy Ross about the work underway.

Next NEEMO Mission Scheduled. NASASpaceFlight (2/28, Bergin) reports, "The next NASA Extreme Environment Mission Operations (NEEMO) mission is being scheduled for June, with teams already preparing for a recon trip ahead of the exercise." As with last year's mission, this year's will simulate a mission to a near-Earth asteroid.

(Continued on page 35)

Current Events

From AIAA Daily Launch, a daily e-mail news summary.

AIAA Daily Launch archives

(Continued from page 34)

UrtheCast Progressing With HD ISS Platform. Canada's Postmedia News (2/28, Toneguzzi)

Virgin Galactic Launching Passengers This Year Or The Next, Reuters (2/28)

Perminov Downplays Russia's Plans Of Sending Cosmonauts To The Moon. Aerospace Daily and Defense Report (2/27, Francis)

Russia Criticized For Not Issuing Phobos-Grunt Report In English. In an article for the Space Review (2/27)

NASA Scientist Wins Suborbital Flight. Space (2/28, Wall)

With Successful Parachute Test, Orion Has Another Achievement. NASASpaceFlight (3/4, Bergin)

New Asteroid Diverting Technique Under Development. Aerospace Daily and Defense Report (3/2, Carreau) reported, "Texas A&M University is leading a collaboration on a novel 'soft-push' technique for diverting hazardous Near Earth Asteroids that is gathering maturity for a future orbital flight test." Thae University is working with the Ames Research Center and others on the technology. David Hyland of Texas A&M is now working to obtain a slot as a secondary payload to test the method. Students developed the "Surface Albedo Treatment Subsystem, a Triboelectric charging apparatus that could apply a light or dark powder coating on [asteroid] Apophis to alter its albedo enough to produce a three-Earth-radius dispersion by 2036."

Astrobotic Pushes Back Launch By One Year. The Pittsburgh (PA) Tribune-Review (3/4, Erdley)

New Set Of Kepler Exoplanet Candidates Released.
The San Francisco Chronicle (3/3, A9, Perlman) reported, "Astronomers hunting for planets orbiting distant stars in the Milky Way reported Friday that their Kepler spacecraft has now detected more than 2,300 'candidate' planets since the search began three years ago." While these planets need to be confirmed, Kepler team members "said 46 of the probable 'exoplanets' are orbiting their stars in what astronomers call the 'habitable zone,' where conditions are benign enough for liquid water to exist on their surfaces." Several are also close to the size of Earth.

Dione Found To Have Thin Oxygen Atmosphere. Space (3/3)

New App Shows Moon At Any Hour Throughout The Year.
Robert Gonzalez at io9 (3/3) wrote that because of the high-resolution images coming from the Lunar Reconnaissance Orbiter, "the Goddard Visualization Studio has used those images to create an applet that lets you see - in absolutely mind-blowing detail - what the Moon will look like on any given hour throughout 2012." According to Gonzalez, "the result is a truly remarkable, high-definition video of the Moon, unlike any you've ever seen."

Tyson: Funding NASA Should Be "Obvious." NPR (3/2, Flatow)

Nield Predicts Over 1000 Launches Per Year By End Of Decade.
Space (3/2, Wall) reports, "George Nield, associate administrator for commercial space transportation at the Federal Aviation Administration, thinks it's possible to double the number of permit-holding private launches every year for the rest of the decade. That exponential increase would lead to 1,280 liftoffs in 2019 - an average of 3 1/2 per day." Nield said this amount was not "unreasonable" when compared to the number of plane flights per day. At the recent Next-Generation Suborbital Researchers Conference, Nield "proposed some ideas that he said could help make the annual doubling of commercial launches a reality" such as paying companies to launch

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Kepler

Can't Stop the Survey: Kepler Data Keeps Coming
By Nick Gautier

Kepler continues normal operations, gathering data in the 11th quarter of its exoplanet survey. Kepler has now found more than 2300 exoplanet candidates around more than 1800 stars. Eighty-five percent of these candidates are expected to be real planets. The Kepler team has now confirmed more than 30 of these candidates as true planets.

The exoplanet survey data for quarters 4, 5 and 6 will be publicly released in January with 3 more quarters following in July.

Text credit.: NASA.

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materials and space prizes. Nield said, "I'd rather do what we can to see if we can make that prophecy come true - or to see if we can make it happen faster."

SpaceX Completes Falcon 9 Countdown Test. Florida Today (3/2, Dean)

Holdren Grilled About NASA Cuts During House Hearing. ScienceInsider (3/2, Mervis), Jeff Foust at Space Politics (3/1)

Quadcopters Play James Bond Theme. Clay Dillow at Popular Science (3/2)

USAF Buying iPads To Replace Flight Bags. The Los Angeles Times (3/7, Netburn)

DARPA To Start Algorithm Challenge Later This Month. Network World (3/7, Cooney)

Elachi Describes Upcoming "Six Minutes Of Terror" For Curiosity.
In his column for BBC News (3/7)

Grail Spacecraft Begin Science Operations. The AP (3/7, Chang)

NASA Says Earth Is Not Threatened By Asteroid Next Year.
Space (3/7, Wall) reports an update yesterday from NASA's Near-Earth Object Program Office said that "despite feverish speculation from doomsayers, the near-Earth asteroid 2012 DA14 won't slam into our planet next year." The office said, "Its orbit about the sun can bring it no closer to the Earth's surface than 3.2 Earth radii on February 15, 2013." According to the article, there has been "a media firestorm" about the threat from the asteroid with salacious headlines.

Dawn Spacecraft Gets More Time At Closest Orbit Around Vesta.
Ken Kremer at Universe Today (3/7) writes, "NASA's Dawn mission is getting a whopping boost in science observing time at the closest orbit around Asteroid Vesta as the probe passes the mid-way point of its 1 year long survey of the colossal space rock. And the team informs Universe Today that the data so far have surpassed all expectations and they are very excited!" The spacecraft has been given 40 "bonus" days at this orbit. According to Kremer, "The big extension for a once-in-a-lifetime shot at up close science was all enabled owing to the hard work of the international science team in diligently handling any anomalies along the pathway through interplanetary space." Kremer also notes the time will be "effectively used" to map any areas that have not been hit so far.

Ellington International Airport May Become Spaceport.
The Friendswood (TX) Journal (3/7, Martin) reports Ellington International Airport could become a spaceport, according to General Manager Brian Rinehart. He said, "You got Embry-Riddle pushing aviation, you got NASA, you got all the aerospace companies here, and that means that we have the capital to really make spaceport work."

Massimino To Lead Rice University's Space Institute. The Houston Chronicle (3/7, Berger)

Boeing Outlines Plan For Mission To Near Earth Asteroid.
NASASpaceFlight (3/9, Gebhardt) reports NASA contractors "continue their push for new and innovative technologies – including Radiation Storm Shelters, Deep Space Habitats, and Solar Electric Propulsion – to be used as humankind pushes beyond the confines of planet Earth toward Near Earth Asteroids." Boeing Director of Advanced Space Exploration Mike Elsperman outlined one plan as a "phased approach" to eventual missions to Mars, detailing all of those technologies under a presentation titled "Asteroid Mission Concept with Solar Electric Propulsion." Under the proposal, astronauts would launch in 2024 to an asteroid for a mission that would last a year in total.

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NASA Blocked From Shutting Down Mars Project. Aviation Week (3/8, Morring)

Students Name Google Lunar X Prize Spacecraft "Spirit Of Alabama."
The Huntsville (AL) Times (3/9, Kelley)

BAE Systems' F-35 Designs Reportedly Hacked By Chinese.
The UK's Lancashire Evening Post (3/12, Coates)

NASA Preparing To Contract With Russia Into 2017.
The Wall Street Journal (3/12, A6, Pasztor, Subscription Publication) reports that, according to NASA Administrator Charles Bolden's testimony to the House Science Committee last week, budget issues were delaying development of commercial spacecraft to replace the shuttle so NASA was preparing to buy more seats on Russian spacecraft into 2017, although there was no guarantee the spacecraft would be ready by then. While NASA is calling this a contingency plan, the article notes that Congress is concerned about the commercial crew program. Rep. Ralph Hall said NASA was "putting large sums of tax dollars at risk" with the program. Rep. Donna Edwards added, "It doesn't seem to me there is a real plan yet" for a feasible program.

Dextre Completes Satellite Service Experiment. Canada's CBC News (3/10)

Worden: Synthetic Biology Under Development Will Help Astronauts.
UK's The Register (3/10, Thompson) reported Ames Research Center Director S. Pete Worden discussed the development of "synthetic biology" at the center in conjunction with Craig Venter, who "is working with NASA to develop programmed microbes that have been hacked to be much more efficient than their current forms, and which can be used in space exploration" for tasks like air and water purification, a "replacement pancreas" for astronauts, or could develop into food items on other planets. Worden "predicted some of these specimens will be created in the next decade, and maybe sooner."

SpaceX, NASA In Talks About Launch Pad For Falcon Heavy Rocket.
Spaceflight Now (3/12, Clark)

Garriott Believes Spaceflight Will Be Less Expensive If More Profitable.
Chris Taylor at Mashable (3/10) wrote about a talk at SXSW given by Richard Garriott, who paid to travel to the International Space Station. In outlining spaceflight for the next 30 years, Garriott believes "competition will bring the cost of a sub-orbital trip down to the same as a round-the-world ticket within a matter of years." The article noted Garriott was able to make money off his trip but not enough to offset costs so that one of the biggest challenges to lowering costs is "figuring out how to make more of a profit when you're up there."

Startram Could Dramatically Lower Launch Costs With Maglev Technology.
Alasdair Wilkins at io9 (3/12) writes about the technically feasible Startram concept, "a proposed launch system that would use magnetic levitation trains, a 1000-mile tunnel, and a superconducting cable to reach low Earth orbit." Because it is based on maglev trains, the same technology could technically be adapted to launch cargo or even crews. Furthermore, "its designers - James Powell, George Maise, and John Rather of the Johns Hopkins Applied Physics Laboratory - point out that supporting a 12-mile cable would require only a fraction of the engineering knowhow needed to hold up the much longer tethers involved in a space elevator." Once the Startram is completed, "it would only cost $50 per kilogram to send things into orbit, compared to the current rates of $10,000 per kilogram for cargo and $100,000 per kilogram for people."

China Wants To Launch 100 Rockets Between 2011 To 2015. China's Xinhua (3/11)

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NASA Hopes To Complete USA Pension Obligation This Summer.
Space News (3/10, Berger, Leone, Subscription Publication)

New Amateur Challenger Footage Released. ABC World News (3/10, story 9, 0:40, Muir)

Boeing CST-100 Spacecraft Hits Milestones.
Aerospace Daily and Defense Report (3/13, Norris)

DARPA Wants Satellite Swarm To Aid Overseas Soldiers. The New Scientist (3/14, Aron)

Chang'e-2 Exceeds China's Goals. China's Xinhua (3/14)

China May Have Already Decided To Launch Female Astronaut.
NASASpaceFlight (3/14, Quine)

NASA To Decide If Dragon Capsule Docking Will Take Place After Launch.
The Huntsville (AL) Times (3/17, Roop)

FAA Examining If SpaceShipTwo Can Launch From Mojave Space Port.
The Tehachapi (CA) News (3/18, Gordon)

Clinton Supports Renewed Earhart Search. ABC World News (3/20, story 10, 1:45, Sawyer)

ISS Could Be Used To Simulate Mars Mission. The AP (3/21, Dunn)

Musk Claims Mars Mission Could Be Done For $500,000.
In his column for the BBC News (3/21) website, Jonathan Amos

Below: 130-ton cargo version of the SLS. Image credit: NASA.

FAA Predicts Growing Space Tourism Industry In Coming Years.
Reuters (3/21, Klotz) reports George Nield, associate administrator for the FAA's Office of Commercial Space Transportation, testified to the House Subcommittee on Space and Aeronautics that he expects space tourism companies to be operating in the next year or two in an industry that could be worth $1 billion in 10 years. Nield described it as a "new and growing industry."

SLS Work On Schedule.
The Huntsville (AL) Times (3/21, Kelley) "42" blog reported, "Space Launch System (SLS) Program Manager Todd May said the massive effort to design and build the next US heavy lift rocket, NASA's largest development program, is on schedule and on track to meet the 2017 first mission launch." May, speaking to the Marshall Association Tuesday, said NASA had "a strategy and a mission" for the rocket despite what critics said. He also "repeated a key NASA talking point - SLS has to be affordable in a time of budget constraints" and outlined how NASA is keeping costs in line. However, "a major challenge, he said, has been combining Shuttle and Ares personnel, who together make up nearly 90% of the SLS development workforce, and their cultures they bring with them."

NASA Extends GRAIL Mission To December. Spaceflight Now (3/21, Clark)

Original Material From Vesta's Birth May Have Been Discovered.
Space (3/22, Malik) reports the Dawn spacecraft orbiting Vesta "has snapped amazing new photos of the colossal space rock, images that reveal strange fea-

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tures never-before-seen on an asteroid, scientists say." The images show "shiny spots that are nearly twice as bright as other parts of the asteroid - suggesting it is original material left over from the space rock's birth 4 billion years ago, NASA officials said" at the Lunar and Planetary Science Conference. Marc Rayman, Dawn chief engineer at the Jet Propulsion Laboratory, said, "Dawn's ambitious exploration of Vesta has been going beautifully."

Exploration Roadmap Could Be Released Soon.
NASASpaceFlight (3/24, Bergin) reported, "Classed as one of the defined destinations for NASA astronauts in the mid to late 2020s, missions to a Near Earth Asteroid (NEA) – utilizing the Space Launch System (SLS) – have received a level of technical evaluation via the Exploration Systems Development Division (ESD) Concept Of Operations (Con Ops) document, which overviewed the Initial, Advanced and Full mission capabilities." The article contrasted how much work has been given to a NEA mission with the fact that "no actual NEA destination or timeline has yet been determined." However, an "expansive roadmap" may be released soon. Meanwhile, training exercises have been ongoing with the NEEMO missions "laying a set of initial procedures for the eventual missions to an actual asteroid."

ESA, Chinese Officials Discuss Possible ISS Collaboration. Aviation Week (3/23, Svitak)

Small Satellites Could Vaporize Asteroid Using Lasers.
The UK's The Observer (3/25, McKie)

Cassini Reveals More Details About Enceladus' Structure. Time (3/23, Kluger)

Von Braun's Birthday Commemorated.
The Huntsville (AL) Times (3/24, Accardi) "Breaking" blog reported, "The US Space & Rocket Center threw a huge party Friday night to commemorate what would have been the 100th birthday of rocket pioneer Dr. Wernher von Braun."

Cameron Reaches Bottom Of Mariana Trench. The Washington Post (3/26, Vastag)

Messenger Reveals "Baffling" Mercury. The Washington Post (3/27, Vastag)

X-37B Mission Extended Indefinitely.
US News & World Report (3/26, Koebler) reported at last week's breakfast with reporters, US Air Force General William Shelton announced the X-37B mission has been "extended indefinitely" and there is no set date for when it will return to Earth. Shelton called the mission "spectacular" and "game-changing." The article noted that Shelton "repeatedly dodged questions about what the military is up to with the ship."

Lampson: Congress Needs To Properly Fund NASA.
In an op-ed for the Washington Times (3/27)

Cassini Makes Lowest Pass Over Enceladus' South Pole.
BBC News (3/28, Rincon) reports, "The Cassini spacecraft has made its lowest pass yet over the

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south pole of Enceladus, an active moon of Saturn which may harbour a liquid water ocean." The pass was made to learn more about the plumes of ice and water vapor coming from the moon.

New Spitzer Catalogue To Be Released This Year. Space (3/27)

Bezos To Recover Apollo 11 Rocket Engine. The AP (3/29, Chang)

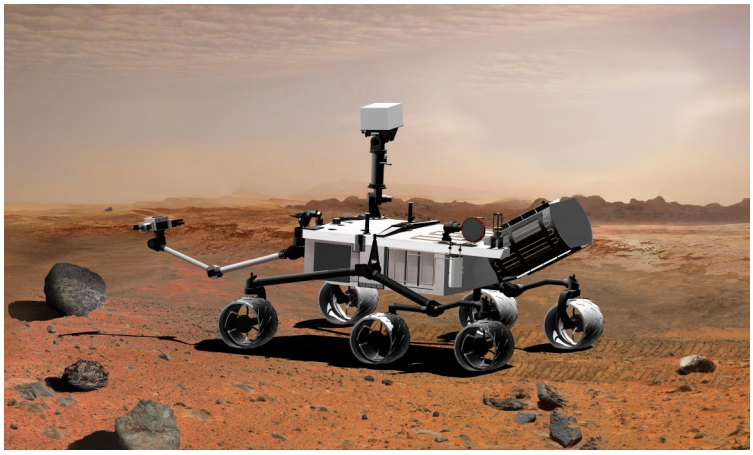
US Needs More Stealth Aircraft For Potential Chinese Campaign.
The Military Times (3/29, Schogol)

ATV-3 Arrives At ISS. Florida Today (3/29, Halvorson)

Orion To Be Assembled At KSC. Florida Today (3/29, Halvorson)

Ion Propulsion Could Have Important Consequences In Space.
In an article for Popular Mechanics (3/29), Rand Simberg writes on Boeing's recent announcement of building communications satellite without any chemical propulsion.

MSL Makes Another Successful Course Correction.
Aerospace Daily and Defense Report (3/28, Carreau) reported, "Nearing the midpoint of its 254-day journey, NASA's Mars Science Laboratory (MSL) has successfully carried out the second of six planned trajectory correction maneuvers, fine-tuning the rover's course toward an Aug. 6 landing on the red planet within the scientifically promising Gale Crater." Furthermore, ever instrument has been turned on "and checked out as well." JPL science payload test engineer Betina Pavri said, "The types of testing varied by instrument, and the series as a whole takes us past the important milestone of confirming that all the instruments survived launch."



Right: An artist's concept illustrates what the Mars rover Curiosity will look like on Mars. Credit: NASA/JPL-Caltech.

Russia Plans To Develop Nuclear Propulsion System By 2017.
Russia's RIA Novosti (3/29)

New "Cloaking" Technology Has Spacecraft Applications.
The UK's The Register (3/28, Page) reported French scientists have developed "cloaking" technology "which instead of bending microwaves or light can shield an object from heat - or concentrate heat upon it." According to the article, this is a "big deal" for spacecraft heat management. While it has its uses for current spacecraft, when future interplanetary trips occur spacecraft "will probably have to use nuclear power or some other method which will produce substantial amounts of waste heat, and stopping that heat from building up and melting the spacecraft will be a difficult challenge indeed. The new heat-director ideas...could come in very handy here."

Senators Critical Of Commercial Crew Program. Florida Today (3/29, King)

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Former DARPA Head Gives TED Talk.
Popular Science (3/29, Dillow) posts a video of former DARPA head Regina Dugan giving a talk at the TED conference, titled "From Mach-20 Glider to Hummingbird Drone." According to the article, "Dugan's theme of discouraging the fear of failure is a retrospective on DARPA's technological milestones and how the nerds at DARPA reached them by believing in impossible things."

Galaxy Could Be Filled With Billions Of Super-Earths.
BBC News (3/29, Amos) reports, "There could be many billions of planets not much bigger than Earth circling faint stars in our galaxy, says an international team of astronomers." Scientists using the Harps instrument made the estimate of exoplanets known as super-Earths "based on detections already made and then extrapolated to include the Milky Way's population of so-called red dwarf stars." The article notes the study "suggests super-Earths in the habitable zone occur in 41% of cases, with a range from 28% to 95%."

New NASA Film For Kids To Debut Tonight.
The Houston Chronicle (3/29, Baird) reports, "The red carpet is being rolled out March 29 for the Houston area kids appearing in a new movie about space exploration." The "Dare to Explore" movie, which features the Robonaut 2 robot at the ISS and will premiere tonight, "is designed to show the wonders of NASA's space exploration mission as well as provide an entertaining adventure story of space travel, much like the movie 'Spy Kids,' said Joy Saxton, who co-wrote, directed and produced the movie."

Cassini Images Several Moons Of Saturn.
BBC News (3/30, Rincon) reports, "The Cassini spacecraft has captured striking images from flying by three moons of Saturn, including new pictures of Enceladus's gushing geysers." The image was from the lowest pass over the moon's southern pole. The article notes that Cassini also "passed Dione at roughly the same distance and captured, among other observations, a nine-frame mosaic depicting the side of the moon that faces away from Saturn."

Space (3/30, Moskowitz) notes that Cassini also imaged the moon Janus, which "is so tiny that it hasn't rounded into a spherical shape; rather, it is more like a pile of icy rubble."

Researchers Develop New Motor That Could Reduce Launch Costs.
AFP (3/30) reports, "Swiss researchers said Thursday they have built a mini-motor which they claim could slash the costs of satellite launches by 10 times, ushering in 'a new era of low-cost space exploration.'"

France Wants EU To Take Over ESA.
Space News (3/30, de Selding, Subscription Publication)

Buzz Lightyear Toy Handed Over To Smithsonian. collectSPACE (3/29, Pearlman)

New Image Using Robonaut-2 Replicates Sistine Chapel.
Space (3/30, Moskowitz) reports, "Humans and robots appear to be coming closer than ever in a NASA photo that features the International Space Station's Robonaut-2 paying tribute to" Michelangelo's painting on the Sistine Chapel. Casey Joyce, Robonaut operations lead at the Johnson Space Center, said, "We felt it was symbolic of closing the technology gap between robotic technology and human capability." The article notes, "It's hard to distinguish its gracefully curling hand from the astronaut's glove in the picture."

Below: Image credit: NASA.

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60 Minutes To Air Segment On Loss Of Shuttle Jobs. The CBS News (3/30)

Increased Drone Use Spurs Questions Over Privacy. The AP (4/2)

Bolden "Tempering Expectations" About Working With China.
The Aerospace Daily and Defense Report (4/1, Svitak, Morring)

Dragon Capsule Carrying Important, But Not Unique, Cargo. Spaceflight Now (3/30, Clark)

NASA Pressing Forward With Deep Space Habitat.
NASASpaceFlight (3/31, Gebhardt) reported, "With the push for exploration Beyond Earth Orbit (BEO) increasing, a proposed habitat for human exploration outside the confines of Earth's immediate space is taking shape as NASA presses forward with the development of its new Deep Space Habitat (DSH) – a module-based habitation facility that will be used as part of manned exploration missions to the moon, asteroids, and eventually Mars." The article detailed how an initial configuration could be expanded "to a 500-day configuration, which would see the incorporation of an MPLM (Multi-Purpose Logistics Module) to the HAB/Orion duo." Meanwhile, a presentation on the concept says it would be designed to launch on EELV rockets but "should be possible" to eventually be launched on the Space Launch System.

ATV-3 Fixed Before Premature Undocking Needed. The CBS News (4/1, Harwood)

AMS Results Could Be Released In A Year.
Nature News (4/1) reported that at the American Physical Society's opening session, Samuel Ting "spent almost all his 30-minute talk describing the" Alpha Magnetic Spectrometer (AMS) now operating at the ISS "and going over the multitudinous tests his team has conducted to prove that the AMS is working a planned in the weightless, airless, sun-blasted environment of space."

Chinese Rocket Launches Apstar 7 Satellite. Spaceflight Now (3/31, Clark)

Bolden Says NASA Will Support Apollo Engine Recovery Efforts.
The Orlando Sentinel (3/31, Matthews)

Terrafugia Completes First Flight.
The AP (4/3, Durbin) reports Terrafugia "said Monday that its prototype flying car has completed its first flight, bringing the company closer to its goal of selling the flying car within the next year."

NASA Claims Supersonic Aircraft Breakthrough.
Aviation Daily (4/2, Warwick) reported, "NASA is claiming a breakthrough in the design of supersonic aircraft, with wind-tunnel tests proving it is possible to design configurations that combine low sonic boom with low cruise drag, characteristics once thought to be mutually exclusive."

ESA Shuts Down ATV Production Lines. Spaceflight Now (4/2, Clark)

Competitive Enterprise Institute Wants Homestead Act For Space Settlement.
Popular Science (4/3, Boyle) reports, "The latest in a drumbeat of pro-colonization comes from the libertarian Competitive Enterprise Institute, which is advocating the recognition of property rights on the moon or other celestial bodies."

Advisory Council Wants NASA To Choose Destinations, Milestones.
Florida Today (4/4, Halvorson) reports NASA Advisory Council Chairman Steven Squyres said in a recent letter to NASA Administrator Charles Bolden, "Given the budget reality and the de-

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velopment time for new hardware and software, which is estimated to be at least 10 years, now is the time to pick a specific destination." Squyres also wanted an outline of "near and interim steps" to reach those destinations else it will delay when astronauts can reach them. The council also found that "without a specific program definition it will become increasingly difficult to get the American public excited about the future of NASA."

Managers Do Not Know Cause Of ATV-3 Power Failure.
Aerospace Daily and Defense Report (4/3, Carreau)

Kepler Telescope Extension Expected To Bring Benefits. The AP (4/5)

SpaDE Would Remove Space Debris By Firing Pulses Of Air. In his column for Space (4/6)

Spaceport America Launches 10th Rocket. The AP (4/6)

ISS Orbit Raised.
Russia's RIA Novosti (4/6) reports, "Europe's ATV-3 unmanned resupply spacecraft, which docked with the ISS last week, readjusted the space station's orbit once again, the Russian Mission Control said." This time the engines "remained switched on for 904.2 seconds, almost 15 minutes," to raise the ISS orbit by 3.9 km.

Company Plans To Build Russian Spaceport.
Russia's RIA Novosti (4/6) reports, "The Uniparx Development company said on Thursday it was planning to build a spaceport in central Russia near the birthplace of Yury Gagarin, the first man to conquer space." It is expected to be like Spaceport America in the US. Space Adventures "has expressed its willingness to become a partner in the project."

Roscosmos, ESA Agree To Work On ExoMars. Russia's RIA Novosti (4/7)

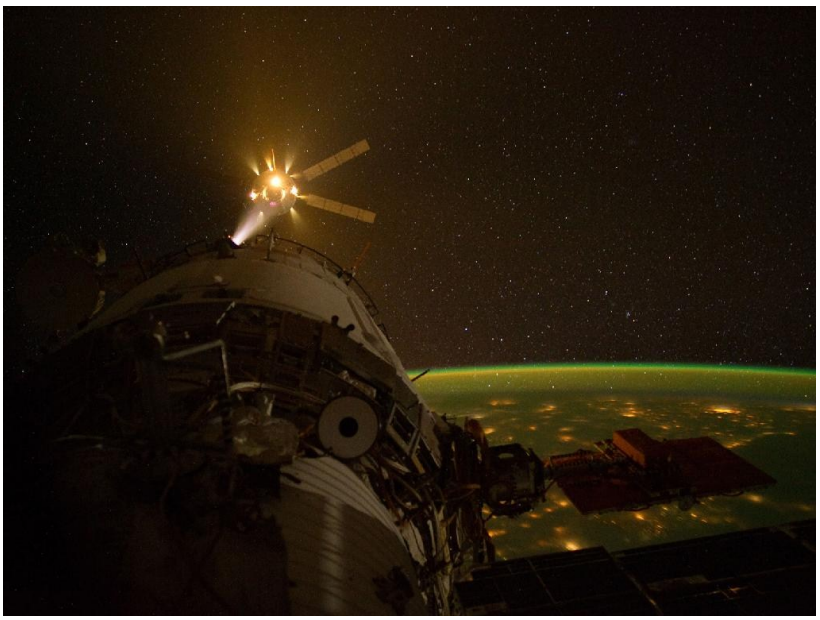
Russia Plans To Launch Spacecraft To Apophis.
Russia's RIA Novosti (4/8) reported, "Russia plans to send a satellite with a radio beacon to near-Earth asteroid of 99942 Apophis for finding out how big is a threat of its collision with Earth, the country's Academy of Sciences said in its report on Saturday." The article noted Russia views the asteroid "as the most serious threat to Earth" currently. In order to understand this threat the mission will "clarify the exact trajectory of Apophis for up to 2036."

Two Landers Will Be Sent To The Moon To Prepare For Russian Base.
Russia's RIA Novosti (4/8) reported, "Russia plans to send two lunar rovers to Moon after 2020 and a landing station after 2022 as the first steps to form the future

ISS Astronauts Take Image Of Docking ATV.

Space (4/7) reported, "Astronauts aboard the International Space Station captured an extraordinary photo of an unmanned European cargo ship as it docked to the orbiting outpost last week." Astronaut Don Pettit posted the image of the ATV-3 on his Twitter account.

Below The European Space Agency's Automated Transfer Vehicle-3 (ATV-3) approaches the International Space Station on March 28, 2012.CREDIT: NASA. Thanks to www.space.com.



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SpaceX Releasing Details On Proposed Texas Launch Site.
Space News (4/10, Leone, Subscription Publication) reports SpaceX is releasing details of its proposed launch site in Texas. As revealed in an FAA notice of intent, the site would "launch orbital and suborbital launch vehicles from a private site in Cameron County." About 12 commercial launches of the Falcon 9 medium rocket and the Falcon Heavy rocket could take place each year. It also could launch "a variety of smaller reusable suborbital launch vehicles." SpaceX spokesperson Kirstin Grantham said despite what the documents say, "The Brownsville area is one of the possibilities [for the site], but there is a long way to go before this could happen."

Teams In "Fierce" Competition To Find Earhart's Remains.
The AP (4/11, Plushnick-Masti) reports on the "fierce" competition underway between teams trying to find the remains of Amelia Earhart's in the Pacific Ocean. One group led by Jon Thompson will "spend two months searching a 400- to 600-square-mile area within 20 miles of Howland Island. It's the final section of an area where research from three institutions suggests the plane could have crashed."

Portugal Site First To Be Named Starlight Tourism Destination.
Nancy Atkinson at Universe Today (4/10) wrote, "The Great Lake Alqueva Dark Sky Reserve in Portugal is the first site in the world to receive the 'Starlight Tourism Destination' certification and has good atmospheric conditions for stargazing for more than 250 nights of the year, as well as having special lodging just for astro-tourists." Atkinson added, "Astrophotographer Miguel Claro was tasked with having just two nights to take images of one part of this Dark Sky Reserve to help promote the region, and he has sent Universe Today his stunning images" that are posted on the website.

Orbital Sciences Rolls Out Antares Rocket For Fitting Tests.
Space News (4/12, Leone, Subscription Publication)

Another Orion Parachute Test Approaches. NASASpaceFlight (4/12, Bergin)

Misidentified Fireball In Texas Was A Meteor. Life's Little Mysteries (4/12, Wolchover)

First Engines Delivered For New Chinese Rockets. Aviation Week (4/11, Perrett)

ESA Releases Navipedia.
GPS World (4/11) reported the ESA "has introduced a wiki-based information source, Navipedia, a technical wiki open to the public. Written and reviewed by experts, there are more than 400 articles on the site covering the fundamental principles of satellite navigation, how receivers operate, the various systems in current or future operation around the globe, and GNSS-related services and applications." A beta version of the website was introduced last month. The article notes that "following the wiki template, the website is now being made editable also by outside contributors."

Virgin Galactic Allowed To Launch Foreign Customers Without Export License.
Space News (4/12, Leone, Subscription Publication)

NASA Regulations For Commercial Spacecraft "Touchy" Subject.
The Huntsville (AL) Times (4/11, Roop)

Researchers Communicate Successfully Using Neutrinos.
Nancy Atkinson at Universe Today (4/11) wrote, "Scientists of the MINERvA collaboration at the Fermi National Accelerator Laboratory successfully transmitted a message through 240 meters of rock using neutrinos. The team says their demonstration 'illustrates the feasibility of using neutrino beams to provide a low-rate communications link, independent of any existing electro-

(Continued on page 45)

Current Events

From AIAA Daily Launch, a daily e-mail news summary.

(Continued from page 44)
magnetic communications infrastructure.'" The team was able to decode the message at "99 percent accuracy after just two repetitions of the signal." However, they say "significant improvements" are needed for this to be of any practical use.

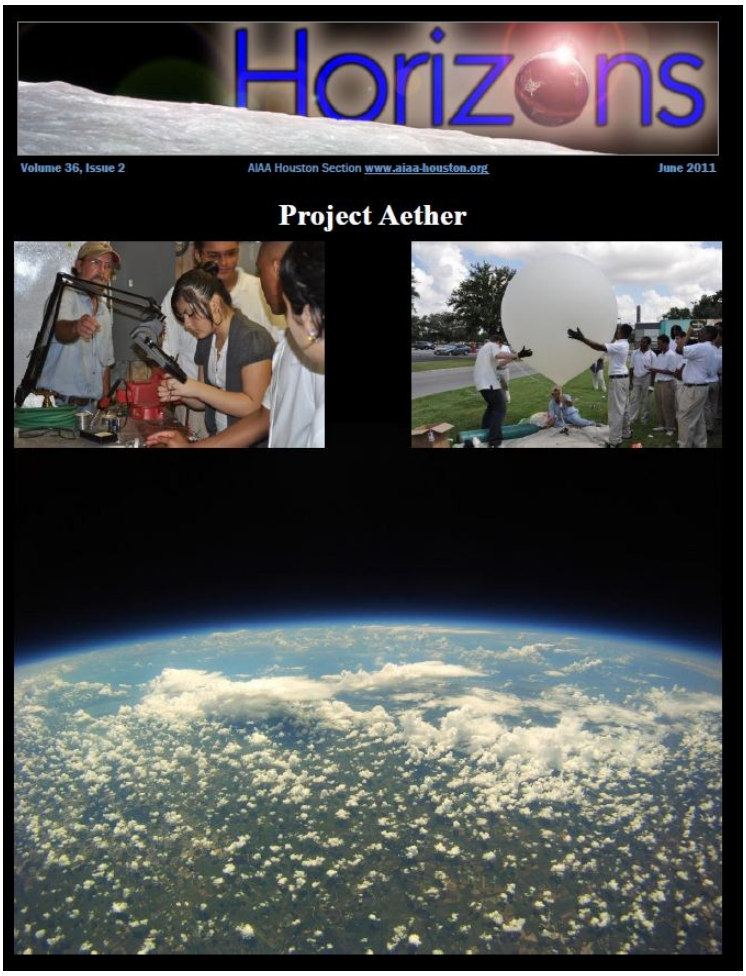
ISS Preparing For Dragon Capsule. The Aerospace Daily and Defense Report (4/12, Carreau)

NASA Examining Psychological Needs For Future Mars Mission.
Bruce Dorminey at Forbes (4/13)

AIAA Daily Launch archives

Oettinger Says EU Carbon Plan "An Impediment" To Reducing Climate Change.
USA Today (4/13, Jansen)

Public Asked To Try To Find Missing Balloon Payloads [Lost in Alaska].



Left: Horizons cover, June 2011. Image credit: Project Aether.

Space (4/19, Wall) reported Project Aether: Aurora team members are asking the public to help find six research balloon payloads they were not able to find after launching a series of balloons over the course of two weeks. If found, a person can "keep the GoPro camera that launched with it - as long as you send in the SD memory card, along with the payload's GPS device." Expedition leader Ben Longmier said the, "One of these payloads contains a Le Petit Prince action figure. ... The person to recover the payload that contains the Le Petit Prince will receive a special GoPro accessories package."

This item is not from AIAA Daily Launch, but the Houston Chronicle:
Space Launch System is a Threat to JSC, Texas Jobs, Opinion, Houston Chronicle, Chris Kraft and Tom Moser, Friday, April 20, 2012. Excerpt:
"While NASA's Space Launch System (SLS) is a well-intentioned program, we cannot afford to provide NASA with the extra $4 billion to $5 billion per year needed to make an SLS-based exploration strategy work. As a result, the human deep space exploration program is on the verge of collapse, which will have severe consequences for Texas as well as the nation."

Staying Informed

Wikipedia:
It was announced on August 5, 2011 that Neil deGrasse Tyson will be hosting a new sequel to Carl Sagan's Cosmos: A Personal Voyage television series.
New book by Tyson (2012): *Space Chronicles: Facing the Ultimate Frontier*

Right: From a Houston Chronicle blog:

Observable Universe
Exploring the cosmos with Steve Clayworth

November 2011: Here is Jupiter. Over the course of five days, the Pic du Midi observatory in the French Pyrenees took a beautiful series of images of the planet, and they were then combined into this lovely video.

The Pic du Midi is located in the region of our French sister section, 3AF MP.

Right: The Serpent Dust Devil of Mars

A towering dust devil casts a serpentine shadow over the Martian surface in this image acquired by the High Resolution Imaging Science Experiment (HiRISE) camera on NASA's Mars Reconnaissance Orbiter.

The scene is a late-spring afternoon in the Amazonis Planitia region of northern Mars. The view covers an area about four-tenths of a mile (644 meters) across. North is toward the top. The length of the dusty whirlwind's shadow indicates that the dust plume reaches more than half a mile (800 meters) in height. The plume is about 30 yards or meters in diameter.

A westerly breeze partway up the height of the dust devil produced a delicate arc in the plume. The image was taken during the time of Martian year when the planet is farthest from the sun. Just as on Earth, winds on Mars are powered by solar heating. Exposure to the sun's rays declines during this season, yet even now, dust devils act relentlessly to clean the surface of freshly deposited dust, a little at a time.

This view is one product from an observation made by HiRISE on Feb. 16, 2012, at 35.8 degrees north latitude, 207 degrees east longitude. Other image products from the same observation are at http://www.uahirise.org/ESP_026051_2160 .

HiRISE is one of six instruments on NASA's Mars Reconnaissance Orbiter. The University of Arizona, Tucson, operates the orbiter's HiRISE camera, which was built by Ball Aerospace & Technologies Corp., Boulder, Colo. NASA's Jet Propulsion Laboratory, a division of the California Institute of Technology in Pasadena, manages the Mars Reconnaissance Orbiter Project for the NASA Science Mission Directorate, Washington. Lockheed Martin Space Systems, Denver, built the spacecraft.

Image credit: NASA/JPL-Caltech/Univ. of Arizona

Staying Informed

Left: ISS030-E-175120 (28 March 2012) --- European Space Agency's "Edoardo Amaldi" Automated Transfer Vehicle-3 (ATV-3) approaches the International Space Station. The unmanned cargo spacecraft docked to the space station at 6:31 p.m. (EDT) on March 28, 2012, delivering 220 pounds of oxygen, 628 pounds of water, 4.5 tons of propellant, and nearly 2.5 tons of dry cargo, including experiment hardware, spare parts, food and clothing. Image credit: NASA.

Left: ISS030-E-175090 (28 March 2012) --- European Space Agency's "Edoardo Amaldi" Automated Transfer Vehicle-3 (ATV-3) approaches the International Space Station. The unmanned cargo spacecraft docked to the space station at 6:31 p.m. (EDT) on March 28, 2012, delivering 220 pounds of oxygen, 628 pounds of water, 4.5 tons of propellant, and nearly 2.5 tons of dry cargo, including experiment hardware, spare parts, food and clothing. Image credit: NASA.

Left: From left to right: NM Cultural Director Veronica Gonzales, Retired NASA Astronaut Harrison Schmidt, Marta Kranz, NASA Apollo Flight Director Gene Kranz, and Ed Brabson of Governor's Commission for the NM History of Space Museum. (Photo by Steve Kovar)

Left:
Gene Kranz Inducted Into the International Space Hall of Fame.

Above: Saturday, March 10, 2012—At the New Mexico History of Space Museum in Alamogordo, Gene Kranz was inducted into the International Space Hall of Fame. He is the 154th inductee.

http://www.nasa.gov/centers/wstf/news/2012/Gene_KranzVisit.html

History

The Conquest of Space

DR. A. A. JAKCSON, CHAIR, AIAA HOUSTON SECTION ASTRODYNAMICS TECHNICAL COMMITTEE

The Conquest of Space is a prolog to the article starting on the next page, The Ugly Spaceship, a reprint (updated) by Dr. Albert A. Jackson IV from the April 2002 issue of Horizons.

Prolog (2012)

In the ten years since I wrote the article below, Wernher von Braun's *Project Mars: A Technical Tale* was published by Apogee Press 2006. It was von Braun's concept that a science fiction [SF] novel about an expedition to Mars would fire the public's imagination, done as what would be called nowadays, "hard SF." The original manuscript was in German and called *Das Marsprojekt*. He claims in the 1948 introduction that he wanted to avoid "pulp" science fiction, yet failed to notice that John Campbell and his boys (Heinlein, Asimov, Clarke…) had banished BEMs [Bug-Eyed Monsters] and Brass Bras to the realm of third string SF magazines starting about 1938! Realistic, scientifically accurate space flight SF was common currency in 1950. No publisher in the USA would touch the manuscript. The story is not totally awful, but nowhere near the standards of, say, a Heinlein juvenile SF in 1950. Von Braun sent the German manuscript to a publisher in Munich. The publisher didn't like the story but was astounded by the scientific appendix. He came to USA and spoke to von Braun about publishing the novel, but first he wanted to publish the appendix! Von Braun agreed to this, but first the appendix was reworked; broken into chapters with nicer figures. Published in 1952 in German as *Das Mars Projekt,* it was quickly translated by the University of Illinois as The Mars Project in 1953.

During the 1990s I worked with ESA [European Space Agency] astronautics engineers at JSC [Johnson Space Center] on the International Space Station [ISS]. There were many ESA countries represented on the ISS team, but all of these individuals happened to be German. One of them made an astounding discovery. Living in the JSC area was old Peenemünder [Peenemünde is the area in northern Germany highly involved in the production of the V-2 rocket during World War II.], Joachim Mühlner. (If you have a copy of *The Mars Project*, can find his name in the introduction by von Braun.) An electrical engineer who worked on the V2, ICBMs, Apollo and the Shuttle! What a span! I met him in 1998, and finally interviewed him in 2000. I could not believe my good luck. Joachim was in his late 80s, retired for some time, quite frail and hard of hearing, but a very nice man. He died in 2004. I only had about two hours with him, although he spoke perfect English, he would lapse into German now and then, and my German friends would coax him back to English. His memory of working on *Das Marsprojekt* was a bit clouded by age, but it's the only firsthand account I have.

He recalled von Braun, in 1947, getting bored sitting at White Sands, working in his inimitable manner to think of something to galvanize the public about spaceflight. The idea was to give all the engineering physics a rock solid underpinning, then write a science fiction novel. Joachim stated that von Braun said, "Shoot for stars! Knock their socks off!" All the technical details, as I wrote above, were worked out down to the bolt head!

The great visionary Krafft Ehricke apparently had long arguments with von Braun about the scale of the project. However, he was good humored enough to play along. A lot of ideas in the final blueprint are Ehricke's . Check out the astrodynamics figures, those are pure Ehricke, see: Krafft A. Ehricke: *Space Flight, Volume 2: Dynamics,* Van Nostrand Reinhold (1962).

According to my notes, Mühlner told me none of the team believed there would be a social – economic setting in the near future that would make the concept real, but what the hell, damn the torpedoes full steam ahead! Even in 1953, the whole concept belonged to a parallel universe, and so it remains. Who knows how many teenagers, me included, went on to study math and physics because of this totally crazy concept!

Above: Peenemünde in Germany. Image credit: Public domain. Image source: Wikipedia.

(Continued on page 49)

The Ugly Spaceship

History

Dr. A. A. Jakcson, Chair, AIAA Houston Section Astrodynamics Technical Committee

I was 11, a week from being 12 years old. It was in the mailbox. "It" was the October 18, 1952 issue of Collier's magazine. I had seen the movie *Destination Moon*; I had my copy of Fletcher Pratt and Jack Coggins' *ROCKETS JETS, GUIDED MISSLES AND SPACE SHIPS*. Where was the bullet shape? The fins? The needle nose? This was not right! This was supposed to be a space ship! It was ugly!

Yet! That lighting, the color, that splash of molten rock! The detail! How could something so ugly... catch my imagination? How could it seem so real? I took that issue to my room… "Ugly!"

It lay about most of the day. Well... eventually I had to read it. That week I must have read that issue 20 times!

Air! If you don't have air, you don't need aerodynamics. I thought about Willy Ley and Werner von Braun's words. Yeah! To land on the Moon, you don't need a bullet shape. Almost any shape will do.

I came to love that ugly space ship! It cemented itself to my soul. It led me to a life in science, a B.A. degree in Mathematics, a M.A. degree in physics and Ph.D. in physics. All due to the romance of space expressed by Chesley Bonestell, Wernher von Braun and Willy Ley.

(See Figure 1.)

March 22, 2002 marks the 50th anniversary of the most influential feat of popular science writing ever. The March 22, 1952 issue of Col-

(Continued on page 50)

The Ugly Spaceship is a reprint (updated) of this article by Dr. Albert A. Jackson IV from the April 2002 issue of Horizons. See the prior page for Dr. Jackson's 2012 prolog to this reprint.

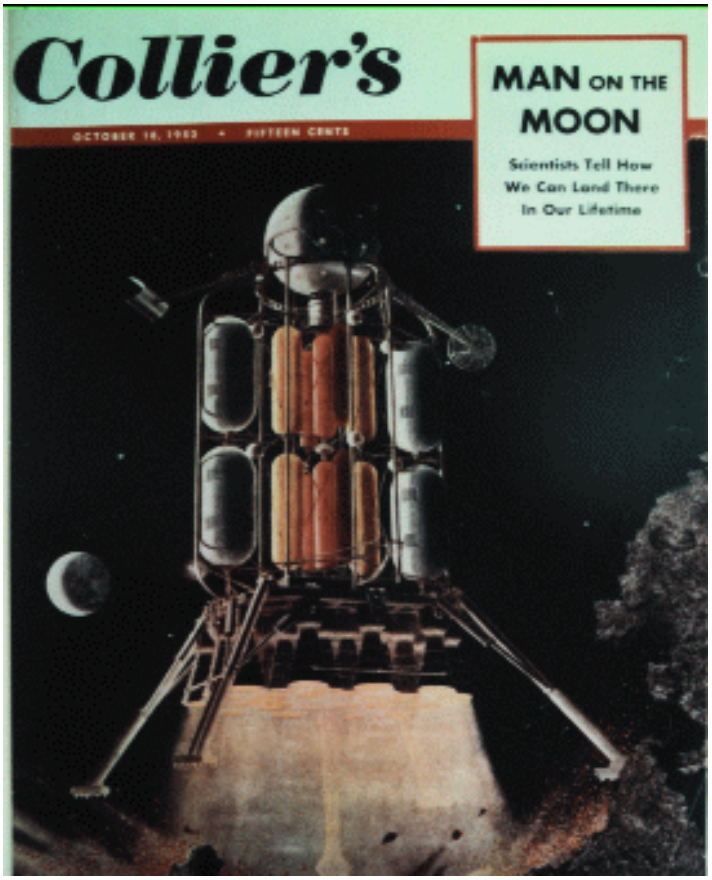


Figure 1 : Landing on the Moon.

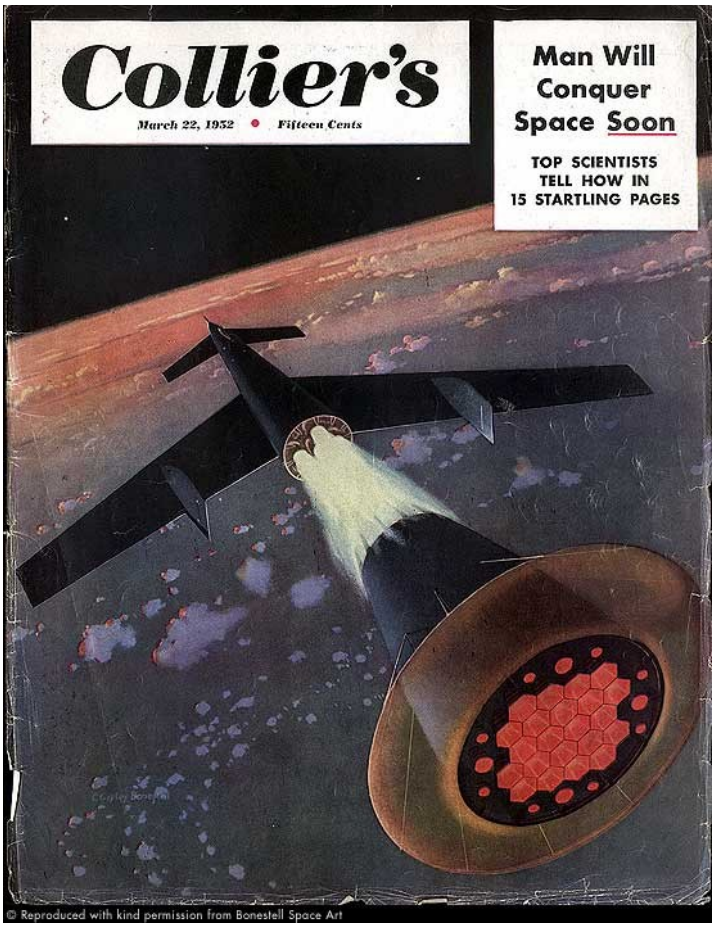


Figure 2: Ferry separation for the second state.

History

(Continued from page 49)

lier's stands a landmark in the history of space flight.

(See Figure 2: prior page.)

Collier's magazines from March 1952 to April 1954 outlined an amazing dream. There was a huge vertical three-stage launch vehicle with its horizontal landing ferry space ship, a large torus space station, orbital transport ships, a base on the Moon, exploration of the Moon, and ultimately a manned expedition to Mars. Even though the exposition in each issue was brief, all aspects of manned space flight were covered. Besides the hardware, there was coverage of the medical/psychological and training elements of manned space flight, even the legal aspects of manned exploration of earth orbit and the Moon. The prose in the Collier's issues was simple, direct and clear. The illustrations on the covers and pages conveyed an immense sense of detailed design. Even if those articles were fairly short, the amount of information contained in the paintings and drawings enfolded a mind-boggling amount of depth of thought.

(See Figure 3.)

The March 22, 1952 issue of Collier's dealt with the design and building of the space station. The basic building blocks were ferry ships and were incredible, in the words of Wernher von Braun: "Imagine the size of this huge three-stage rocket ship: it stands 265 feet tall, approximately the height of a 24-story building. It base measures 64 feet in diameter. And the overall weight of this monster rocket ship is 14,000,000 pounds, or 7,000 tons – about the same weight as a light cruiser." Hardly mentioned is that in the building and testing this ferry ship, man would have made his first orbital flight!

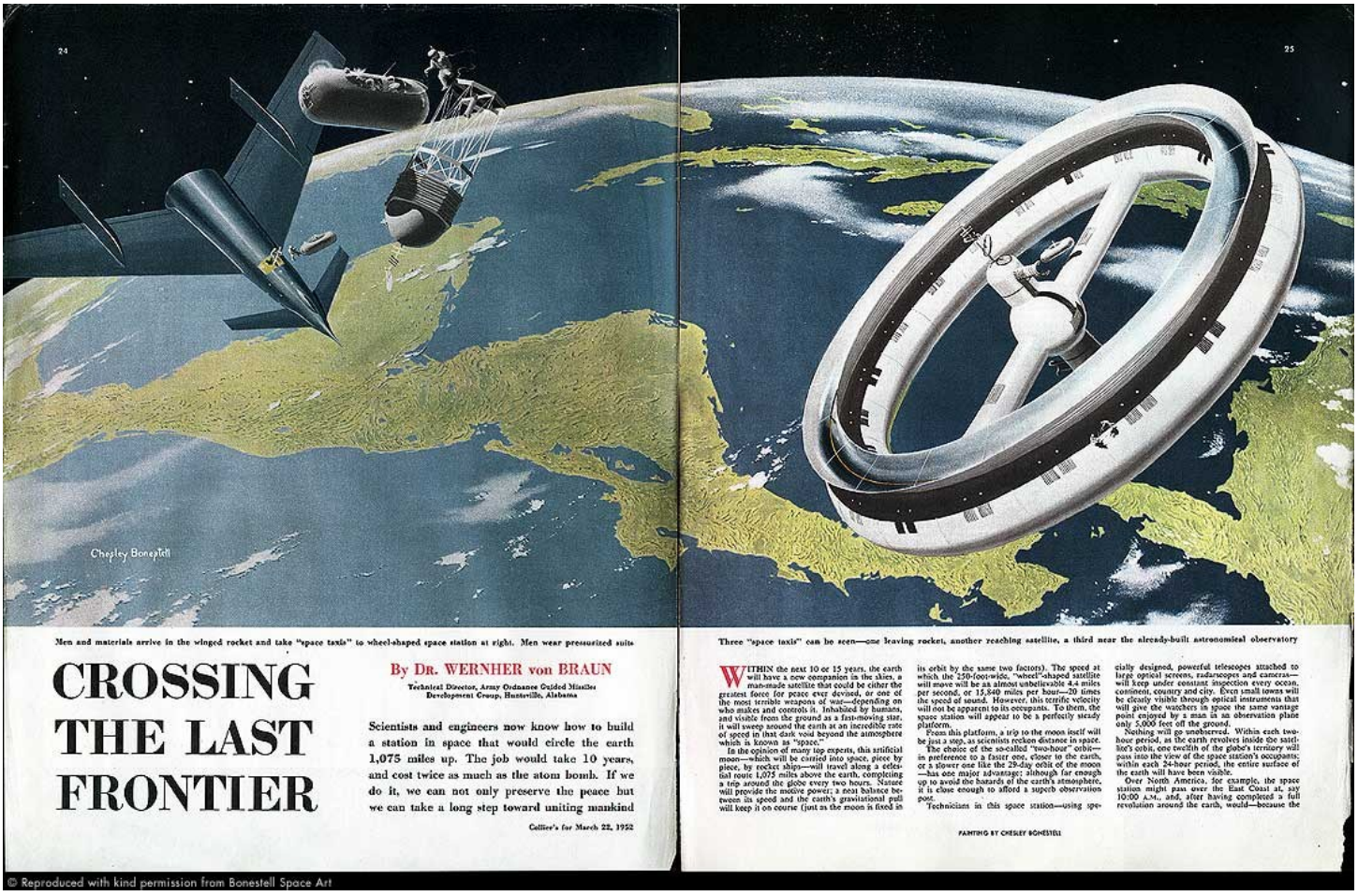
Only 15 years later von Braun led his Marshall Space Flight Center crew to design and build the Saturn V.

(See Figure 4: next page.)

The design of a totally manned space flight mission

(Continued on page 51)

Below: Figure 3: Crossing the Last Frontier. This is from the Collier's issue of March 22, 1952.



Men and materials arrive in the winged rocket and take "space taxis" to wheel-shaped space station at right. Men wear pressurized suits

Three "space taxis" can be seen—one leaving rocket, another reaching satellite, a third near the already-built astronomical observatory

CROSSING THE LAST FRONTIER

By Dr. WERNHER von BRAUN

Technical Director, Army Ordnance Guided Missiles Development Group, Huntsville, Alabama

Scientists and engineers now know how to build a station in space that would circle the earth 1,075 miles up. The job would take 10 years, and cost twice as much as the atom bomb. If we do it, we can not only preserve the peace but we can take a long step toward uniting mankind

Collier's for March 22, 1952

WITHIN the next 10 or 15 years, the earth will have a new companion in the skies, a man-made satellite that could be either the greatest force for peace ever devised, or one of the most terrible weapons of war—depending on who makes and controls it. Inhabited by humans, and visible from the ground as a fast-moving star, it will sweep around the earth at an incredible rate of speed in that dark void beyond the atmosphere which is known as "space."

In the opinion of many top experts, this artificial moon—which will be carried into space, piece by piece, by rocket ship—will travel along a celestial route 1,075 miles above the earth, completing a trip around the globe every two hours. Nature will provide the motive power: a neat balance between its speed and the earth's gravitational pull will keep it on course (just as the moon is fixed in its orbit by the same two factors). The speed at which the 250-foot-wide, "wheel"-shaped satellite will move will be an almost unbelievable 4.4 miles per second, or 15,840 miles per hour—20 times the speed of sound. However, this terrific velocity will not be apparent to its occupants. To them, the space station will appear to be a perfectly steady platform.

From this platform, a trip to the moon itself will be just a step, as scientists reckon distance in space.

The choice of the so-called "two-hour" orbit—in preference to a faster one, closer to the earth, or a slower one like the 28-day orbit of the moon—has one major advantage: although far enough up to avoid the hazards of the earth's atmosphere, it is close enough to afford a superb observation post.

Technicians in this space station—using specially designed, powerful telescopes attached to large optical screens, radarscopes and cameras—will keep under constant inspection every ocean, continent, country and city. Even small towns will be clearly visible through optical instruments that will give the watchers in space the same vantage point enjoyed by a man in an observation plane only 5,000 feet off the ground.

Nothing will go unobserved. Within each two-hour period, as the earth revolves inside the satellite's orbit, one twelfth of the globe's territory will pass into the view of the space station's occupants; within each 24-hour period, the entire surface of the earth will have been visible.

Over North America, for example, the space station might pass over the East Coast at, say 10:00 A.M., and, after having completed a full revolution around the earth, would—because the

PAINTING BY CHESLEY BONESTELL

(Continued from page 50)
had occurred before. In 1939, The British Interplanetary Society had planned out a mission to the Moon. The scale of the Collier's space flight series seemed titanic. It is interesting that the sequence of events in Collier's sequence was kind of backfill. Von Braun and his Peenemünde colleagues had envisioned the origin of the ferry ships and the interplanetary passenger-cargo vehicles in 1948. In fact, this "paper mission" appeared as the last installment of the Collier's series April 30, 1954.

(See Figure 5.)

Dr. von Braun's paper project was worked on between the end of 1947 and throughout 1948. It was published in a special edition of the German space flight journal *Weltraumfahrt* in 1952, later that year in a hardback edition. Lucky for me I bought a copy of the English translation in 1953, from the University of Illinois Press.

(See Figure 6: next page.)

This slim little volume details the design of the earth-to-orbit ferry vessels, the passenger/cargo ships and the Martian landing "boats." The chapter headings are (a) THREE-STAGE FERRY VESSELS, (b) SPACE SHIPS, (c) LANDING BOATS, (d) FERRY FLIGHTS AND GENERAL LOGISTICS, (e) POWER PLANT PERFORMANCE and (f) INTERPLANETARY RADIO COMMUNICATION.

The vision was: a grand flotilla of ten space ships would go to Mars for an expedition time of two years, with seventy explorers! Fifty men go to the surface, twenty stay in orbit. Everything is worked out, even the 950 (!) ferry flights needed to assemble the ten space ships. In the Collier's series the Space Station plays a role in the Grand Design.

(Continued on page 52)

Figure 4: How Man Will Meet EMERGENCY in Space Travel.

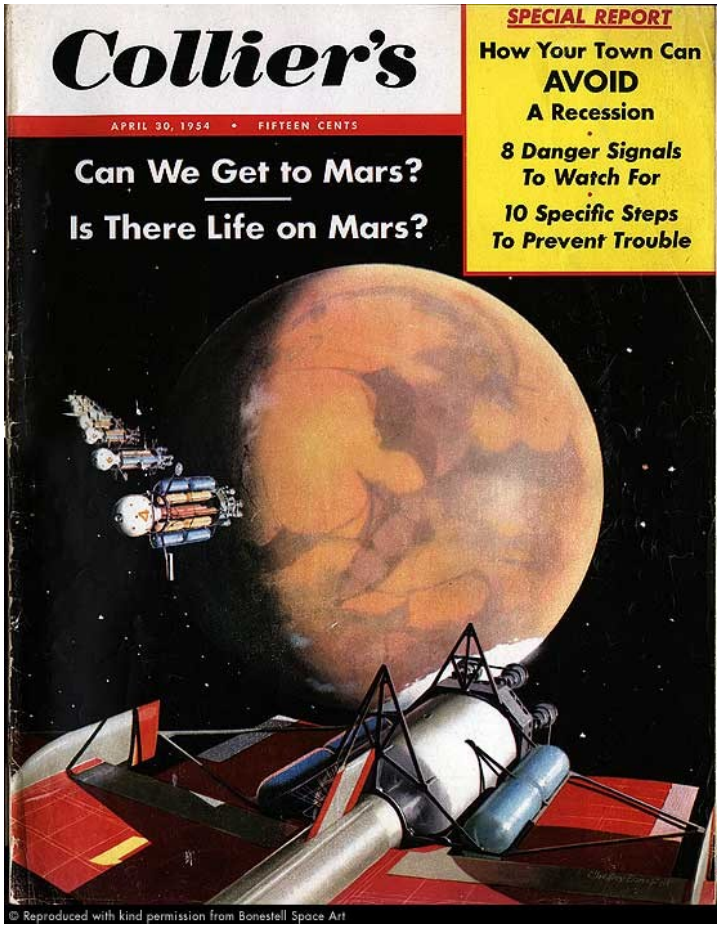


Figure 5: Can We Go to Mars? Is There Life on Mars?

History

(Continued from page 51)

Thus the basic space ships for the Collier's series were finished in 1948. It is amazing that one might think of the great establishment of manned space flight in terms of the 1952 Collier's series. Actually, it was even earlier: 1948! Yet the full realization of this Collier's series from 1952 to 1954 is astounding, due in great measure to the artistry of Chesley Bonestell.

References

(1) Pratt, Fletcher. Illustrated by Coggins, Jack. *Rockets, Jets, Guided Missiles and Space Ships*.

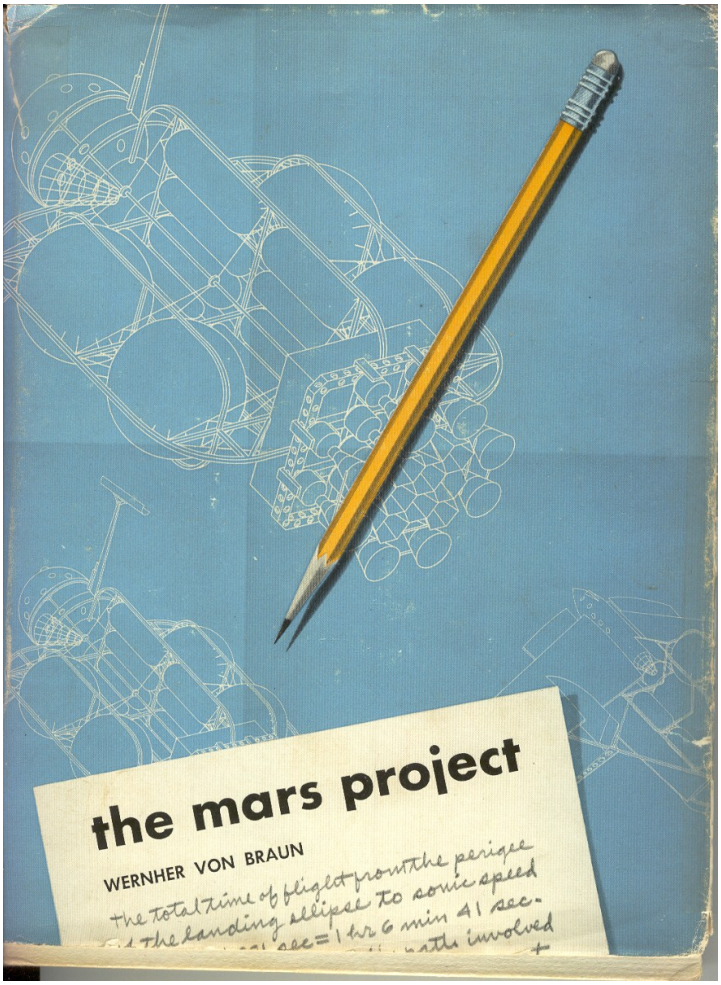
(2) The Collier's *Space Flight Series*

- March 22, 1952: *Man Will Conquer Space Soon*, a collection of eight articles .
- October 18, 1952: *Man on the Moon, The Journey, and Inside the Moon Ship*
- October 25, 1952: *Man on the Moon, Inside the Lunar Base*
- February 28, 1953: *The World's First Space Suit*
- March 7, 1953: *Testing the Men in Space*
- March 14, 1953: *How Man Will Meet Emergency in Space*
- June 27, 1953: *The Baby Space Station*
- April 30, 1954: *Can We Get to Mars? Is There Life on Mars?*

(3) *Marsprojekt; Studie einer interplanetrischen Expedition*. Sonderheft der Zeitschrift Weltraumfahrt. Frankfurt: Umschau Verlag, 1952.

(4) Das Mars Projekt / Wernher von Braun. - Esslingen : Bechtle Verlag, 1952.

Below: Figure 6: The Mars Project, by Wernher von Braun, University of Illinois Press, 1953, the copy belonging to Dr. A. A. Jackson.



Epilog (2012)

The publication of von Braun's novel revealed so much very interesting information! Most of the technical infrastructure had been worked out, but only small parts of it appear in the 1953 monograph. Though the ferry ships are briefly described *The Mars Project* monograph, they are not detailed, nor is the space station. They are detailed in the novel *Project Mars: A Technical Tale*, except that was not known until 2005! Von Braun and his collaborators had all technical stuff, in their back pocket, worked out, even for the Moon expedition that appeared in Collier's, though they and even Chesley Bonestell did some tweaking for that Collier's series.

It is a shame that the whole eight issues of the Collier's series were never collected into a single volume. There are a couple of stunning Bonestells [images] in those issues never appeared anywhere else, plus a lot of exposition that never appeared in the Viking Press books that came from that series. (Not to forget the wonderful Fred Freeman and Rolf Klep illustrations.)

This Bonestell [image] (Figure 7) appeared in the March 1953 issue of Collier's, concerned with how to handle emergencies, such as the failure, which in the space shuttle era would be known as "abort." The cover illustration by Fred Freeman is his only featured Colliers lead for the spaceflight series. The details of these illustrations and the exposition are not in the von

(Continued on page 53)

(Continued from page 52)

Braun novel, except for von Braun's anticipation of the loss of ferry ships in the building of the space station, the Moon expedition and the Mars expedition. The whole sequence of this emergency is amazing. In the Apollo program, this was covered in a different way. In the Space Shuttle Orbiter program only the first flights had ejection seats, and later nothing for low or high altitude aborts.

(See Figure 7.)

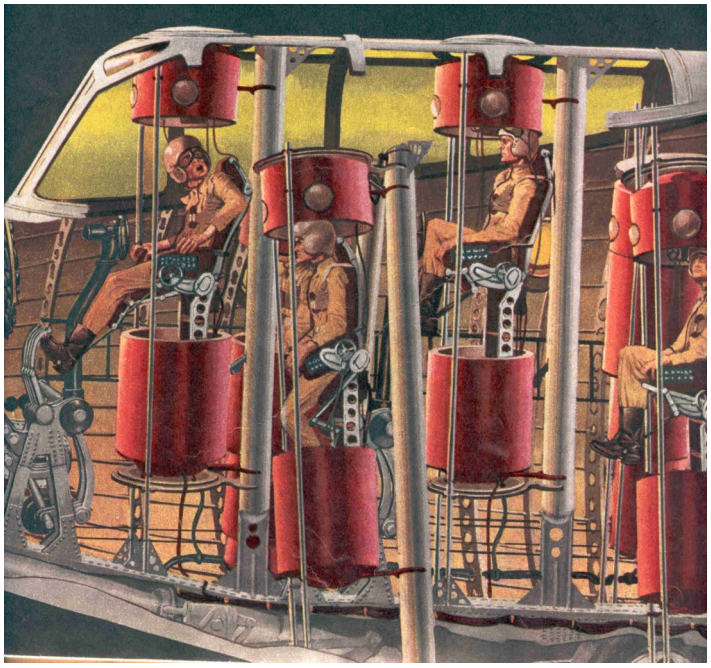
Detail by Fred Freeman , with a 'phantom' illustration of the interior abort sequence.

(See Figure 8.)

The abort capsule, the Shuttle program may have considered such a configuration but it is unclear if such a concept was even on paper.

(See Figure 9.)

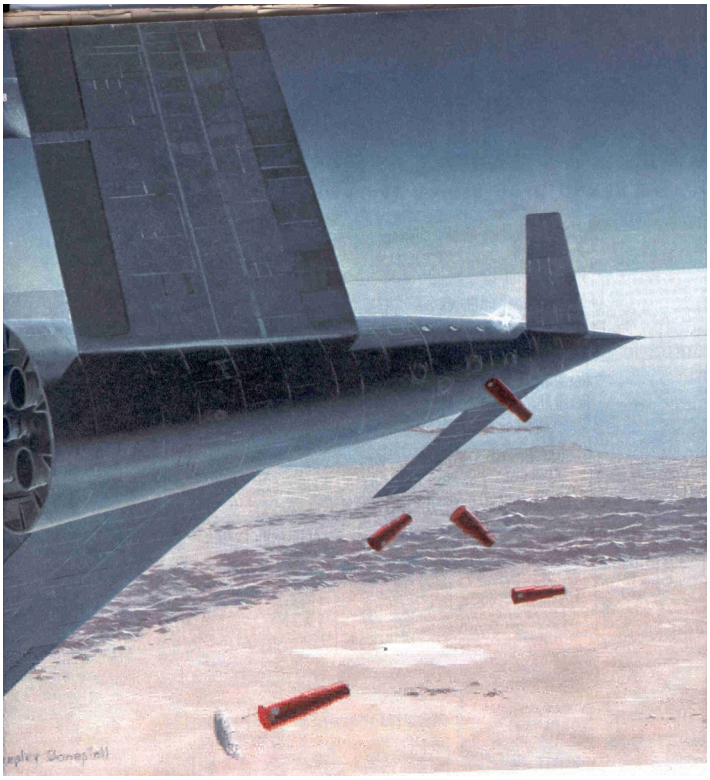
(Continued on page 54)



Below: Figure 7: Abort scenario.

Below left: Figure 8: Detail by Fred Freeman, the interior abort sequence.

Left: Figure 9: The abort capsule.



History

(Continued from page 53)

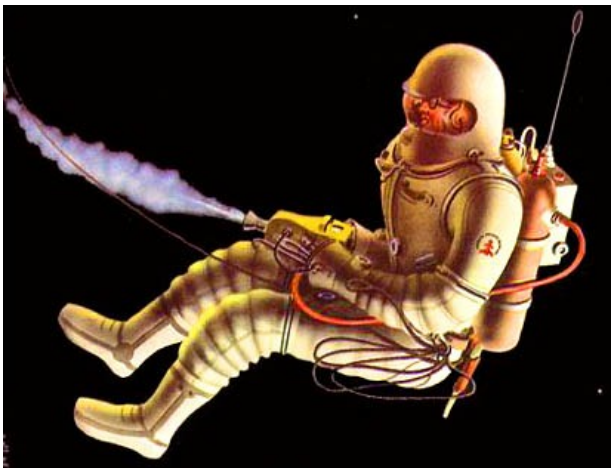
From March 7 1953 another Fred Freeman illustration of preflight testing and simulation. This artwork anticipates some work done for Apollo. The accompanying article goes into detail about training and mission simulation. I know of no other popular publication that covered such detail.

(See Figure 10.)

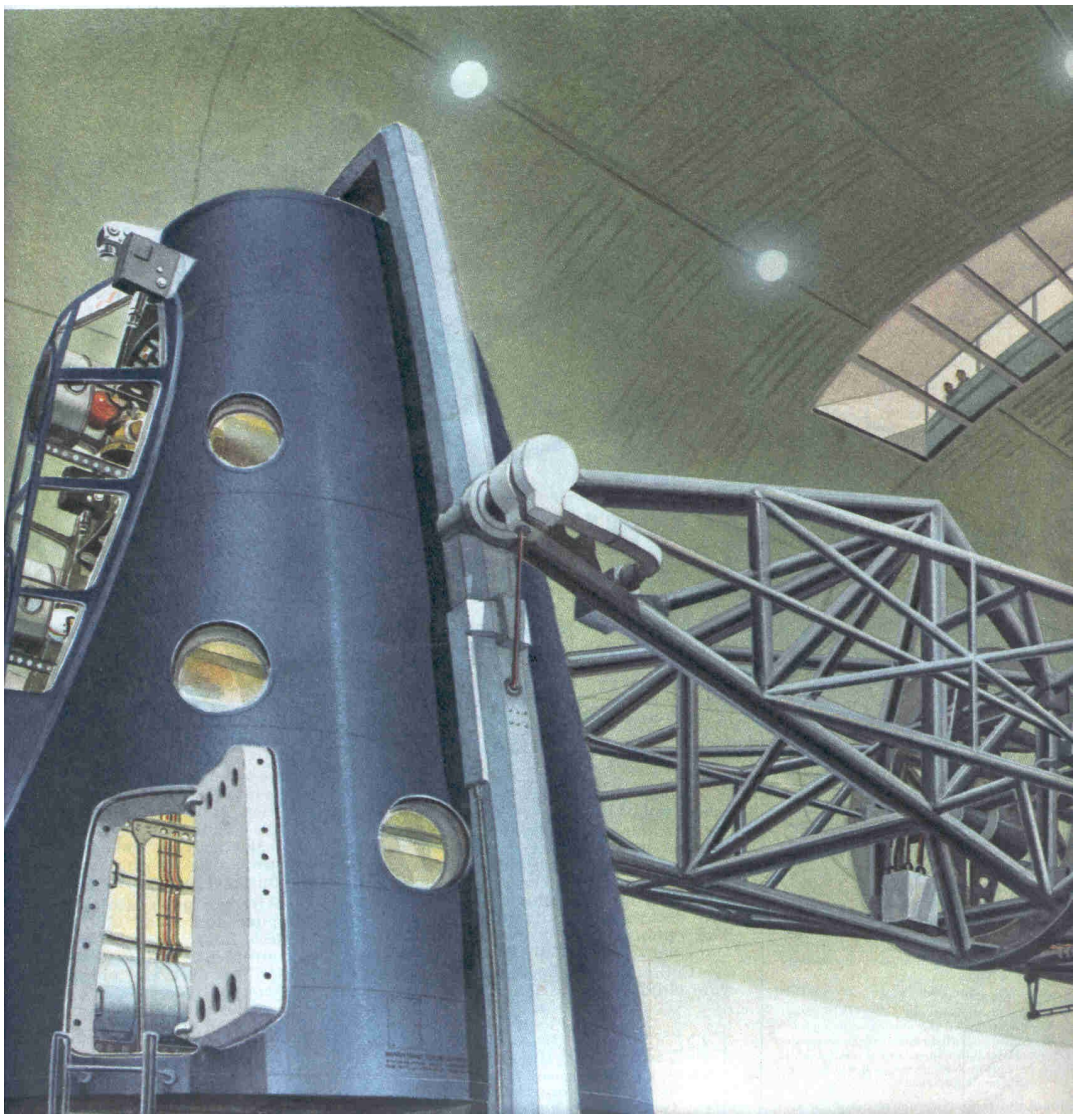
There is even space suit design. With a maneuvering system used in Gemini , but abandoned .

(See Figure 11.)

(Continued on page 55)



Right: Figure 11: There is even space suit design. With a maneuvering system used in Gemini , but abandoned .



Right: Figure 10: From March 7 1953 another Fred Freeman illustration of preflight testing and simulation. This artwork anticipates some work done for Apollo. The accompanying article goes into detail about training and mission simulation. I know of no other popular publication that covered such detail. (Dr. A. A. Jackson)

(Continued from page 54)

Figure 12 shows Rolf Klep's beautiful phantom drawing of the Mar Project ferry ship. Notice on the right von Braun with the "fat" A11 derived version. It was Bonestell who did the redesign for a more "slim" version. I have to wonder where that scale model is?

(See Figure 12.)

[The End]

History

Editor's note: Dreams of Space: we came across this excellent March 22, 2012 blog entry in April of 2012. It presents excellent page scans of Collier's from the issue dated March 22, 1952, the first in this series of eight articles: the 60th anniversary!

Below: Figure 12: Rolf Klep's beautiful phantom drawing of the Mar Project ferry ship. Notice on the right von Braun with the "fat" A11 derived version. It was Bonestell who did the redesign for a more "slim" version. I have to wonder where that scale model is? (Dr. A. A. Jackson)

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Left: JSC2012-E-020143 (17 Jan. 2012) --- Expedition 31/32/33 crew members pose for a group photo in an International Space Station mock-up/trainer in the Space Vehicle Mock-up Facility at NASA's Johnson Space Center. Pictured from the left are Japan Aerospace Exploration Agency (JAXA) astronaut Akihiko Hoshide and Russian cosmonaut Yuri Malenchenko, both Expedition 32/33 flight engineers; NASA astronaut Sunita Williams, Expedition 32 flight engineer and Expedition 33 commander; Russian cosmonaut Gennady Padalka, Expedition 31 flight engineer and Expedition 32 commander; NASA astronaut Joe Acaba and Russian cosmonaut Sergei Revin, both Expedition 31/32 flight engineers. Photo credit: NASA.

Above right: ISS032-S-001 (September 2011) --- This patch represents the 32nd expedition to the International Space Station (ISS) and the significance of the science being conducted there for current and future generations. The arch shape of the patch symbolizes the "doorway" to future space exploration possibilities. The ISS, an orbiting laboratory above the Earth, provides a unique perspective for Earth observation and monitoring. The flame depicts the pursuit of knowledge and highlights the importance of education as the key to future human space flight. The astronaut symbol circles the Earth, acknowledging the work of all astronauts, past, present, and future. The names of each crew member located on the border of the patch are written to honor the various cultures and languages on the mission. The three flags also depict the home countries of the Expedition 32 crew members and signify the collaborative ISS partnership of 15 countries working as one. Photo credit: NASA and Its International Partners.

Left: NEEMO 15 crew pose for one last picture - Takuya Onishi (JAXA), Shannon Walker (NASA), David Saint-Jacques (CSA), Steve Squyers (Cornell), Nate Bender (NURC), and James Talecek (NURC). Photo credit: NASA.

Editor's note: Hurricane Rina cut short the NEEMO 15 mission in late 2011. NEEMO 16 is scheduled next. That is tentatively set for summer 2012.

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