Horizons

Volume 39
Issue 1

The Newsletter of AIAA Houston Section
The American Institute of Aeronautics and Astronautics

July / August 2013
www.aiaahouston.org

Images of Earth from Two Distant NASA Spacecraft

Also, Continuing in this Issue! Part 7 of 8:
Man Will Conquer Space Soon!
(Collier's 1952-54)

Near the top of every page is an invisible link to return to this page.
The link is in located here (the blue bar), but not all pages display this bar.

July / August 2013
Horizons, Newsletter of AIAA Houston Section

TABLE OF CONTENTS

From the Chair, by Michael Frostad 3
From the Editor, by Douglas Yazell 4
Cover Story: Images of Earth from Two Distant NASA Spacecraft 5
Webster's Tourism Connection, by Dr. Betsy Giusto 10
The 1940 Air Terminal Museum at Hobby Airport 14
The Experimental Aircraft Association (EAA) Chapter 12 (Houston) 15
Climate Change and Local Responses 16
The Johnson Space Center Astronomical Society (JSCAS) 17
Staying Informed (United Nations 2013 IPCC AR5 climate change report) 20
The Late James C. McLane, Jr. (Part 1 of 6, Dinner Meeting Presentation) 21
A Tour of Copenhagen Suborbitals, by Shen Ge 22
Looking at Houston Horizons for Space, by Wes Kelly 24
Current Events 31
A Tribute to the Pioneers Who Challenged the Atlantic Ocean by Airplane 32
Section News: Calendar and Cranium Cruncher 36
Section News: Organization Charts for 3AF MP and AIAA Houston Section 38
Student Section News: Rice University and Texas A&M University 40
The Collier's 1952-54 Space Series, Man Will Conquer Space Soon! 42
Collier's of June 27, 1953, Man Will Conquer Space Soon! 47
The Back Cover: One Giant Leap! NASA LADEE Moon Mission Launch 62

Horizons and AIAA Houston Section Web Site
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Cover: Image credit: NASA.

This page: part of Vincent van Gogh's 1889 painting The Starry Night.

Back to Basics

From the Chair

MICHAEL FROSTAD, CHAIR

The AIAA Houston Section, one of the largest sections of the American Institute of Aeronautics and Astronautics, kicked off the 2013-2014 season on August 6th with an executive council kick-off meeting, a leadership retreat. As with any beginning, we started with the basics: What is our Objective? What is our Mission?

Our Objective is to further within our territory the purposes and programs of the American Institute of Aeronautics and Astronautics.

We accomplish this objective by fulfilling four primary missions:

- Provide the AIAA Houston Section Membership with opportunities for continuing education, professional growth, and recognition for accomplishments.
- Stimulate the exchange of information within the scientific and technical community.
- Provide support and encouragement for students learning math, science, and engineering.
- Assist the general public in understanding the benefits of aerospace systems technology.

At the kick-off event many great ideas were discussed on how to fulfill these missions over the year and already we have been working towards their implementation.

One of the main concerns is one that recurs over and over in any organization – Communication. To this end the email lists have already been updated and scrubbed so that we can insure members get the benefit of members only information and yet still reach out to past members and others in the area that might be interested in our public programs. Already a "members only" email with STEM event training was sent out so if you did not receive it, be sure your membership is up to date or contact us to help sort it out. Other emails about upcoming events and our Horizon's newsletter announcements have also gone out to help you stay up to date. Furthermore we plan to expand the use of our social media to spread awareness, and perhaps reminders, of upcoming AIAA Houston events so look for us on Facebook and LinkedIn if those are your preferred avenues of staying in touch.

In addition to Communication, we want to make sure our technical branch is providing a good base community for each discipline. Examining our organization chart you will find that the Houston Section has 14 technical committees. I highly encourage you to find your technical committee (or a closely related one) and to contact the technical committee Chair to get on their lists so you are the first to know when the next meeting or Lunch and Learn is – or even to offer a talk about your current work. A technical Lunch and Learn is a great way to share your information locally and perhaps help you to hone that presentation before a national conference.

As the AIAA year ramps up, AIAA Houston Section has already coordinated a local STEM event, provided information for national STEM training courses, and volunteered at the 100 Year Starship Symposium. Upcoming events include a booth at Wings Over Houston airshow, sending a speaker(s) to a local elementary school, and technical lunch and learns; so be sure to always check the website and pay attention to those emails to stay in the loop.

As we move forward, continuing to build our capabilities, the AIAA Houston Section plans to make this year another great one for the Houston area. Putting together a general schedule for the combined Operations and Technical branches we have a goal of over 100 area events and meetings for the year. These events, varied in size and scope, will require effort and time from an already busy community. It is a community that sometimes feels like it is flying through a storm or meteor shower, depending on the day, yet together it accomplishes its missions and objectives. As we come together this next year to accomplish the AIAA Houston Section missions and objective, we will be building a stronger aerospace community and promoting the technical exchanges needed for the future. We look forward to seeing and working with you at the next event!

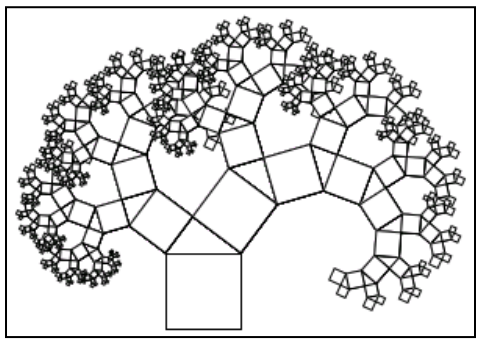
Michael Frostad
chair2013@aiaahouston.org

Above: The official name of Orion is 'Multi-Purpose Crew Vehicle' as the spacecraft can be used to complete different missions. Presently NASA wants to do a first unmanned test flight in 2017, meaning that ESA will have to deliver the first service module in 2016. This is a tight deadline, but the people behind ATV have gotten used to delivering a new spacecraft in under 20 months. Image and text credit: ESA.

From the Editor

We thank Dr. Betsy Giusto and her coworkers at the City of Webster City Council for permission to reprint their cover story about the new display at Space Center Houston. We also thank Janice Larson for suggesting that reprint.

The Horizons Collier's series continues its dramatic reprints by presenting installment 7 of 8 in this issue. This installment is from 1953. Quite a few people deserve thanks for that, but a great American, Dr. Wernher von Braun gets more credit than anyone. He often worked here in Houston at NASA/JSC during his American career, and his base of operations was NASA/MSFC in Huntsville, Alabama. His contributions to NASA were enormous.



Above: A Pythagoras tree from the WolframAlpha website. Image credit: www.wolframalapha.com. Copyright WolframAlpha.

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An archive for Horizons on a national AIAA website is here.

Submissions deadline: October 10, 2013, for the September/October 2013 issue (online by October 31, 2013).

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Pythagoras, Fermat & Red Bull Stratos

DOUGLAS YAZELL, EDITOR

As I walked past Fermat high school in Toulouse, France this summer during my vacation, I decided to review a few aspects of the solution and history of Fermat's Last Theorem (FLT). It relates to the Pythagorean theorem: the sum of the squares of the two sides of a right triangle is equal to the square of the hypotenuse. There is plenty to learn about that alone, as shown by the Pythagorean tree in the figure. I was led to that because I recently enjoyed the 2010 Stephen Wolfram presentation, "Computing a Theory of Everything." (See www.TED.com.)

The Wikipedia FLT article is a good starting point. Fermat conjectured there are no positive integer solutions for those three quantities when the integer exponent is greater than 2. This was finally proven to be true in 1995, 358 years later. Once elementary mathematics was used to prove FLT true for an exponent of 4, it was then sufficient to prove FLT true for prime number exponents. See the Wikipedia Note 1 for a brief explanation.

The fact that our French sister section's office is located in Toulouse, France adds a bit of interest to that history of FLT.

Above: Space Center Houston, Webster's award-winning tourism partner, debuts the Red Bull Stratos Mission to the Edge of Space exhibit, including the actual capsule that lifted Felix Baumgartner 24 miles above Earth. Webster City Council stands in front of the historic capsule from which Baumgartner jumped and broke the sound barrier using only his body. Image credit: Jack Moore/Space Center Houston. (Article: see a later page.)

Images of Earth from Two Distant NASA Spacecraft

Cover Story

Douglas Yazell, Editor, From NASA Websites and Other Sources

NASA, July 22, 2013, PASADENA, Calif. -- Color and black-and-white images of Earth taken by two NASA interplanetary spacecraft on July 19 show our planet and its moon as bright beacons from millions of miles away in space.

NASA's Cassini spacecraft captured the color images of Earth and the moon from its perch in the Saturn system nearly 900 million miles (1.5 billion kilometers)

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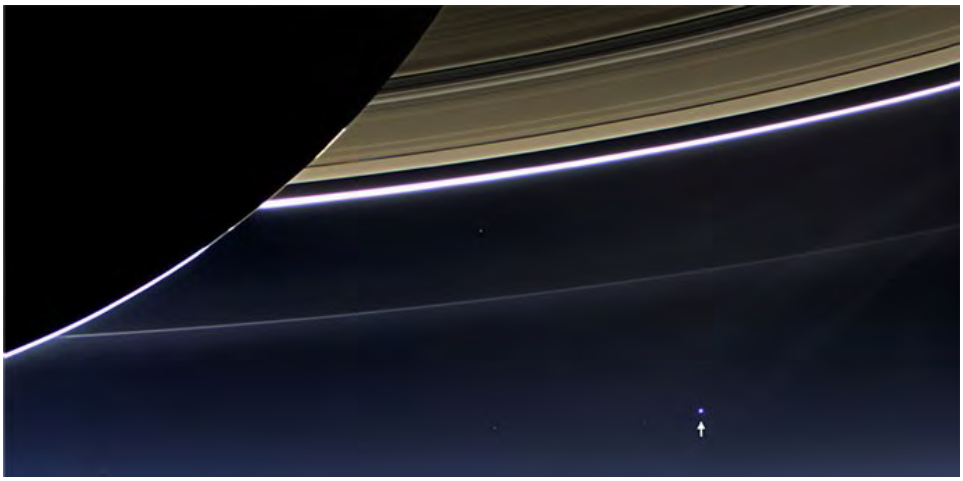

The Day the Earth Smiled: Sneak Preview
In this rare image taken on July 19, 2013, the wide-angle camera on NASA's Cassini spacecraft has captured Saturn's rings and our planet Earth and its moon in the same frame. Image credit: NASA/JPL-Caltech/Space Science Institute.

One Special Day in the Life of Planet Earth - Close-Up. *The cameras on NASA's Cassini spacecraft captured this rare look at Earth and its moon from Saturn orbit on July 19, 2013. Image credit: NASA/JPL-Caltech/SSI.*

Two Views of Home. *These images show views of Earth and the moon from NASA's Cassini (left) and MESSENGER spacecraft (right) from July 19, 2013. Image Credit: NASA/JPL-Caltech/Space Science Institute and NASA/Johns Hopkins University Applied Physics Laboratory/Carnegie Institution of Washington.*

Cover Story

(Continued from page 5)

away. MESSENGER, the first probe to orbit Mercury, took a black-and-white image from a distance of 61 million miles (98 million kilometers) as part of a campaign to search for natural satellites of the planet.

In the Cassini images Earth and the moon appear as mere dots -- Earth a pale blue and the moon a stark white, visible between Saturn's rings. It was the first time Cassini's highest-resolution camera captured Earth and its moon as two distinct objects.

It also marked the first time people on Earth had advance notice their planet's portrait was being taken from interplanetary distances. NASA invited the public to

(Continued on page 7)

One Special Day in the Life of Planet Earth
The cameras on NASA's Cassini spacecraft captured this rare look at Earth and its moon from Saturn orbit on July 19, 2013. Image credit: NASA/JPL-Caltech/Space Science Institute.

(Continued from page 6)

celebrate by finding Saturn in their part of the sky, waving at the ringed planet and sharing pictures over the Internet. More than 20,000 people around the world participated.

"We can't see individual continents or people in this portrait of Earth, but this pale blue dot is a succinct summary of who we were on July 19," said Linda Spilker, Cassini project scientist, at NASA's Jet Propulsion Laboratory in Pasadena, Calif. "Cassini's picture reminds us how tiny our home planet is in the vastness of space, and also testifies to the ingenuity of the citizens of this tiny planet to send a robotic spacecraft so far away from home to study Saturn and take a look-back photo of Earth."

Pictures of Earth from the outer solar system are rare because from that distance, Earth appears very close to our sun. A camera's sensitive detectors can be damaged by looking directly at the sun, just as a human being can damage his or her retina by doing the same. Cassini was able to take this image because the sun had temporarily moved behind Saturn from the spacecraft's point of view and most of the light was blocked.

A wide-angle image of Earth will become part of a multi-image picture, or mosaic, of Saturn's rings, which scientists are assembling. This image is not expected to be available for several weeks because of the time-consuming challenges involved in blending images taken in changing geometry and at vastly different light levels, with faint and extraordinarily bright targets side by side.

"It thrills me to no end that people all over the world took a break from their normal activities to go outside and celebrate the interplanetary salute between robot and maker that these images represent," said Carolyn Porco, Cassini imaging team lead at the Space Science Institute in Boulder, Colo. "The whole event underscores for me our 'coming of age' as planetary explorers."

In the MESSENGER image, Earth and the moon are less than a pixel, but appear very large because they are overexposed. Long exposures are required to capture as much light as possible from potentially dim objects. Consequently, bright objects in the field of view become saturated and appear artificially large.

"That images of our planet have been acquired on a single day from two distant solar system outposts reminds us of this nation's stunning technical accomplishments in planetary exploration," said MESSENGER Principal Investigator Sean Solomon of Columbia University's Lamont-Doherty Earth Observatory in Palisades, N.Y. "And because Mercury and Saturn are such different outcomes of planetary formation and evolution, these two images also highlight what is special about Earth. There's no place like home."

The Cassini-Huygens mission is a cooperative project of NASA, the European Space Agency and the Italian Space

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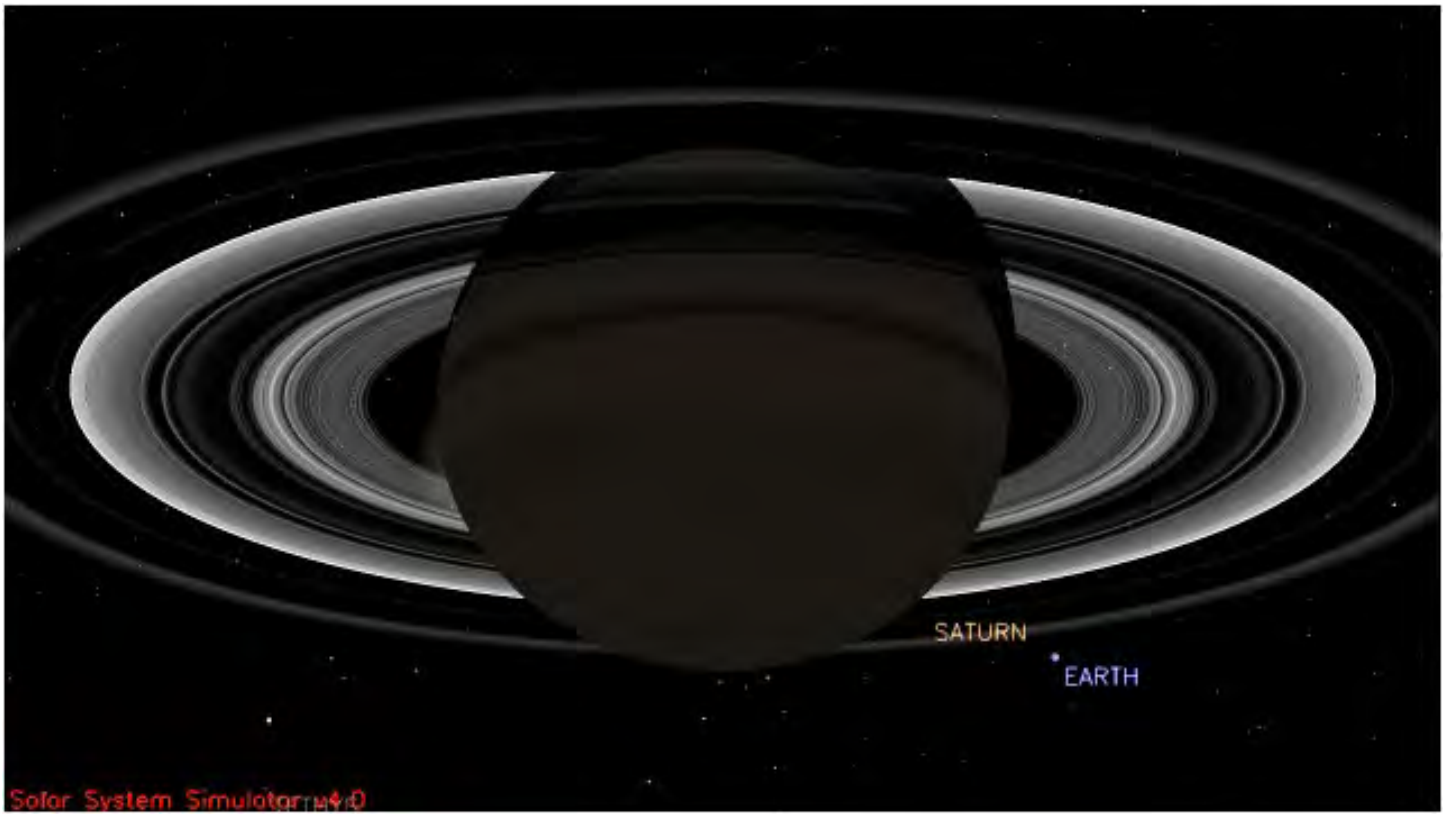


Above: This simulated view from NASA's Cassini spacecraft shows the expected positions of Saturn and Earth on July 19, 2013, around the time Cassini will take Earth's picture. Cassini will be about 898 million miles (1.44 billion kilometers) away from Earth at the time. That distance is nearly 10 times the distance from the sun to Earth. Image credit: NASA/JPL-Caltech.

Cover Story

(Continued from page 7)

Agency. JPL designed, developed and assembled the Cassini orbiter and its two onboard cameras. The Johns Hopkins University Applied Physics Laboratory in Laurel, Md., designed and built MESSENGER, a spacecraft developed under NASA's Discovery Program. NASA's Marshall Space Flight Center in Huntsville, Ala., manages the program for the agency's Science Mission Directorate in Washington. JPL and APL manage their respective missions for NASA. The California Institute of Technology in Pasadena manages JPL for NASA.

(Continued on page 9)

Above: The Reid Gower YouTube video The Frontier is Everywhere was a central theme of a keynote presentation by Loretta H. Whitesides at the 100 Year Starship (100YSS) public symposium in Houston, September 19-22, 2013. Narration is by Carl Sagan. A 1990 pale blue dot photograph and Carl Sagan are discussed on the following page.

To view the Earth images. visit: http://www.jpl.nasa.gov/news/news.php?release=2013-229.

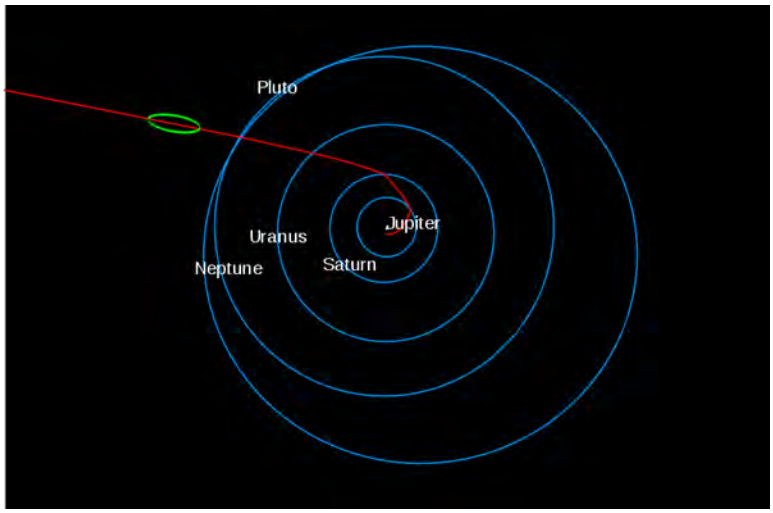
To view the MESSENGER images, visit: http://messenger.jhuapl.edu/gallery/sciencePhotos/image.php?&image_id=1228.

This press release: http://saturn.jpl.nasa.gov/news/newsreleases/newsrelease20130722.

Cover Story

Left: This is the "Pale Blue Dot" photograph of the Earth taken by the Voyager 1 spacecraft on July 6, 1990. The Earth is the relatively bright speck of light about halfway across the uppermost sunbeam. The original version of this image can be obtained from NASA.

The original caption reads as follows: This narrow-angle color image of the Earth, dubbed 'Pale Blue Dot', is a part of the first ever 'portrait' of the solar system taken by Voyager 1. The spacecraft acquired a total of 60 frames for a mosaic of the solar system from a distance of more than 4 billion miles from Earth and about 32 degrees above the ecliptic. From Voyager's great distance Earth is a mere point of light, less than the size of a picture element even in the narrow-angle camera. Earth was a crescent only 0.12 pixel in size. Coincidentally, Earth lies right in the center of one of the scattered light rays resulting from taking the image so close to the Sun. This blown-up image of the Earth was taken through three color filters -- violet, blue and green -- and recombined to produce the color image. The background features in the image are artifacts resulting from the magnification.



Above: Approximate location of the Voyager 1 spacecraft when it took the Pale Blue Dot image on February 14, 1990, shown in the green oval. Image credit: Shereth.

From Wikipedia: http://en.wikipedia.org/wiki/Pale_Blue_Dot#Reflections_by_Sagan.

In his book *Pale Blue Dot: A Vision of the Human Future in Space*, astronomer Carl Sagan related his thoughts on a deeper meaning of the photograph:

From this distant vantage point, the Earth might not seem of any particular interest. But for us, it's different. Consider again that dot. That's here. That's home. That's us. On it everyone you love, everyone you know, everyone you ever heard of, every human being who ever was, lived out their lives. The aggregate of our joy and suffering, thousands of confident religions, ideologies, and economic doctrines, every hunter and forager, every hero and coward, every creator and destroyer of civilization, every king and peasant, every young couple in love, every mother and father, hopeful child, inventor and explorer, every teacher of morals, every corrupt politician, every "superstar," every "supreme leader," every saint and sinner in the history of our species lived there – on a mote of dust suspended in a sunbeam.

The Earth is a very small stage in a vast cosmic arena. Think of the rivers of blood spilled by all those generals and emperors so that in glory and triumph they could become the momentary masters of a fraction of a dot. Think of the endless cruelties visited by the inhabitants of one corner of this pixel on the scarcely distinguishable inhabitants of some other corner. How frequent their misunderstandings, how eager they are to kill one another, how fervent their hatreds. Our posturings, our imagined self-importance, the delusion that we have some privileged position in the universe, are challenged by this point of pale light. Our planet is a lonely speck in the great enveloping cosmic dark. In our obscurity – in all this vastness – there is no hint that help will come from elsewhere to save us from ourselves.

The Earth is the only world known, so far, to harbor life. There is nowhere else, at least in the near future, to which our species could migrate. Visit, yes. Settle, not yet. Like it or not, for the moment, the Earth is where we make our stand. It has been said that astronomy is a humbling and character-building experience. There is perhaps no better demonstration of the folly of human conceits than this distant image of our tiny world. To me, it underscores our responsibility to deal more kindly with one another and to preserve and cherish the pale blue dot, the only home we've ever known.

— Carl Sagan, *Pale Blue Dot: A Vision of the Human Future in Space, 1997 reprint, pp. xv–xvi*

Webster's Tourism Connection

DR. BETSY GIUSTO, ECONOMIC DEVELOPMENT DIRECTOR, CITY OF WEBSTER

As Webster celebrates its invaluable, exclusive 13-year partnership with the region's top tourist attraction, Space Center Houston never ceases to deliver novel and extraordinary exhibits and produce riveting events that result in record numbers of visitors. In fact, Space Center Houston's attendance is up 34,000 over last year, and the number of visitors to the attraction's website has doubled.

Official Visitors Center

As NASA's official visitors center, Space Center Houston expertly combines the past, present, and future of space exploration with popular culture and renders the mix both educational and entertaining. The newest exhibits, the ***Red Bull Stratos Mission to the Edge of Space*** and ***CHOMP – Science of Survival***, adhere to Space Center Houston's top-notch programming prowess. Both exhibits are tied to space exploration in quite remarkable ways, and both exhibits debut at Space Center Houston.

Edge of Space

When Austrian daredevil Felix Baumgartner became the first person to break the speed of sound using only his body and set the world record for the longest parachute jump as he dove from the stratosphere in October 2012 – an astounding chapter in aerospace history unfolded.

The Mission to the Edge of Space exhibition at Space Center Houston conveys the saga of Baumgartner's record-breaking supersonic free-fall from 128,100 feet above Earth and features the actual Stratos Red Bull capsule and space suit. Baumgartner's jump from the edge of space – he was nearly 40 miles short of the Karman line or the boundary between Earth's atmosphere and outer space – resulted in three world records. When Baumgartner lifted off inside the helium balloon-lofted capsule to an altitude of 24 miles over New Mexico and jumped, he broke the speed of sound using only his body in a free-fall, as he accelerated to a top speed of Mach 1.25 or 844 miles per hour; he ascended to a height never before reached for a manned balloon flight; and he achieved the highest altitude jump – breaking a record set in 1960 by Air Force Colonel Joe Kittinger.

Capsule at Space Center Houston

Space Center Houston was victorious not only in landing the Red Bull Stratos Mission to the Edge of Space exhibition but also in starring as the first attraction nationwide to showcase this feat and artifacts. When the exhibit leaves Space Center Houston in early August 2013, it will travel to the US Space and Rocket Center in Huntsville, Alabama; California Science Center in Los Angeles; and the National Museum of the US Air Force in Dayton, Ohio before arriving at its permanent home at the Smithsonian Institute.

On display at Space Center Houston is the 2,900-pound Stratos capsule that measures 11 feet in length and eight feet in width from which Baumgartner ascended 39 kilometers or 24 miles above Earth. The capsule, which weighs 2,900 pounds, is a technological marvel that safely delivered Baumgartner to the stratosphere – protecting him from subzero temperatures

(Continued on page 11)

Above: Aviation pioneer Felix Baumgartner is about to take one giant leap from 128,100 feet above Earth and set three world records. Image credit: Red Bull Media House.

Above: The Stratos capsule, on display at Space Center Houston, operates as Baumgartner's controlled climate as it ascends to a record-breaking altitude of 24 miles, a height never before reached for a manned balloon flight. Image credit: Chris Thrailkill.

(Continued from page 10)

(-95 degrees Fahrenheit), the "death zone" (distance from Earth to 1,000 feet where there is inadequate altitude for a parachute deployment), and decompression sickness. (He did not have to inflate his pressure suit during the ascent, as the capsule was pressurized.) The capsule structure with its four main components – pressure sphere, cage, shell, and base and crush pads – serves to advance the safety and efficacy of space travel and high-altitude escapes from spacecraft, due to the design, testing, and innovation of this sophisticated space vehicle.

What About the Capsule?

After Baumgartner's jump, the capsule, which was attached to a helium balloon, descended under its own parachute to a soft landing approximately 55 miles due east from where it was launched.

While the entire four-year mission forged new scientific and aerospace milestones, the "reefed" parachute system that enabled the capsule to land more directly and quickly certainly constitutes one of those innovations. Typically, with high-altitude payloads, a recovery parachute deploys fully as soon as the payload (Felix Baumgartner) releases from the balloon. The Red Bull Stratos capsule parachute, however, was "reefed" or restrained with fabric around its circumference during the initial segment of the descent, which enabled the capsule to fall rapidly – up to 350 miles per hour – before full parachute deployment. The Red Bull Stratos capsule – with its advanced curved base that aids in stability during descent or the crush pads that were developed after more than 150 drop tests or the reefed parachute system that enables a more secure landing or the advanced liquid oxygen, liquid nitrogen, and instrumentation systems – scale new aerospace engineering heights.

Innovative Space Suit

Also part of the exhibit at Space Center

(Continued on page 12)

Above: Felix Baumgartner exits the Stratos capsule at 128,100 feet. Image credit: Red Bull Media House.

Above: Felix Baumgartner becomes the first person to break the sound barrier without the protection or propulsion of an aircraft. Image credit: Red Bull Media House.

Above: The Red Bull Stratos four-year mission is about scaling new heights, providing scientific innovation and data, and inspiring people to attempt something great. Image credit: Red Bull Media House.

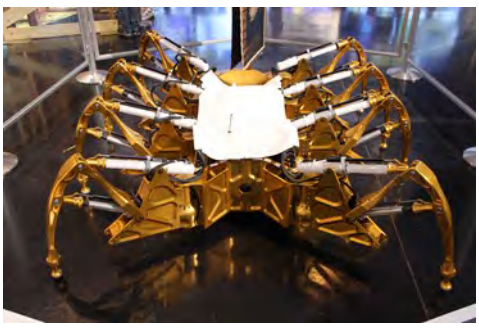
Above: Stratos Mission Control monitors Baumgartner's leap into the record books where Colonel Joe Kittinger serves as mission advisor (seen here in front of the left main monitors). Image credit: Red Bull Media House.

(Continued from page 11)

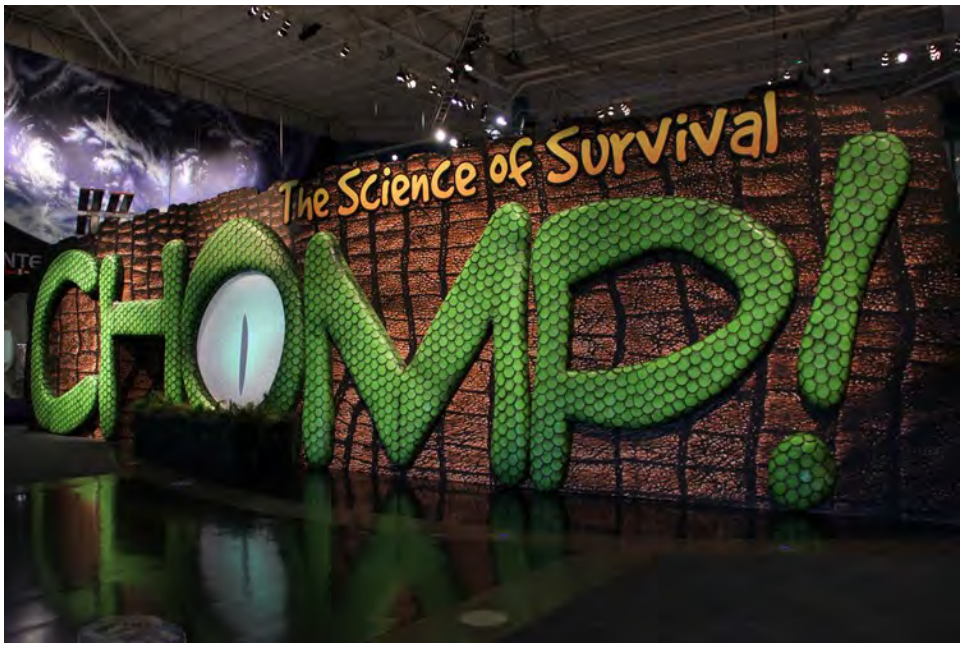
Houston is Baumgartner's pressure suit that he wore during his jump. This pressure suit – built by the same manufacturer who made launch and entry suits used by the astronauts on the space shuttle – custom-made Baumgartner's suit to provide mobility necessary for controlled freefall, as well as enhance visual acuity, GPS tracking, and thermal protection. While Baumgartner could have gone to the Moon in this pressure suit, he was able to freefall with agility, flexibility, and comfort – feats that were impossible before the creation of this suit. Baumgartner's full pressure suit and helmet, his personal life support system, were designed to provide protection from temperatures of +100 degrees F to -90 degrees F and could be pressurized to 3.5 pounds per square inch and prevent ebullism – a condition that occurs above 62,000 feet when liquid in tissues can turn to gas and expand dangerously – and avert decompression sickness.

65 Years to the Day – October 14

Precisely 65 years after American test pilot Chuck Yeager broke the sound barrier in an aircraft, Felix Baumgartner broke the sound barrier in a freefall, without the protection or propulsion of a vehicle. With the assistance of the Red Bull Stratos team of experts, consisting of 250 people, Baumgartner transcended both physical and cognitive limits in a representation of today's "Apollo Moment." Space Center Houston's exhibit conveys this remarkable and historic journey of a 43-year old BASE jumper with 2,500 jumps in his resume who had to learn to work with his team who educated him to become a test pilot. In the four-year process, enormous strides were made in the fields of aerospace medicine, aerospace safety, next-generation space suits and parachute systems, and protocols for high altitude space travel.



Above: Learning from nature, NASA modeled the eight-legged Spidernaut after arachnids. Image credit: Space Center Houston.



Above: Visitors to CHOMP encounter swamp-like enhancements that include a variety of creepy creatures with intriguing space science connections. Image credit: Space Center Houston.

CHOMP Takes a Bite of Space Science

Another world premier exhibit this summer at Space Center Houston is CHOMP – The Science of Survival. Within this 6,000 square foot hands-on exhibit, live animals, space science, and daredevil-like fun coalesce. While CHOMP showcases a number of dangerous animals and somewhat unsavory insects whose permanence convey "survival," like the Goliath Bird-Eating Spider, the Haitian Giant Centipede, rare alligators, venomous snakes, sharks, cockroaches, and tubeworms, the correlation between the animals' attributes and space science is revealed. For example, it is the brightly orange-colored skin of poison dart frogs that warns potential predators of their toxicity and serves to distinguish the small amphibian from harmless organisms. Like the dart frog's coloring, "international orange" is the bright color of the suit astronauts wear during NASA launches, as this color is highly visible for search and rescue and sets astronauts apart from their surroundings – especially the blue of the ocean.

CHOMP touts the tenacious, adaptable, successful prowess of arachnids with "Spidernaut," a spider-like robot developed by scientists and engineers at Johnson Space Center that would be deployed on space stations or space docks to build crew vehicles necessary to support human life during long, interplanetary voyages. Spidernaut, like its namesake, spreads its weight on eight legs, travels over structures under construction without damaging them, and creates its own web to move between structures. Another NASA advancement is derived from spider webs, as spider silk is incredibly strong and flexible – with some varieties performing five times as strong as an equal mass of steel and twice as tough as Kevlar – which is used in bulletproof vests. As some spider webs have existed for at least 100 million years, spider silk is durable, naturally-insulating, extremely light, and ultra-strong. Scientists at Johnson Space Center have been engaged in researching, developing, and testing aerogel – the lightest solid known on Earth that resembles spider silk. The correlation between spiders and their webs and aerogel and space dust is illustrated by the exhibit: spiders use their webs to catch insects, and aerogel, which resembles a spider's web with its strength and flexibility – as one cubic inch of aerogel can be spread out to cover an entire football field – can trap space dust. Aerogel has already been used to insulate

(Continued on page 13)

(Continued from page 12)

the Mars rover's electrical equipment and capture space dust from comets. A team of scientists at NASA's Johnson Space Center are studying space dust captured with aerogel from Comet Wild 2 to unlock secrets about the solar system.

Above: International orange, modeled from the poison dart frog, is the color chosen for astronaut suits to aid visibility should search and rescue operations become necessary during launches. Image credit: Cologne Zoo, Germany.

The creatures of CHOMP include sharks with their well-developed vestibular system or navigational aid. As sharks and humans share a similar vestibular system located in the inner ear to sense direction, scientists at Johnson Space Center study effects of zero gravity on humans during long space voyages and potential solutions demonstrated by the sharks' highly evolved system to aid astronauts in maintaining inner ear balance. Similarly, waterbears, a tiny, segmented animal with eight legs, is virtually indestructible and can survive almost any extreme condition by losing 99% of the water in its body and shutting down its systems in suspended animation until conditions improve. When waterbears were sent to space on the final flight of the Space Shuttle Endeavor, they survived cosmic radiation. In fact, waterbears with their innate ability to repair damage to their DNA enables them to survive 1,000 more radiation than any other animal – including cockroaches. Johnson Space Center scientists are studying the waterbears' suspended animation and resilience to radiation in an effort to replicate those phenomena for humans during deep space exploration.

Above: Stand nose to snout with some of nature's most dangerous creatures, and learn how NASA scientists are mimicking their traits to help astronauts live in space. Image credit: Space Center Houston.

While CHOMP offers fascinating views of a variety of animals, each specimen has an intriguing connection to space science. From the alligator's blood-rich bumpy scales on its back that regulate internal body temperature and aid in food digestion to the solar panels on the International Space Station that absorb sunlight and convert it to energy to a study of the tubeworm that thrives nearly two miles deep in the ocean floor by using bacteria to turn toxic chemicals into food – scientists are working on replicating the symbiotic process for developing crops in space. A new vegetable production system is slated to be delivered to the International Space Station this fall, as growing space food has significant ramifications.

Space exploration – the drive to discover, the determination to pursue, the brilliance that's required to embark, and the courage that's necessary to arrive – is celebrated at Space Center Houston where riveting exhibits connect the very best of space science – past, present, and future.

The City of Webster is most fortunate to preside as Space Center Houston's sole municipal partner. Year after year, season after season, Space Center Houston features exciting exhibits, special events, and daily programs in its spectacular facility that drives visitors to Webster's hotels, restaurants, retailers and entertainment venues.

***Above: Webster City Council Wears International Orange**. Doug North, Larry Tosto, Floyd H. Myers, Natalie Dolan, Alexandra Dietrich, Diana Newland, and Bill Jones recently posed for photos at Space Center Houston. Image credit: NASA/Space Center Houston.*

Museum

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

DOUGLAS YAZELL, EDITOR

This is a bimonthly column about the 1940 Air Terminal Museum, a 2008 addition to the list of AIAA Historic Aerospace Sites. The museum is restored and operated by the non-profit Houston Aeronautical Heritage Society.

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

The raffle airplane has a winner as of July 2013! A maximum of 2,500 tickets (maybe less) were sold for $50 each for this annual fundraising activity. A resident of Bynum, Texas won this 1969 Piper Cherokee 140. A new airplane will tempt us all for that price in the coming year!

The June 2013 Wings & Wheels monthly lunch-hour-centered program (third Saturdays of most months) is now documented on a few museum website pages. Photographs on this page are from the website's report of that day's event. One photograph shows airplanes on display on the ramp behind the museum, and one photograph shows classic cars from the Porsche 356 Club in front of the museum. The other photograph shows a Southwest specialty airplane, Colorado One. A website page for the specialty fleet from Southwest Airlines (now containing 13 airplanes) shows that Colorado One debuted on August 22, 2012 as the 12th repainted airplane in this series.

The Southwest specialty airplanes are, from 1990 to 2013, Shamu Two, Shamu Three, Lone Star One, Arizona One, Triple Crown, California One, Nevada One, New Mexico One, Maryland One, Illinois One, Florida One, Colorado One, and Penguin One. Horizons presented photographs of Maryland One (on page xx of our xxx/xxx year issue), California One (on page 20 of our last issue), and Penguin One (on page 4 in our last issue) in past issues. We look forward to presenting photographs of all of them eventually.

Support this great museum by joining and attending their events!

The Experimental Aircraft Association (EAA) Chapter 12 (Houston)

Mission

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

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

Every individual and organization with an interest in aviation and aviation technology is encouraged to participate. (EAA membership is not required, but encouraged.) Meetings are generally from 6:30 PM to 9:00 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!

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

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)

From Dave and Avril Forster's website, this SeaRey was completed in the summer of 2010. This airplane and others are mentioned on the projects web page on the EAA Chapter 12 website.

Opinion

Climate Change and Local Responses

DOUGLAS YAZELL, EDITOR (ARTICLE #4 IN THIS BIMONTHLY SERIES)

Excerpts from the climate change speech by President Obama on June 25, 2013, at Georgetown University

… On Christmas Eve, 1968, the astronauts of Apollo 8 [presented] a live broadcast from lunar orbit. … Frank Borman, Jim Lovell, William Anders, the first humans to orbit the Moon, described what they saw… And later that night, they took a photo that would change the way we see and think about our world. It was an image of Earth: beautiful, breathtaking, a glowing marble of blue oceans, and green forests, and brown mountains brushed with white clouds, rising over the surface of the Moon. And while the sight of our planet from space might seem routine today, imagine what it looked like to those of us seeing our home, our planet, for the first time. Imagine what it looked like to children like me. Even the astronauts were amazed. "It makes you realize," Lovell [said], "just what you have back there on Earth."

… So the question is not whether we need to act. The overwhelming judgment of science, of chemistry and physics and millions of measurements, has put all that to rest. […] I'm announcing a new national climate action plan… We're building the first nuclear power plants in more than three decades, in Georgia and South Carolina.

… This plan begins with cutting carbon pollution by changing the way we use energy…

Forty-three years ago, Congress passed a law called the Clean Air Act of 1970. […] Six years ago, the Supreme Court ruled that greenhouse gases are pollutants covered by that same Clean Air Act. And they required the Environmental Protection Agency, the EPA, to determine whether they're a threat to our health and welfare. In 2009, the EPA determined that they are a threat to both our health and our welfare… and, therefore, subject to regulation. […] So today… I'm directing the Environmental Protection Agency to put an end to the limitless dumping of carbon pollution from our power plants, and complete new pollution standards for both new and existing power plants.

Now, what you'll hear from the special interests and their allies in Congress is that this will kill jobs and crush the economy… And every time, they've been wrong. […] For example, in 1970, when we decided through the Clean Air Act to do something about the smog that was choking our cities… In 1990, when we decided to do something about acid rain… When we restricted cancer-causing chemicals in plastics and leaded fuel in our cars… When we phased out CFCs, the gases that were depleting the ozone layer… The fuel standards that we put in place just a few years ago didn't cripple automakers.

… And that brings me to the second way that we're going to reduce carbon pollution, by using more clean energy. […] Now, the third way to reduce carbon pollution is to waste less energy… And we'll also open our climate data and NASA climate imagery to the public, to make sure that cities and states assess risk under different climate scenario… And that's why the final part of our plan calls on America to lead, [to] lead international efforts to combat a changing climate. […] Four years ago, in Copenhagen, every major country agreed, for the first time, to limit carbon pollution by 2020. Two years ago, we decided to forge a new agreement beyond 2020 that would apply to all countries, not just developed countries.

… Nobody has a monopoly on what is a very hard problem, but I don't have much patience for anyone who denies that this challenge is real. We don't have time for a meeting of the Flat Earth Society.

"We don't have time for a meeting of the Flat Earth Society."

… Understand this is not just a job for politicians. So I'm going to need all of you to educate your classmates, your colleagues, your parents, your friends. Tell them what's at stake. Speak up at town halls, church groups, PTA meetings. Push back on misinformation. Speak up for the facts. Broaden the circle of those who are willing to stand up for our future.

Convince those in power to reduce our carbon pollution. Push your own communities to adopt smarter practices. Invest. Divest. Remind folks there's no contradiction between a sound environment and strong economic growth. And remind everyone who represents you at every level of government that sheltering future generations against the ravages of climate change is a prerequisite for your vote. Make yourself heard on this issue.

I understand the politics will be tough. The challenge we must accept will not reward us with a clear moment of victory. There's no gathering army to defeat. There's no peace treaty to sign. When President Kennedy said we'd go to the Moon within the decade, we knew we'd build a spaceship and we'd meet the goal. Our progress here will be measured differently, in crises averted, in a planet preserved. But can we imagine a more worthy goal? For while we may not live to see the full realization of our ambition, we will have the satisfaction of knowing that the world we leave to our children will be better off for what we did.

"It makes you realize," that astronaut said all those years ago, "just what you have back there on Earth." And that image in the photograph, that bright blue ball rising over the Moon's surface, containing everything we hold dear, the laughter of children, a quiet sunset, all the hopes and dreams of posterity, that's what's at stake. That's what we're fighting for. And if we remember that, I'm absolutely sure we'll succeed. […]

http://www.whitehouse.gov/the-press-office/2013/06/25/remarks-president-climate-change

Astronomy

The JSC Astronomical Society Building an Astronomer's Chair Complete with Sketch Desk and Red Lighting (Part 2 of 7)

JIM WESSEL, JSCAS EDUCATIONAL OUTREACH CHAIRMAN

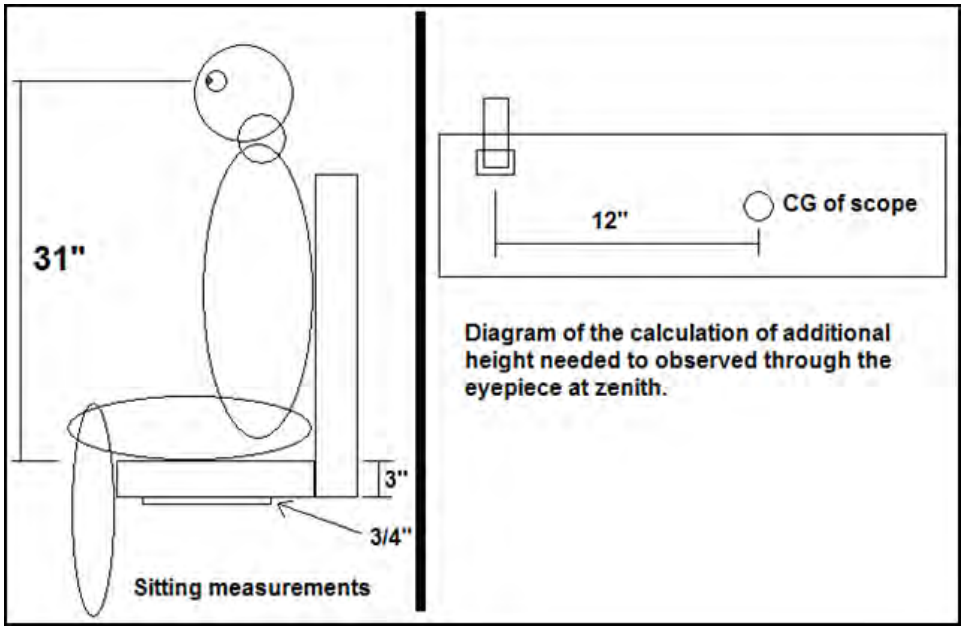
The JSC Astronomical Society (JSCAS)
www.jscas.net

This article first appeared in the October 2010 issue of *Starscan*, the JSCAS newsletter.

Measurements? Who Needs Stinkin' Measurements?

Ideally, a well-designed astronomer's stool (or chair) would allow the observer to view comfortably through the telescope when the target object is near the horizon, or approaching zenith. Obviously, the type of telescope you use and the height of the supporting tripod or pier also play a large role. The determination of the total height of the combination of my upper body and the stool to view through the eyepiece was perhaps the most challenging facet of the entire project. John and I spent a considerable amount of time sketching diagrams, taking measurements, comparing back to Rod Nabholz's original design, and sometimes just plain guessing. Part of my problem lies in the fact that I don't own the tripod that I am targeting for an eventual purchase down the road – a computerized Celestron CGEM. Surprisingly enough, there is no mention of that tripod's height (legs NOT extended) anywhere on Celestron's website, or anywhere else that I could find. So with that caveat in mind, we took a measurement of John's Celestron CPC tripod and used that as a rough guesstimate (thirty inches). We thought this would be a reasonable estimate since I doubt I would ever extend my tripod's legs out fully for observing. We then tacked on ten inches for an approximation of the height of the mount.

Since my telescope is a Newtonian, I have to account for a rather wide difference in eyepiece height between a near horizontal view and a view near zenith. To arrive at a semi-accurate measurement of this additional height, we balanced out the telescope and found a center of gravity, and then found the distance from the center of gravity through a vertical through the center of an eyepiece. This would account for the scope's portion of total height while viewing at zenith. Next we made the "personal" measurement that is pretty much unique to each astronomer – your upper body length. This is taken by sitting in a chair and assuming a comfortable (or your typical) posture, then measuring from where your posterior rests on the seat to the center of your eye level. All of us can slouch, and similarly, we can sit very erect, so there is some difference in those two measurements. (For me, it's a little over four inches without much strain.) That revised measurement helps to account for a less-than-fully-erect posture when viewing. The sketch below gives an idea of our two measuring schemes.



Above: Two of the measuring schemes. Image credit: Jim Wessel.

He who builds his own pedestal had better use strong materials

To partially offset the total needed height, the minimum size of the stool's "pedestal" needed to be increased over that of Rob's original design. Calculating the other measurements, John and I found that the minimum height to the top of the seat (integrated, with seat cushion, support piece of wood, two floor flanges, and the pedestal of the stool) needed to be about 25 inches. (As it turned out, we ended up at 26 inches at the highest spot with the seat cushion uncompressed.) This is only half of the final design measurement. Since the pipe is the total adjustable height feature of the stool, it also must be sized to accommodate viewing near zenith. This complicated things, but just a little. The previously determined total height to view through the eyepiece at zenith MINUS my upper body height and all the fixed height items provided a maximum length needed for the pipe. Obviously, the length of the pipe is the easiest thing to change to allow for a larger future combination tripod, mount and telescope, but it also changes the minimum viewing

(Continued on page 18)

Astronomy

(Continued from page 17)

height and the overall stability of the stool when it is extended to full height. The stability of the stool will be addressed later, but realize here that how snugly the support pipe rides in the pedestal is the prime preventer of unwanted slop or play in seat movement. The neck of the pedestal needs to be a minimum of six inches in length. This neck length certainly factors in for the final needed length of the pipe. Equally importantly, this neck length factors in for the final length of the pedestal. John and I decided that for my needs the pedestal needed to be 19 inches tall, with the internal pipe being a total of 19.75 inches, including the threaded end. The small difference in the height of the pedestal and the height of the pipe is completely offset by the threads seating into the pipe flange and by the two pipe flanges proper. A side view of the partially assembled pedestal column is shown in the figure.

Two points about the construction of the stool are critical. One is the seat attachment, which I will cover later, and the other is the creation of the pedestal column. In the simplest description, the pedestal column is four pieces of wood that are joined together to form a sleeve around the pipe that supports the chair. In the final design, this sleeve has extensions sticking off to the sides to create a larger footprint, and this sleeve also has holes drilled through it for pin placement to regulate the height of the bottom of the pipe.

The pedestal needs to be designed as the strongest portion of the stool. After a few checks to confirm no noticeable pipe bend over its length and uniform outer pipe diameter, we used Rob's layout as a template for our design. As shown in the figure, each of the four individual pieces of wood provided a place for the pipe to rest against the wood, and each provided two surface areas to attach two adjacent pieces of wood. Make absolutely sure that the four pieces of wood making the pedestal form a tight collar around the pipe! This was truly a two-person job and the use of locking clamps helped with this step. When the four pieces of wood are held together and the unit is placed on its end on a level surface, you actually want it tight enough that it is snug and difficult (but not impossible) to slide the pipe up and down inside the pedestal. You will also get a first indication of the amount of terminal (seat end) play or movement if you slide the pipe to the normal, maximally extended spot. This is the time to get it right. John and I micro-ripped the boards lengthwise time and time again until we were sure we had the correct fit.

After assuring we were content with the pedestal column's interlocking fit with the integrated pipe, all edges of the wood were gently sanded. The column was then assembled with the pipe in place. Pilot holes were drilled for all screws a drill size diameter under the root diameter of the 3" wood screws. For our efforts, the Y -axis was extremely snug, and we found that the X-axis has play in it less than the width of a quarter. After we attached the one-inch floor pipe flange to the top of the pedestal column (see the figure), even more of the lateral play was removed. All in all we were very happy with the result. The fully assembled stool does not have an uncomfortable amount of "looseness" when extended to the maximum height.

Next Issue: I will cover the seat attachment site on the underside of the chair and the construction of the armrests.

(Continued on page 19)

Above: Four pieces of wood making the pedestal to wrap around the pipe. Image credit: Jim Wessel.

Above: A side view of the partially assembled column. Image credit: Jim Wessel.

Above: The pedestal end. Image credit: Jim Wessel.

(Continued from page 18)

JSC Astronomical Society Calendar

Upcoming Items from the JSCAS Calendar (Copied on October 12, 2013)

Our JSCAS meetings are held on the second Friday of every month at 7:30 P.M. in the auditorium of the USRA building: 3600 Bay Area Blvd, at the SW corner of the intersection with Middlebrook Drive.

2013

November 1, 2013:	Haak Wine Star Party
November 8, 2013:	Dr. Stanley Love, JSC, Title: TBA (To Be Announced)
November 9, 2013:	Family Space Days Star Party at LPI
December 13, 2013:	Winter Solstice Party

2014

January 10, 2014:	Bob Taylor, *2013 Astronomy Year in Review*
February 14, 2014:	Don Halter, TBA (To Be Announced)
March 14, 2014:	TBA (To Be Announced)
April 11, 2014:	Paul Maley, JSC Trip to Fort McKavett, April 24-27, Tentative
May 9, 2014:	Texas Star Party, May 25-June 1

Below: Education and public outreach from the Lunar and Planetary Institute includes "Cosmic Explorations: A Speaker Series."

http://www.lpi.usra.edu/education/lectures

Staying Informed

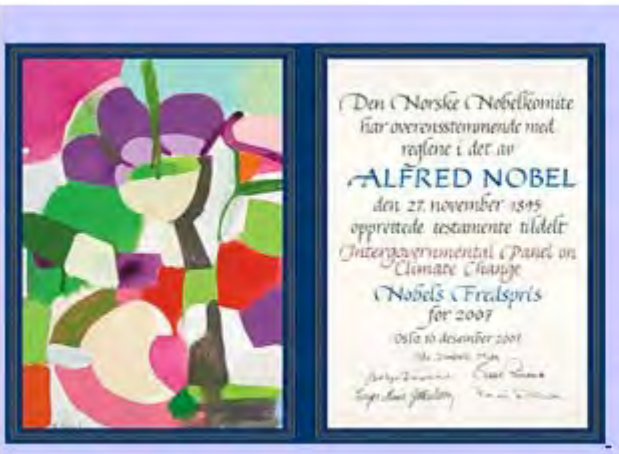
[With a page to fill at the last minute, a few climate change notes are presented here with the 2013 report from the United Nations Intergovernmental Panel on Climate Change (IPCC) in mind, Assessment Report 5 (AR5).]

Climate change
From Wikipedia, the free encyclopedia
For current and future climatological effects of human influences, see global warming.

Global warming
From Wikipedia, the free encyclopedia

Global warming is the rise in the average temperature of Earth's atmosphere and oceans since the late 19th century and its projected continuation. Since the early 20th century, Earth's mean surface temperature has increased by about 0.8 °C (1.4 °F), with about two-thirds of the increase occurring since 1980.[2] Warming of the climate system is unequivocal, and scientists are more than 90% certain that it is primarily caused by increasing concentrations of greenhouse gases produced by human activities such as the burning of fossil fuels and deforestation.[3][4][5][6][7] These findings are recognized by the national science academies of all major industrialized nations.[8][A]

Climate model projections were summarized in the 2007 Fourth Assessment Report (AR4) by the Intergovernmental Panel on Climate Change (IPCC). They indicated that during the 21st century the global surface temperature is likely to rise a further 1.1 to 2.9 °C (2 to 5.2 °F change) for their lowest emissions scenario and 2.4 to 6.4 °C (4.3 to 11.5 °F change) for their highest.[9] The ranges of these estimates arise from the use of models with differing sensitivity to greenhouse gas concentrations.[10][11]



© ®The Nobel Foundation

Oslo, 10 December 2007
The Intergovernmental Panel on Climate Change and Albert Arnold (Al) Gore Jr. were awarded the Nobel Peace Prize "for their efforts to build up and disseminate greater knowledge about man-made climate change, and to lay the foundations for the measures that are needed to counteract such change".

For further clarification regarding the award, click here

The IPCC is now working on the Fifth Assessment Report, and plans to release it in 2013/14. See Key AR5 dates for more information on this process. *[That link from this web page leads to a ten-page PDF calendar file.]*

Links related to IPCC AR5:

1. Andrew C. Revkin, Dot Earth opinion column in the New York Times, September 27, 2013, *Climate Panel's Fifth Report Clarifies Humanity's Choices*.
2. John Abraham and Dana Nuccitelli, an entry in their *Climate Consensus– the 97%* environment blog entry for the Guardian, September 27, 2013, ***Global Warming: why is the IPCC report so certain about the influence of humans?*** *100 percent of the global warming over the past 60 years is human-caused, according to the IPCC's latest report.*
3. Andrew C. Revkin, Dot Earth opinion column in the New York Times, October 10, 2013, *Countdown to a Hotter Climate– Tropics First.*

Address to AIAA Houston Section about the late James C. McLane, Jr., Part 1 of 6

JAMES C. MCLANE III

James C. McLane, Jr.
1923 - 2012

June 13, 2013

First I want to say that the many of you here tonight who knew my dad realize that he was a modest person who would be surprised, but pleased to see that his memory honored at this meeting. He had a long and busy life and I'm going to mention some unusual facts rather than those things many of you might already know.

He became active in the American Institute of Aeronautics and Astronautics (AIAA) in 1962 shortly after coming to Houston to work for NASA. I believe his interest in technical societies may have stemmed from a paper on the design of large butterfly valves that he presented at the 1961 ASME Aviation Conference in Los Angeles. Over the next 50 or so years as a member and later an associate fellow he served the AIAA in many capacities. He 1972 he was our local Section Chairman. He also served as a Regional Director. He was proud that he co-founded the AIAA Space Simulation Working Group which still is quite active and has annual meetings at various places around the world. I find it remarkable that he co-founded this particular organization with the help of Dr. Bernhard Goethert, the famous German aerodynamicists who designed the near supersonic Messerschmitt ME-262 jet. This is curious since during WW2 my dad was an Air corps pilot flying around Europe in a P-51 Mustang trying to shoot down ME-262's.

My Dad was responsible for the local AIAA Section sponsoring a number of very memorable dinner meetings. My all time favorite was a joint presentation featuring Georgia Tech professor Alan Pope who spoke about his WW2 experiences designing the shell for the first atom bombs. At the very same meeting a man named Kermit Behan talked about his job as the bombardier on the plane that dropped the Atom bomb on Nagasaki. Kermit was probably the most historical person to ever speak to the AIAA. This man, whose finger pushed a button that ended WW2, was a technician at NASA. He lived a quiet life in Clear Lake City.

My Dad promoted a number of local and national AIAA initiatives. For example he helped persuade the Houston Section to hold an annual technical mini-symposium designed to give local engineers and scientists some experience presenting technical papers. He persuaded the national AIAA to formulate a professional ethics policy and he headed a program which promoted career development in the fickle aerospace industry. He obtained support for the AIAA from local NASA contractors, civil servants, technical societies and nearby universities. In particular he encouraged a close relationship between the Houston AIAA chapter and the student chapter at Texas A&M. For many years this even included trips to A&M for tours of their aerospace facilities and a football game.

Many significant names in the space program have served the AIAA in one capacity or another, in part due to the solicitation and encouragement of my father.

[Continued next issue.]

"When he was just 14 years old, without any technical guidance or help, he built and flew one of the first gasoline-powered model airplanes, first in South Carolina and later a second plane in Georgia. This was so remarkable that it was covered in the newspapers." McLane and his Corben Ace in 1937 in Newberry, South Carolina. Image credits: James C. McLane III family photographs.

Denmark

A Tour of Copenhagen Suborbitals

SHEN GE

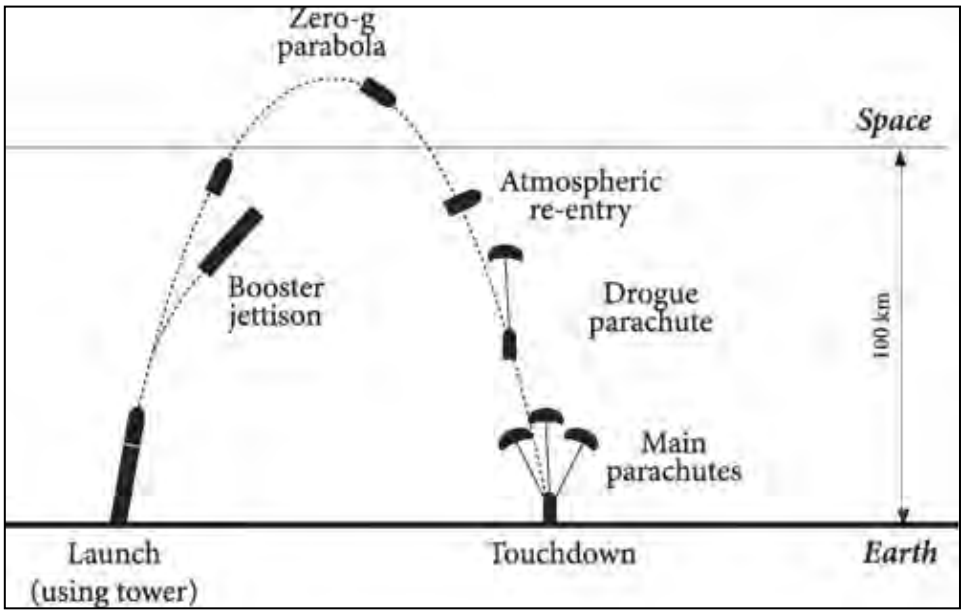
I was in Copenhagen for personal reasons, so a friend and I decided to ask for a tour of the local aerospace organization Copenhagen Suborbitals. With a brand new Danish cell phone sim card in my hand, I looked up their number on their website and gave them a quick ring. The person who answered was the man in charge, Peter Madsen. His English was excellent. I told him that I am an aerospace engineer in Houston and I would love to see his team's facility, since I heard about them on the news, a private nonprofit group that launched the biggest rockets ever for an amateur group, and a team developing their own capsules for launching a crewed flight. Madsen was happy to hear my enthusiasm and invited us to visit them on the evening of the following day.

The next day, we walked the half hour or so from the bus station near Freetown Christiania (the only place in the city where marijuana use is legal, not that we care about that!) to their facility. When we got close, we saw a huge building. My friend thought it was their facility. It was actually a rock climbing training camp. The Copenhagen Suborbitals facility is a small hangar that could fit at most three cars. Most of the employees seemed to be holding a meeting. I assumed Madsen was one of them. We walked around outside and saw a derelict submarine which they are refurbishing. Several men were welding pieces of metal.

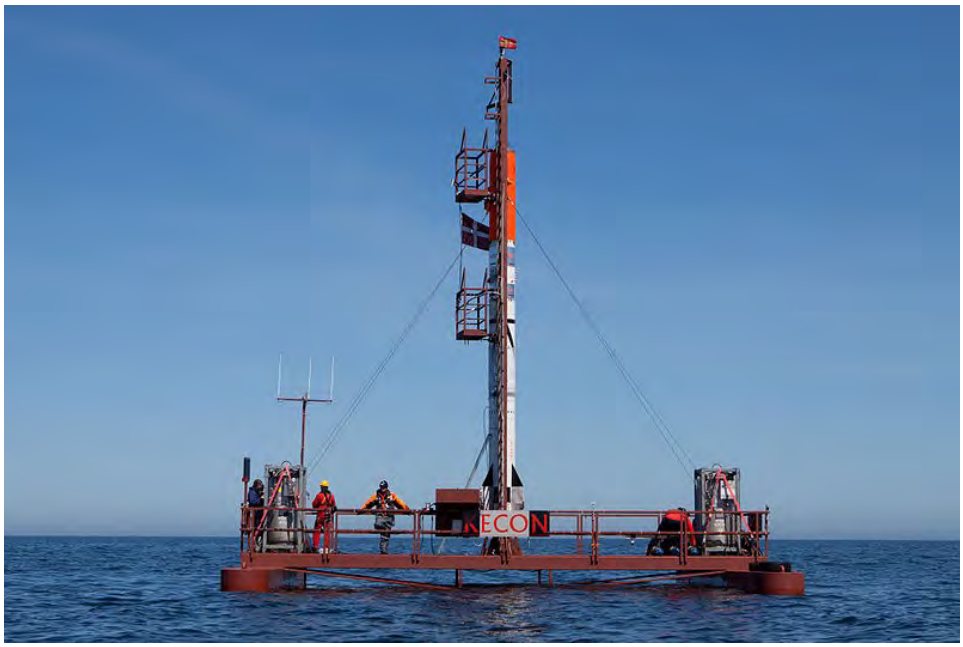
Above: Tycho Deep Space 1 capsule. Image credit: Shen Ge.

There was a fellow smoking outside so I approached him and asked him to give us a tour of the place. He was a welder named Claus Norregard. He happily showed us around. We started outside where he showed us the 500-kilogram Tycho Deep Space 1 capsule that test launched from their ship, the MLP Sputnik, with a dummy inside in 2012. It reached a height of 1,000 meters before the capsule separated from the rocket and splashed down.

We returned to the hangar where Norregard pointed to the small mockups they built for the next generation capsule called Tycho Deep Space 2. Even more impressive was the long tube that was lying horizontally on much of the shop floor. Fuel and oxidizer will be pumped into this tube



Above: The flight path of the manned suborbital flight. Image credit: Copenhagen Suborbitals.



Above: Mobile launch platform Sputnik with HEAT 1X and Tycho stacked. Image source: Wikipedia. Image credit: Thomas Pederson. Image date: June 3, 2011.

(Continued from page 22)

when they do a rocket test. The rocket motor that will be installed on the end of this tube was visible on the floor nearby. They are doing tests on a bigger engine which has a larger diameter and greater thrust. They will need to build a new and long fuel and oxidizer chamber that can hold 600 kilograms of propellant for this new 65-kiloNewton engine. There were also a few ancient machines scattered around where they did most of the machining. These machines dated back to World War II. They are apparently adequate for producing modern rocket parts.

Above: HEATX1 Tycho Brahe launch photo and concept drawing. Image credit: Copenhagen Suborbitals and Thomas Pederson.

Above: Rocket engines. Image credit: Shen Ge.

I asked Norregard about spacesuits. The day before, Madsen told me that two crazy Californians had flown to Copenhagen to test their homemade spacesuits with Copenhagen Suborbitals. Norregard said that Madsen tested the spacesuits yesterday and found them to be in good condition, and they are planning to improve on them and use them for their crewed flight.

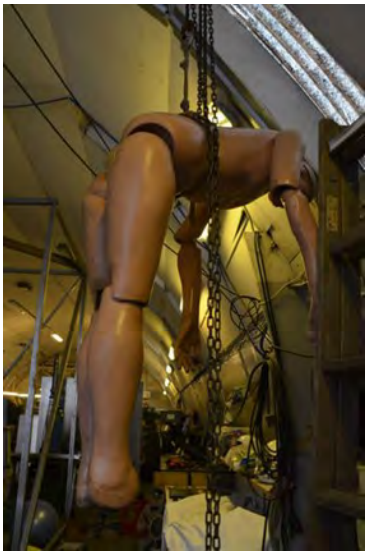
Above: Tycho Deep Space and Launch Escape System launch. Image credit: Copenhagen Suborbitals.

Denmark

I took a look at the spacesuits. I was impressed. I asked Norregard when they plan to test launch a crewperson and he replied, "In the next ten years."

I asked Norregard if they needed more professional help or marketing and he informed us that the only people they need are people who can weld and do electronics.

We exchanged a few more pleasantries and ended our visit by wishing them luck.



Above: This test dummy has been used in several Copenhagen Suborbitals test flights. Image credits: Shen Ge.

Above: The tubes to contain the chambers for fuel and oxidizer. Image credit: Shen Ge.

Looking at Houston Horizons for Space

WES KELLY, TRITON SYSTEMS, LLC

At Space Center Houston, adjacent to the NASA Johnson Space Center, Commercial Spaceflight Federation (CSF) President Michael Lopez-Alegria moderated an all-astronaut panel on Wednesday evening, September 4th as part of a three-day meeting of commercial space leaders in the Houston area. The Director of Aviation for the City of Houston, Mario Diaz, opened panel discussions with a report on progress in establishing Ellington Field as a spaceport (**Fig. 1**). Invited guests and the general public filled a reserved Space Center Houston auditorium for proceedings also webcast. In the announcement Tweeted questions were solicited from space enthusiasts around the world.

With a full agenda of airport system officials, the CSF and a panel of astronauts representing spacecraft designing firms, two hours was hardly enough time for the prepared presentations (see **Tables 1 & 2**). As a result there were no questions fielded by speakers or panelists until the reception which followed. But presentations elaborated on many areas of advancement in commercial space infrastructure; advances marked by commercial cargo re-supply of the International Space Station under contracts originating in 2006, plus parallel efforts by other firms to provide transport for as many as 7 crew and passengers per flight. Spacecraft milestones included configuration, wind tunnel (e.g., **Fig. 2**) and landing tests, static firings and efforts to recover ballistic first stages.

Not only had commercial entities moved to fill in for Space Shuttle missions, Spaceports beside the Kennedy Space Center were springing up to launch the flights (see **Table 3**) as evidenced by plans

(Continued on page 25)

Figure 1. Houston Airport Director Mario Diaz (top) and Commercial Spaceflight Federation (CSF) President Michael Lopez-Alegria. Image credit: CSF web site screen capture images from the video recording.

Table-1 Introducing Participants, Organizations, Facilities and Vehicle Concepts

Participant	Organization	Facility/ Crew Vehicle	Descent Mode	Launcher	Type
Dr. David Alexander	Rice Space Institute Institute (director)	-	-	-	-
Mario Diaz	Houston Airports	Ellington	-	-	"reusable"
Michael Lopez -Alegria	Commercial Space Federation (moderator)	-	-	-	-
Christopher Ferguson	Boeing Space Exploration	CST-100	Ballistic	Atlas 5	expendable
Jim Voss	Sierra Nevada	Dream Chaser	Winged to runway	Atlas 5	expendable
Garrett Reisman	SpaceX	Dragon	Ballistic	Falcon 9	expendable
Jeff Ashby	Blue Origin	Shepard	Retro Fire	In-House	expendable
Rick Searfoss	XCOR	Lynx	Winged to runway	Lynx	reusable

Table-2 Launch Vehicle and Spacecraft Characteristics

Design Org.	Crew Vehicle	Crew Max	Descent Mode	Launcher	Spacecraft Loaded Wgt(mt)*	Launch System Wgt (mt)	Dimensions Length (ft)	Span (ft)	Diam (ft)
Boeing SE	CST-100	7	Ballistic	Atlas 5-402	n/a	333	n/a	n/a	n/a
Sierra Nevada	Dream Chaser	7	Winged to runway	Atlas 5-402	11.34	333	29.5	22.9	
SpaceX	Dragon	7	Ballistic	Falcon 9-V1.1	10.2	505.8	-	-	3.7m
Blue Origin	Shepard, New		Retro Fire	In-House	n/a	n/a	n/a	n/a	n/a
Figures of Merit for Orbital Operations									
RSC	Soyuz-	3	Ballistic	Soyuz	7.13	310	-	-	2.7m
Suborbital or First Stage									
XCOR	Lynx	2	Winged to runway	Lynx					

***service modules included**

Table 3 Existing Space Ports within the United States and Territories

1. Cape Canaveral Station/Kennedy Space Center, adapting Apollo and Shuttle facilities to commercial applications.
2. Edwards Air Force Base near Lancaster, CA, home base of Spaceship One and XCOR test flights.
3. Spaceport America in New Mexico just west of the White Sands Missile Range.
4. Cecil Airport in Jacksonville, Florida.
5. The Kodiak Launch Complex on Kodiak Island, Alaska, site of Athena ballistic rocket launches.
6. Mid-Atlantic Regional Spaceport (MARS), adjoining NASA's Wallops Flight Facility on the Delmarva Peninsula near Chincoteague, Virginia **(see Fig.-6).** Site of Antares-Cygnus commercial cargo launch to ISS, Sept. 18th.
7. The Oklahoma Spaceport at Burns Flat, Oklahoma. FAA site license of June 2006 grants to the Oklahoma Space Industry Development Authority oversight of takeoff and landing of suborbital, reusable launch vehicles". Former site for Kistler Rocketplane.
8. Corn Ranch by Van Horn, Texas, 165,000-acre privately owned site (Jeff Bezos) of Blue Origin's flight tests of New Shepard vehicle flight tests, beginning with November 13, 2006.
9. Kwajalein Island in the South Pacific has also been used by SpaceX for test flights of the Falcon 1 launcher.

(Continued from page 24)

for a launch from Wallops Island, Virginia to the ISS was planned for later in the same month (18 September at this writing – more below). Nationally, several other spaceports had already opened to business or were in planning stages – and the Houston Airport Authority announced its plans to join their ranks. At this joint press conference Wednesday afternoon at the Johnson Space Center, Houston Airport Director Mario Diaz unveiled preliminary plans and conceptual drawings and videos for a spaceport at Ellington Airport.

"This is a new and exciting sector of the 21st Century economy that carries amazing potential for growth," observed Houston Mayor Annise Parker in the papers the following day. "We believe a licensed Spaceport in Houston would not only serve as an economic generator for the city but it would also enhance Houston's well-deserved reputation as a leader and key player in the aerospace industry."

In the reception following the presentations, this reporter discovered that video animations of the future airport were designed with the assist of the University of Houston Space Architecture Institute over the past year. Also, judging from earlier local news coverage, planning for the Spaceport had begun in earnest prior to April 2012. Diaz and colleagues pointed out that now there were as many as 8 US spaceports and each had the potential for generating commerce and new businesses in their communities. Houston with its Johnson Space Center infrastructure and work force had some built in commercial advantages.

This reporter attended the evening by invitation of one of the invitees; he has also described his own interest in this subject in a previous **Horizons** article (see references). The Stellar-J space launch system was (and is) a concept employing horizontal takeoff with wings and air-breathing engines , characteristics that would make it very well adapted to an environment such as Ellington, compared with systems described here in text and tables. Still, copious notes were taken of the evening's presentations and several of the principals were interviewed in the reception that followed. But, since those notes were also lost on the way to the parking lot, much of the content is from memory or subsequent background research, assumed with a concerned (and not necessarily an undiscerning) eye.

For the CSF and its president, there are major human spaceflight issues to commercial space. Beside panel discussion all among astronauts now involved in expanding the human spaceflight industrial base, President Lopez- Alegria, a former astronaut as well, expressed dismay at US projected expenditures in Russia over the

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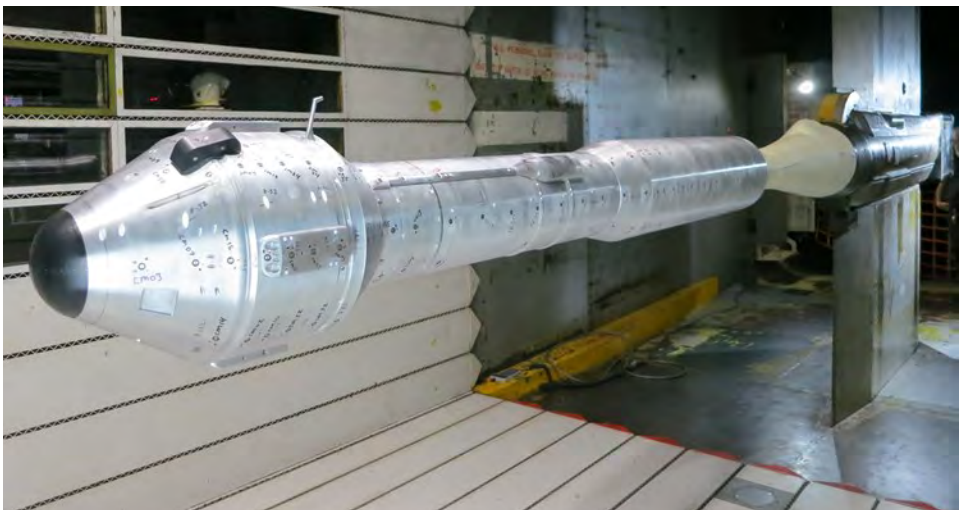

Figure 2. CST-100 Crew Capsule and Atlas 5 Wind Tunnel Model at NASA Ames Research Center . (Credit: Boeing)

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next several years ($400 million) for what are basically Soyuz shuttle services to the International Space Station. Cargo contracts to ISS do exceed this figure, but funding for programs to provide genuine domestic crew transport options are dwarfed by the Soyuz transport outlays.

Ellington Field & Commercial Spacecraft: Constraints or Openings?

When the features of the five space launch systems are reviewed in **Tables-1** and **2**, it can be seen that nearly all would face great difficulty providing launch services to orbit from Ellington Field. Four of five spacecraft launch with ballistic expendable systems. The suborbital Lynx takes off horizontally, true; but it also uses a rocket engine rather than the turbofans of a typical commercial aircraft. Yet consider as well the Shuttle Orbiter Endeavour's last return to Ellington Field (**Fig. 3**) atop its B-747 carrier craft, on 9th October 2012. The first visit by this Orbiter was two decades earlier via the same conveyance. Payloads manufactured for space missions arrived and departed from Ellington over the same period on a variety of jumbo jets. What's more, Ellington and the Houston region share one geographic feature with other ballistic launch spaceports, proximity to open water; in this case, the Gulf. If not necessarily launching directly from Ellington, ferrying to "satellite" coastal fields from the Ellington manufacturing and service center is one possibility. But could, for example, an L-1011 carrying a Pegasus booster for air launch take off or land at Ellington on an operational mission? Could a vehicle with a hybrid first stage launch under turbofan thrust and then transition to rockets in the stratosphere over water? These would have posed good Twitter questions for the panel convened in early September.

Aside from the fact that commercial programs in full development as yet do not match very well with airport operations, we do connect a feature of both expendable orbital passenger systems and commercial aircraft: a Soyuz expendable launch vehicle at lift off weighs roughly the same as a 747. In fact many freighter versions weigh more than the Soyuz at launch by as much as 100 metric tons. It stands to reason that if passengers and crew are to someday launch from Ellington or other American airports, their aircraft features should be similar to a jumbo jet and the first stage should be reusable. Are there any signs of hope for this?

Systems in operation or planned for launching crews into orbit consist typically two or three stages to impart an "ideal" velocity of about 30,000 feet per second to the final stage and/or orbital module. This is a somewhat empirical fallout of the rocket equation. In single-stage form, final mass over initial mass, $m_f / m_i = \exp(-\Delta V / g\, I_{sp})$, taking into account initial and target orbital velocity, heading, altitude, drag and other ascent losses. We can see that the Dream Chaser and the Dragon spacecraft (including service modules), carrying up to seven passengers have similar weight budgets as payloads for their boosters. And the CST-100, while we do not have explicit statement of its weight, we can see that it is constrained to the Atlas V-402 booster as well.

To reduce lift-off weight the principal resources in the ballistic rocket equation are propellant specific impulse (I_{sp}) and reduction of structural weight. One can see some disconnect between lift-off weights of the Atlas V and the Falcon 5 v.1.1, owing to use of LOX-hydrogen propellants on the second stage of the Atlas 5 vs. the choice of kerosene and LOX on the Falcon. It should also be noted that the Dragon has employed aluminum lithium (Al-Li) alloys extensively in its propellant tanks; this shears off about 10% of the weight required to do the same task with aluminum alloys available decades earlier (e.g., for Apollo-Saturn flights).

However, there remains another way to alter performance: taking velocity requirements out of the rocket equation.

The principal velocity losses identified in the rocket equation are the so-called gravity losses. These when analyzed translate literally to the square root of "work". If the target altitude is lowered or the rocket ignition altitude is increased, there results a change of delta-altitude instead of delta velocity, but its velocity impact can be estimated in the following form:

$$\Delta V_{grav} = \mathrm{sqrt}(\, 2\, g\, \Delta h).$$

Since wings and air-breathing engines in the flight regime from zero relative velocity to nearly the speed of sound are nearly as efficient in I_{sp} terms as ion engines are in space (e.g., specific fuel consumption of 0.5 equivalent to an I_{sp} of 7200 sec-

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Figure 3. Shuttle Orbiter Endeavour and B-747 Carrier at Ellington Field – October 9, 2012. Image credit: Wes Kelly.

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onds) – and if they act as well in behalf of recovery of first stage reusable systems such as high performance booster engines, they might just compensate for or justify their weight. Then, there is also the heading velocity of a platform propelled by air -breathing engines. Horizontal flight may yet lead to airport access to space.

Remarkably, 7 passengers to ISS, more than double the payload capability of the Soyuz launch system, does NOT necessarily result in doubling the mass of the launch system. Using similar propulsion, the Falcon 9 booster comes in well below this target and the Atlas V solution comes in at an even lower ratio probably due to its cryogenic upper stage. We can deduce that spacecraft weight growth is not necessarily linear with increasing passenger numbers, though the volume inside might well be. Wider booster diameters behind the spacecraft might be of help. The diameters of Atlas V and Falcon 9 stages are 12.5 and 12 feet respectively; Soyuz diameter is 8.8 feet. We do not have CST-100 diameter, but comparing the mounted wind tunnel model in **Fig.-5** with **Fig.-6** data, we guess that its width nearer to the Orion capsule (5 meters) vs. the Dragon (3.7).

The Dragon is already demonstrating missions similar to the Progress, HTV and ATV cargo vehicles, but with the noteworthy additional feature of recovery of the pressurized cargo module at sea similar to earlier NASA crew capsules.

We do not yet know the Blue Origin New Shepard spacecraft features and its possible launcher, save its goal too is to carry seven passengers and the on-orbit mass of the vehicle is in the same range. Since this organization is testing a new LOX-H2 engine with a thrust rating of 100,000-lbs (the BE-3), we cannot entirely rule out a liquid hydrogen first stage for this vehicle. The selection of hydrogen for a propellant would result in a low liftoff weight for the same **and** type of mission, but a vehicle with large dimensions due to the low density liquid fuel (**Fig. 4**).

Reading the Full Label on the Booster

Of course, for the five systems portrayed some remarks should be made of features not bearing directly on the issue of an Ellington Spaceport. For example, there is the full label on the booster.

Ostensibly the Falcon-9 booster with 9 clustered first stage engines is derived from the Falcon 1 booster featuring only one Merlin engine. Suffixes on the Merlin denote several upgrades and adaptations and like software packages the Falcon 9 has versions 1.0 and 1.1. The liftoff weight of version 1.1 is about 505.8 metric tons vs. 318 for the version 1.0. The early version can deliver a payload of

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Figure 4. Blue Origin New Shepard for Suborbital Orbital Flight. Image credit: NASA.

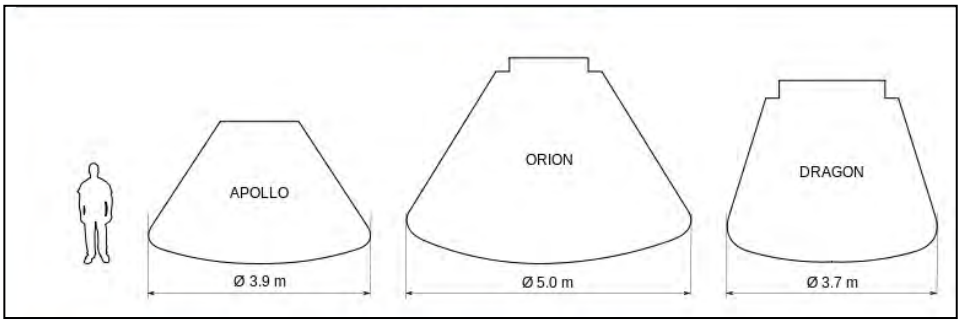

Figure 5. Apollo, Orion and Dragon Spacecraft Base Diameters: 3.9, 5.0 & 3.3 meters. Image credit: Wikipedia.

Figure 6. Antares with first Cygnus spacecraft positioned at Mid-Atlantic Regional Spaceport on Wallops Island, VA. Launched on its first ISS cargo mission, 18 September 2013. Image credit: Orbital Sciences Corporation.

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about 9 metric tons to 28.5° LEO from Kennedy Space Center vs. about 13.15 with the later version. With the higher (51.2°) inclination target of the International Space Station, some margin remains in the system with a Dragon weight of 10.3 metric tons.

Both Sierra Nevada and Boeing presentations indicated that their vehicles would be flying aboard the Atlas V booster, a vehicle which in its present configuration has flown 39 successive and successful missions. The venerable Atlas family's launch history dates back to before the birth of the Space Age with Sputnik; and the Atlas I was drafted as carrier of Mercury capsules with which manned spaceflight in this country began. But unlike Soyuz and its like named launcher, Atlas has played a role largely of satellite and space probe launcher since the '60s with most headed for high altitudes or escape. The Atlas V 401 with a single upper stage RL-10 engine flies frequently; for delivering a 10-12 ton crewed spacecraft complete with a service module, the dual RL-10 engine 402 configuration was selected. No Atlas V 402 configurations have flown thus far. In fact, none of the 39 Atlas Vs yet flown thus featured two RL-10 engine Centaur upper stage.

Atlas V series breaks out into a number of configurations based on fairing diameter (4 or 5 meters), number of side mounted boosters (0, 2, 3, 4) and cryogenic upper stage engines (1 or 2). Customers select configurations based on a host of reasons, principally payload weight, dimensions, launch site east or west, mission orbit altitude and inclination and cost. Ascent characteristics for low earth orbit (LEO) missions and high altitude satellite missions (e.g. to 12 or 24-hour period) orbits differ. In ascent to LEO the upper stage LOX-Hydrogen propulsion fires only once to provide terminal velocity. The payload is several times heavier than that for a GEO satellite mission and all cryogen propellant is burned to the margins. But in the case of a GEO mission, the Centaur stage often tops off the ascent burn and then fires up again for transfer and perhaps for apogee kick and plane change. In the terminal burns, a second engine subtracts from payload delivery margins and the added acceleration is of diminishing advantage. In a LEO mission with a large payload, the 2-engine thrust level is critical to overcome gravity losses. If radial acceleration does not exceed V^2/R sufficiently, then the trajectory might never reach target burnout altitude. Additional engines drive the cost of the upper stage and change the propellant manifold designs.

To illustrate, the first Atlas V mission was a 401 configuration in 2002 for a geosynchronous communications satellite as were many that that followed. Mars Reconnaissance Orbiter in 2005 and the Lunar Reconnaissance Orbiter – LCROSS combination in 2009 were examples of 401 space exploration missions. Remarkably, Atlas II launched numerous 2-engine Centaur missions and of the 6 Atlas III missions, four were in the IIIB two engine configuration, the last in February 2005.

If Atlas 5 concentrates largely on high altitude satellites or customers are unwilling to shell out for a second RL-10 engine, then needs of Dream Chaser and CST-100 argue for 402 development rather than the 402's ready availability to make these missions possible. Admittedly, Atlas V-401 has been used for classified platforms at low altitudes, but we do not know if payload margins were a significant issue in mission payload planning or the selection of a single or two engine RL-10 configuration. For Dream Chaser and CST-100 it will be.

There is also the issue of new vehicles not looking like those covered by standard payload fairings and not looking much like each other either. Study of wide or winged payloads atop ballistic launchers has had a long history: DynaSoar, Hermes, Orbital Space Plane… And the concern has often been sufficient control authority in ascent against possible disturbance of a complex outer mold line (e.g., buffeting). On a dual engine Centaur upper stage, significant roll control can be provided by "scissoring" the deflection of the left and right engines in addition to the deflections for pitch and yaw. A single engine Centaur would need to the assist of attitude control thrusters.

Winged Vehicles
at Airports as They Appear Now

We have discussed a number of commercial spaceflight program issues largely unrelated to spaceport operations of air fields, but there are still some definite connections between winged space vehicles and airfields beside the examples provided by the Space Shuttle. It is expected that the Dream Chaser selection of "green" propellants for its attitude control and on-orbit maneuver systems will reduce the safing time on the ground in comparison to the Shuttle Orbiter after a runway landing. In fact, most of the commercial vehicles are considering less exotic (and less toxic) propellants than pioneer spacecraft of decades back. Hydrocarbon or hydrogen fuels for primary propulsion would certainly be easier to handle than the so-called "hypergolic" propellants that

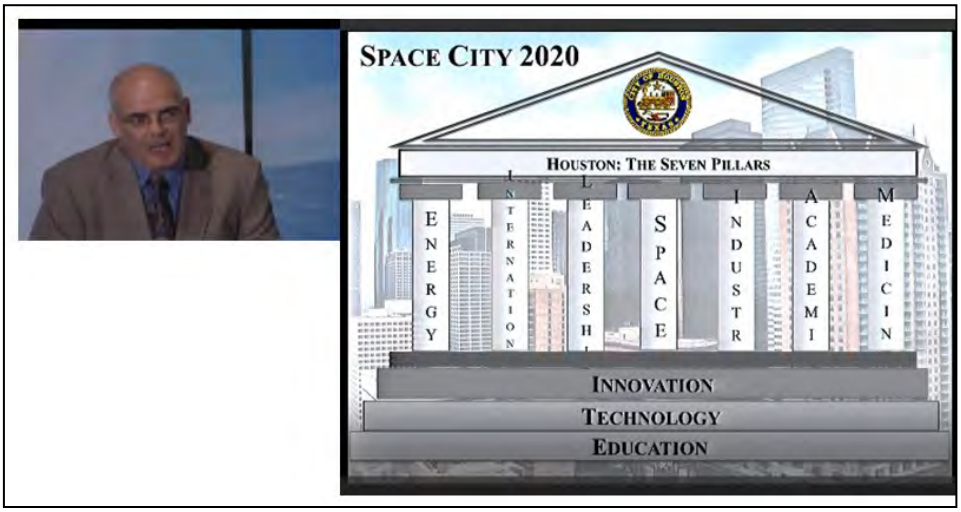

Figure 7. Dr. David Alexander and a Rationale for Building Houston's 2020 Space. Image credit: CSF website screen capture images from the video recording.

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were used on board Apollo or provided core stage main propulsion on Titans IIIs and Titan IVs. Even if the Lynx rocket plane ascends from an airport runway on rocket power, it will burn propellants not much different than other aircraft.

Since days of the X-Prize competition the application of commercial spacecraft at airports has focused largely on "space tourism", judging from many articles over the years about its progress and the plans of organizations such as Virgin Galactic. But there are other short term, lower level investment opportunities or markets beside that of transporting crews to the ISS or tourists on suborbital parabolic arcs. It became clear to many that a passenger sign in with a parrot or a monkey could be an eccentric or a researcher studying zoology under micro-g conditions with an NSF grant. Attached payloads similar to sounding rockets of previous years could require payload specialist interaction in flight. Payloads which detach themselves are better known in some circles by names such as Cube-sats or Nanosats. The small horizontal, reusable winged-spacecraft could provide means to deploy a backlog of small satellites. How quickly, in what effective numbers and at what market price are questions that are of great interest to many concerns. **See references and external links**.

Among the briefings on that Wednesday night, the Lynx presentation included illustrations of the vehicle carrying above its fuselage and flight deck a payload fairing for what could have been an upper stage expendable booster and payload. On the ascending arc of the spacecraft the nose segment of the fairing was raised to an open position. Further research indicated that this was an attached telescope payload, similar to what was flown prior to Sputnik on sounding rockets in this country and overseas. NASA Ames Research Center, in recent years has encouraged study of such suborbital payloads.

Estimating the dimensions of the liftoff weight of the Lynx is not straight-forward and without verification. But descriptions of the Lynx Mark II indicate a configuration with four XCOR XR-5K18 engines rated at 2900-lbs thrust each. If thrust to take-off weight is roughly equal to 1, than this is a vehicle that weighs about 12,000-lbs or about half that of the 7 passenger orbital vehicles. Upper stages for satellite payloads would be substantially smaller.

Figure 8. Mario Diaz. Application and Implementation of the Houston Spaceport. Image credit: CSF website screen capture images from the video recording.

Conclusion: The Panel Introduction

We turn back to the evening's beginning, a reflection on why the participants are doing all this in the first place.

Dr. David Alexander, in his introduction (see **Fig. 7**) called the audience's attention to the John F. Kennedy's speech summoning speech (12 September 1962) to the nation from Houston, calling it forth for a race to the moon. It was at Rice University and Dr. Alexander pointed out at the opposite end of the stage the same podium behind which the President had stood fifty one years before. Houston was also was the place to which the astronauts on the lunar surface reported that they had landed less than seven years later. It was where the astronauts trained for Gemini, Apollo, Shuttle and Station missions, where the missions were planned and coordinated via mission control. It was where it was only recently and very tersely reported by the flight commander of STS-135 at Kennedy Space Center, "Houston, wheels locked", the end of Shuttle flights. It was a radio communication called in by another evening speaker, Chris Ferguson who described the design and development efforts on the Boeing CST-100 craft.

Mr. Diaz assessed the current commercial space industry as a $256 billion global enterprise with a compounding growth rate around 5% annually. If Houston was "Space City" in the 20th century since Kennedy's speech, then there were the problems and remedies (**Fig. 8**) of how it

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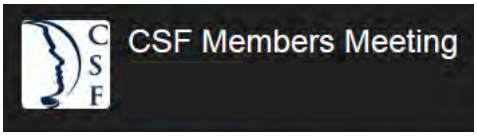
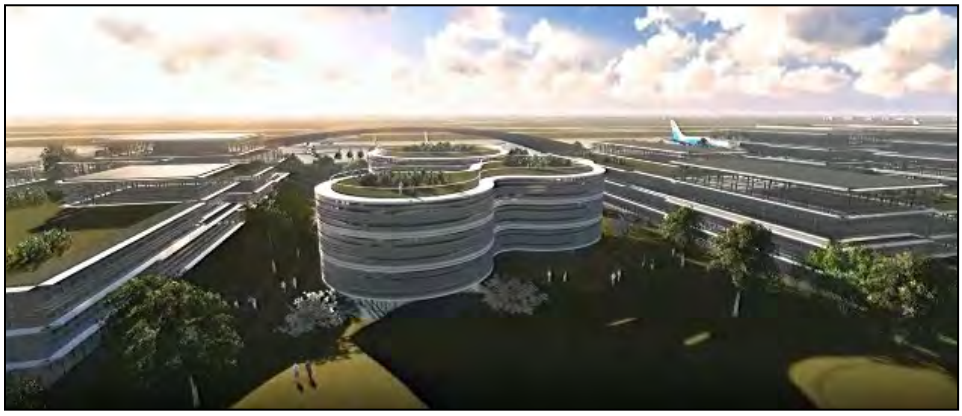
would maintain its identity as such in the 21st. As a space port, its geographic position by water, its local industries, its already close connections to space technology and aviation, its medical, chemical, energy and higher learning institutions made it a site for solving problems up there and here on Earth.

"Wheels locked," was a significant moment for the Shuttle and the city. And we cannot help hoping that an evening of talk about Commercial Spaceflight and a Houston Spaceport will be another one that augurs well. The sentiments of speakers Alexander and Diaz were much the same: Houston did not want to be locked out of the commercial space future that was to come and that they wanted to help the city to roll up its sleeves to make it possible. Whether it is with commercial vehicles taking off vertically or horizontally here in Houston or elsewhere, here we have provided a report on the local community's efforts, readying to remove the blocks in front of the wheels.





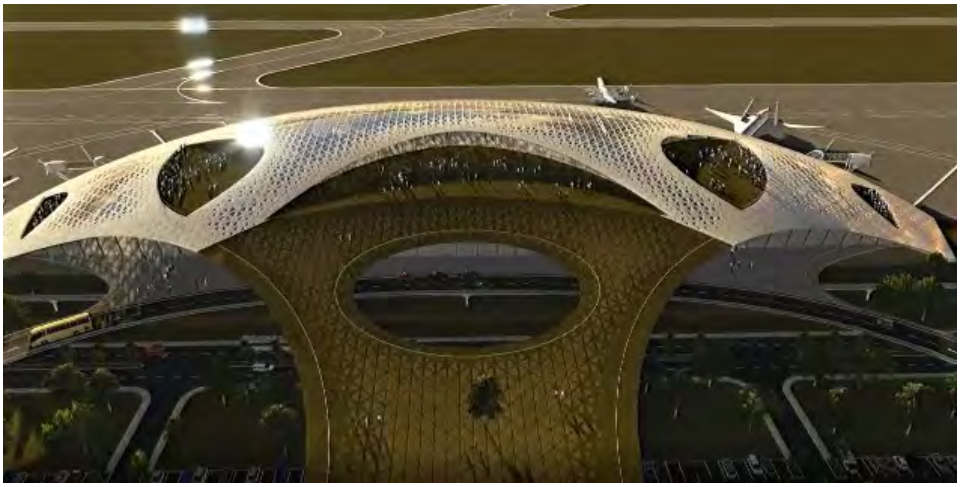
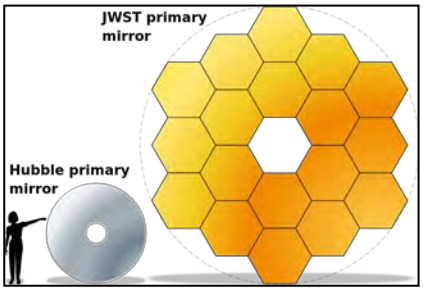
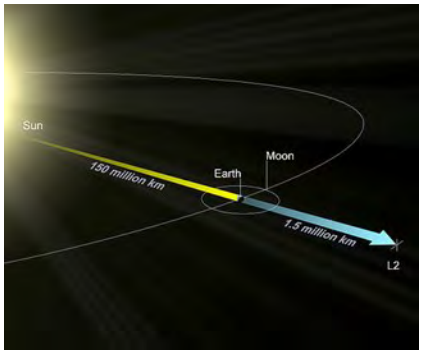


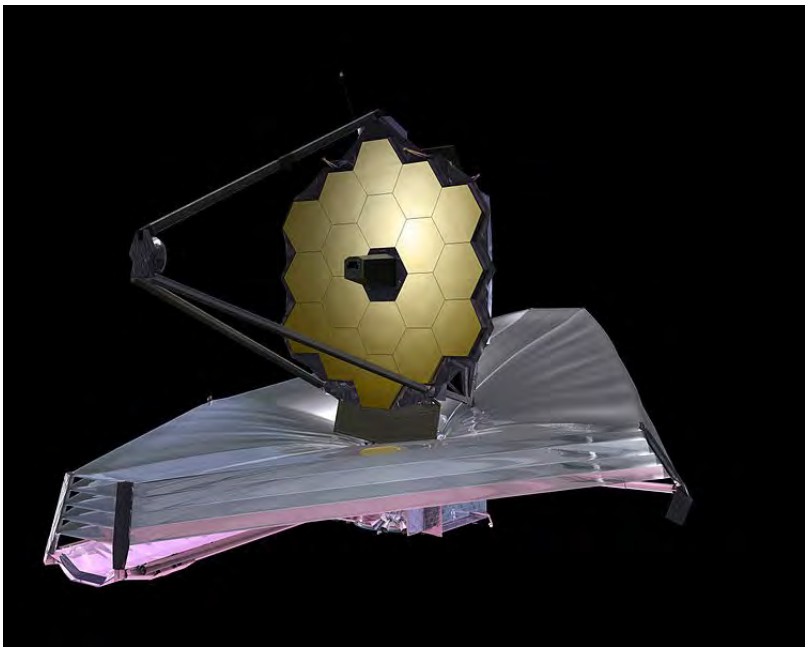
Image credit: Images on this page are Commercial Spaceflight Federation (CSF) website screen capture images, most from the video recording.

The ESA astronaut blog of Luca Parmitano presents his description of his second Extra-Vehicular Activity (EVA). He was a crew member on the International Space Station (ISS). The EVA encountered serious trouble when his helmet filled with water. It ended well with Parmitano safe inside the ISS, but it was a close call. The following link provides a description in his own words:

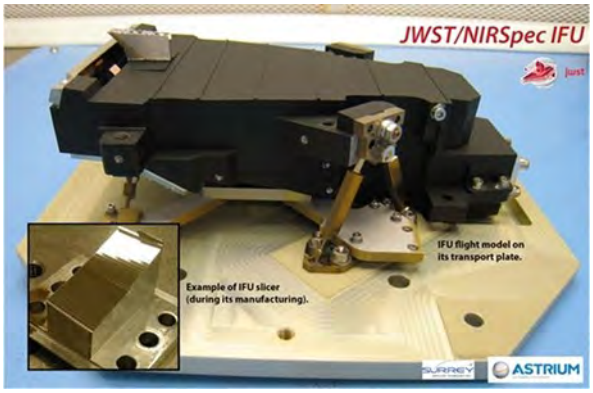
http://blogs.esa.int/luca-parmitano/2013/08/20/eva-23-exploring-the-frontier/



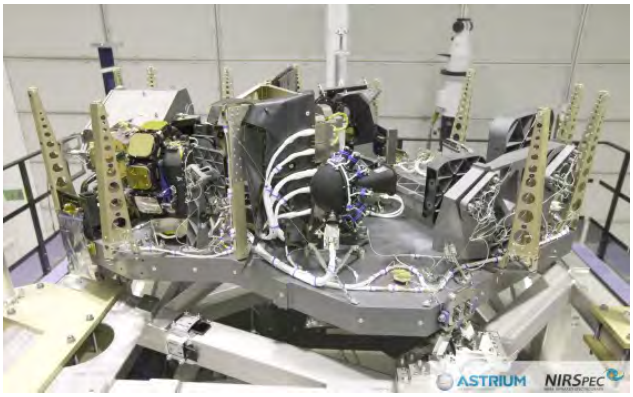




Above: The James Webb Space Telescope (JWST). Image sources: Wikipedia.



Above: The NIRSpec IFU (main picture) and image slicer (inset). Credit: EADS Astrium GmbH – SSTL.



Above: JWST's Near InfraRed Spectrograph (NIRSpec), July 2013. Credit: EADS Astrium GmbH.

3AF MP

A Tribute to the Male and Female Pioneers who Challenged the Atlantic Ocean by Airplane

PHILIPPE MAIRET, 3AF MP

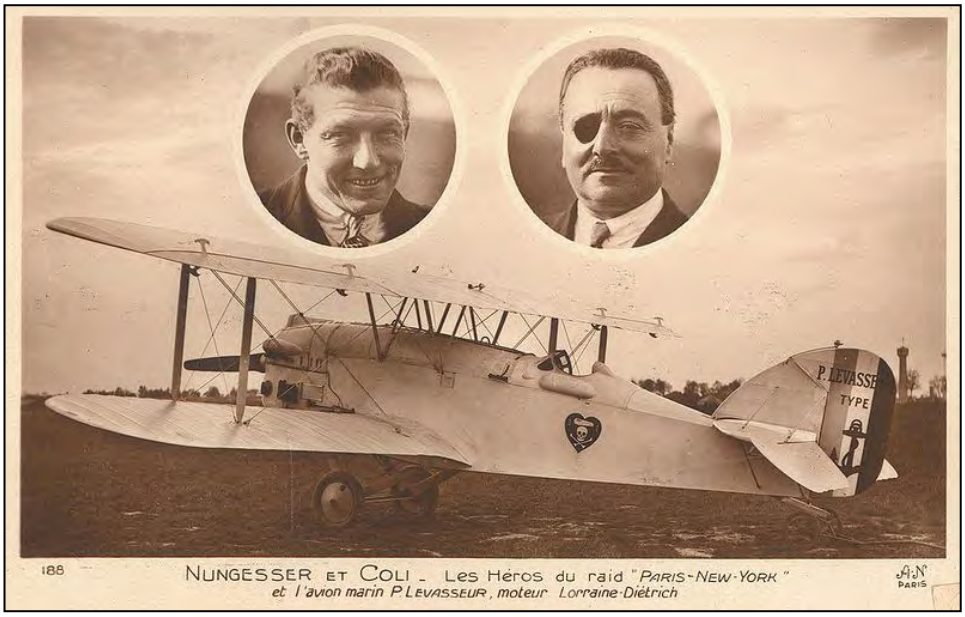
Recently the Midi-Pyrenees Regional Group of l'Association Aéronautique et Astronautique de France (3AF) produced in partnership with AAE (Academy of Air and Space or Air and Space Academy, whose website is www.academie-air-espace.com) a conference titled, "In Search of the White Bird." Not being able to attend, I followed it as closely as possible, using either the French national press or the internet. Just think of all of those male and female pioneers who challenged the Atlantic Ocean by airplane at the beginning of twentieth century! Sometimes they found success, a trans-Atlantic Ocean airplane flight, and sometimes they died in the attempt. Only one man or woman would be the famous winner, the first to complete that incredible flight.

But recently, a team led by Bernard Decré is trying, with the help of the Safran Group, to find pieces of the wreckage of an airplane, "The White Bird." It belonged to two men, Mr. Nungesser and Mr. Coli. Not long ago, Decré went to meet some authorities of the United States of America (USA) and some of the residents of Saint Pierre (a French island 1,200 miles by car east of Maine in the Atlantic Ocean). There is a theory that says that the airplane, with the doomed Nungesser and Coli onboard, might have been damaged at sea near Saint Pierre and Miquelon, which together form a little piece of France near the southern coast of Newfoundland.

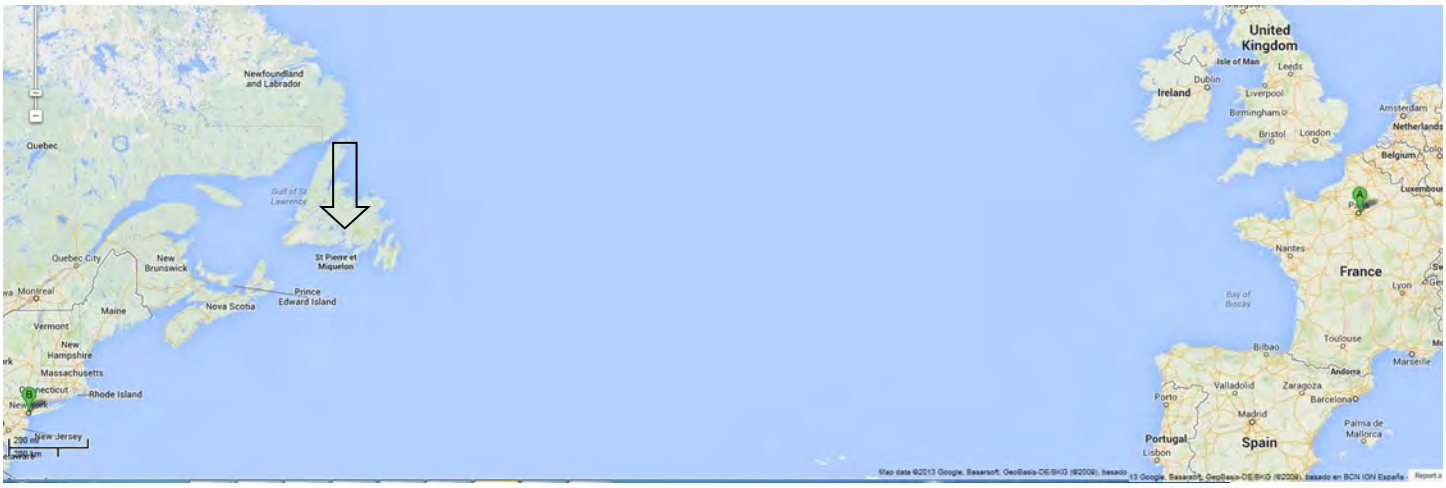
Francis Renard, the 3AF Midi-Pyrénées (MP) historian, told me recently he has clear memories, after viewing a television report about this valiant White Bird research team, that the area off Saint -Pierre and Miquelon, though shallow, was a bin of miscellaneous objects, due to an immense ocean-going traffic during Prohibition (1919-1933) in the USA. According to him , it should be very possible to identify a badly damaged airplane engine, the only part of the airplane that might be obtained from this coveted wreck.

I could interview Yves Chemla, who joined me for dinner as my guest in Toulouse a few years ago. He is an experienced pilot for the Air Saint Pierre airline,

(Continued on page 33)



Above: Post card of the White Bird, a French biplane which disappeared in 1927, during an attempt to make the first non-stop transatlantic flight between Paris and New York. The aircraft was flown by French aviation World War I heroes Charles Nungesser and Francois Coli. Image credit: Wikipedia (anonymous).



Above: Google maps are used for a rough visualization of the distance from Paris to New York, showing Saint-Pierre and Miquelon.

(Continued from page 32)

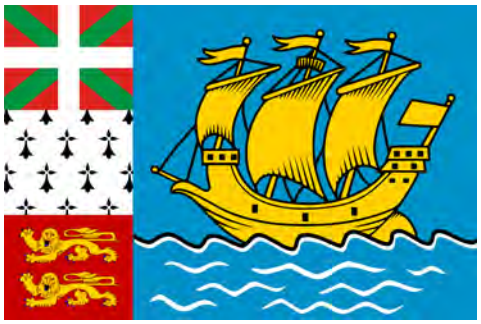
I gave him a gift of a book about the new Airbus A380 airplane. Maybe he will have the same memory as Francis Renard. In any case, let us welcome the effort of the Decré team trying to put the puzzle together, a puzzle whose solution would help us learn more about the tragic history lived by Nungesser and Coli.

Finally, I would add that what matters is not whether the winner in the face of this challenge was French, American, male or female. What matters is that the winner gained this victory with technology which is so limited compared to the state of the art in our time. They had no GPS, no fleet of Galileo satellites in Earth orbit. Piloting airplanes solo or duo for long distances, trying not to fall asleep during the journey, braving the elements, it had to be done!

(Continued on page 34)

Above: In French, this is Ile Sainte-Pierre. In English, Saint Pierre island. The town there, with the harbour, goes by the same name. The airstrip, bottom right, is relatively new. Image credit: Doc Searls from Santa Barbara, USA.

Above: Saint Pierre and Miquelon. Image credit: NASA Visible Earth.



Above: The flag of Saint-Pierre and Miquelon. Image source: Wikipedia (public domain).

Above: Map of Saint Pierre and Miquelon with scale. Image source: Wikitravel.org (public domain image).

3AF MP

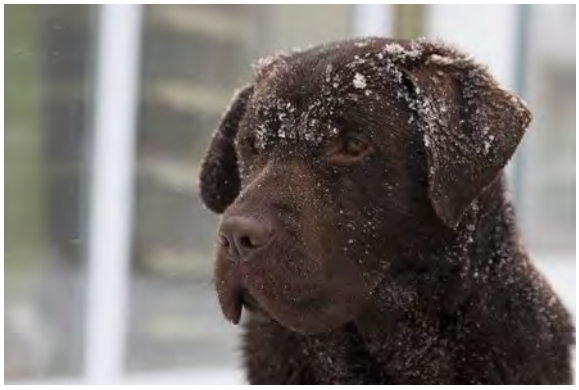
(Continued from page 33)

This page presents photographs of Saint Pierre and Miquelon by photographer Jean-Christophe L'Espagnol.

Right: A performance in General de Gaulle Square. [Five-ball juggling in a crossing pattern. As the ball thrown by the right hand reaches its peak, the next ball is thrown from the left hand just under that ball.] © Jean-Christophe L'Espagnol – Max'Images.

Above: A horseback rider on Diamond Beach. © Jean-Christophe L'Espagnol – Max'Images.

Above: The Atlantic Beachcombers' Festival. © Jean-Christophe L'Espagnol – Max'Images.



Above: A Labrador Retriever, a common dog breed on the archipelago. © Jean-Christophe L'Espagnol – Max'Images.

Above: A Snowy Owl. © Jean-Christophe L'Espagnol – Max'Images.

Above: Ile-Aux-Marins (Sailors' Island). © Jean-Christophe L'Espagnol – Max'Images.

Above: A sailboat. © Jean-Christophe L'Espagnol – Max'Images.

(Continued on page 35)

(Continued from page 34)

Erik Lindbergh (born 1965) is an aviator, a promoter of space tourism, and an artist. Grandson of pioneering aviator Charles Lindbergh, who was the first person to fly non-stop between New York and Paris in 1927, in 2002 Erik honored the 75th anniversary of his grandfather's historic flight by retracing the journey in his own single-engine aircraft. The journey was documented by the History Channel, raised over one million dollars for three charities, garnered half a billion media impressions for the X PRIZE Foundation and prompted a call from United States President George W. Bush for inspiring the country after the tragedy of September 11.

In May 2002, Erik Lindbergh honored the 75th anniversary of his grandfather's historic flight by re-tracing the flight across the Atlantic in a small single engine aircraft, a Lancair Columbia 300 dubbed The New Spirit of St. Louis which cost USD $289,000. Leaving from San Diego, he flew to St Louis, then Farmingdale, New York, and then the most famous portion, the non-stop flight from Republic Airport on Long Island to Le Bourget Airport in Paris on May 2, 2002. The last portion of the flight was completed in 17 hours and 7 minutes, roughly half the time as the original (33.5 hours), but still a challenge as Erik suffers from disabling rheumatoid arthritis and has two artificial knees. The "Mission Control" for the flight was located at the Saint Louis Science Center in St. Louis, Missouri, which as of 2011 maintains multiple exhibits about the flight.

After his anniversary flight, Lindbergh participated in the Flight Across America project, speaking during the opening ceremonies at Paine Field, Everett, Washington on August 11, 2002 and then participating in the closing ceremonies in New York City on the deck of the USS Intrepid on September 8, 2002. Text source: Wikipedia.

Above: Erik Lindbergh and the flag of Saint Pierre and Miquelon. © Jean-Christophe L'Espagnol – Max'Images.

Above: Erik Lindbergh (left) and Bernard Decré (second from left). © Jean-Christophe L'Espagnol – Max'Images.

Above: Erik Lindbergh (left) and Bernard Decré. © Jean-Christophe L'Espagnol – Max'Images.

Above: Erik Lindbergh (dropping the wreath) and Bernard Decré. In memoriam: Nungesser and Coli. © Jean-Christophe L'Espagnol – Max'Images.

Calendar

All calendar items are subject to change without notice.

Section council meetings (email secretary2013[at]aiaahouston.org)
Time: 5:30 - 6:30 PM usually
Day: First Tuesday of most months except for holidays.
Location: NASA/JSC Gilruth Center is often used. The room varies.

Upcoming Section events

Audiobook in work by Ted Kenny, NASA/JSC, Chair, AIAA Houston Section History technical committee, *Suddenly Tomorrow Came, A History of JSC*. The author of this 1993 book is Henry C. Dethloff. See that web page for author information and a short bio.

2013 Conferences www.aiaa.org (Events link)

21 - 24 October 2013, Las Vegas, Nevada, International Telemetering Conference/USA
24 - 25 October 2013, Fukuoka, Japan, Satellite Communications (JC-SAT 2013)
25 - 27 October 2013, Toronto, Ontario, TSAA Do It Yourself Engineer
3 - 7 November 2013, Ribeirao Preto, 22nd International Congress of Mechanical Engineering – COBEM 2013
5 - 7 November 2013, Frankfurt, 8th International Conference Supply on the Wings

2014 Conferences www.aiaa.org (Events link)

13 - 17 January 2014, National Harbor, Maryland, 16th AIAA Non-Deterministic Approaches Conference
13 - 17 January 2014, National Harbor, Maryland, 22nd AIAA/ASME/AHS Adaptive Structures Conference
13 - 17 January 2014, National Harbor, Maryland, 32nd ASME Wind Energy Symposium
13 - 17 January 2014, National Harbor, Maryland, 52nd AIAA Aerospace Sciences Meeting
13 - 17 January 2014, National Harbor, Maryland, 55th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference
13 - 17 January 2014, National Harbor, Maryland, 7th Symposium on Space Resource Utilization
13 - 17 January 2014, National Harbor, Maryland, AIAA Atmospheric Flight Mechanics Conference
13 - 17 January 2014, National Harbor, Maryland, AIAA Guidance, Navigation, and Control Conference
13 - 17 January 2014, National Harbor, Maryland, AIAA Modeling and Simulation Technologies Conference
13 - 17 January 2014, National Harbor, Maryland, AIAA Science and Technology Forum and Exposition (SciTech2014)
13 - 17 January 2014, National Harbor, Maryland, AIAA Spacecraft Structures Conference (formerly the AIAA Gossamer Systems Forum)
26 - 30 January 2014, Santa Fe, New Mexico, 24th AAS/AIAA Space Flight Mechanics Meeting
27 - 30 January 2014, Colorado Springs, Colorado, Annual Reliability and Maintainability Symposium (RAMS) 2014
2 - 6 February 2014, Atlanta, Georgia, American Meteorological Society Annual Meeting
1 - 8 March 2014, Big Sky, Montana, 2014 IEEE Aerospace Conference
24 - 26 March 2014, Lille, France, 49th International Symposium of Applied Aerodynamics
30 April 2014, Washington, DC, 2014 Aerospace Spotlight Awards Gala
5 - 9 May 2014, Pasadena, California, SpaceOps 2014
26 - 28 May 2014, St. Petersburg, Russia, the 21st St. Petersburg International Conference on Integrated Navigation Systems
5 June 2014, Williamsburg, Virginia, 2014 Aerospace Today and Tomorrow
16 - 20 June 2014, Atlanta, Georgia, 11th AIAA/ASME Joint Thermophysics and Heat Transfer Conference

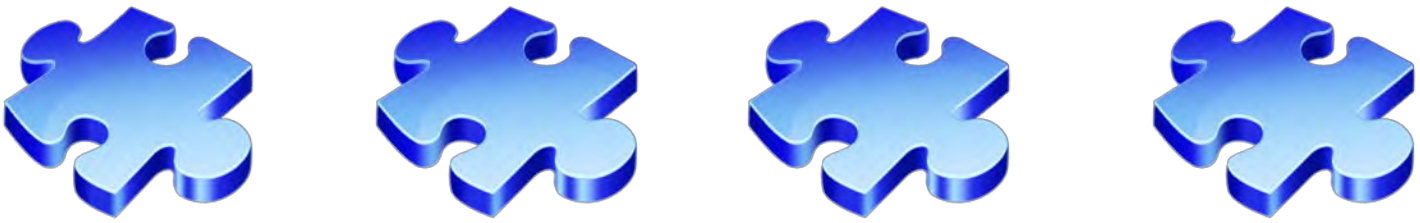
Horizons: published bimonthly by the end of February, April, June, August, October & December at www.aiaahouston.org.

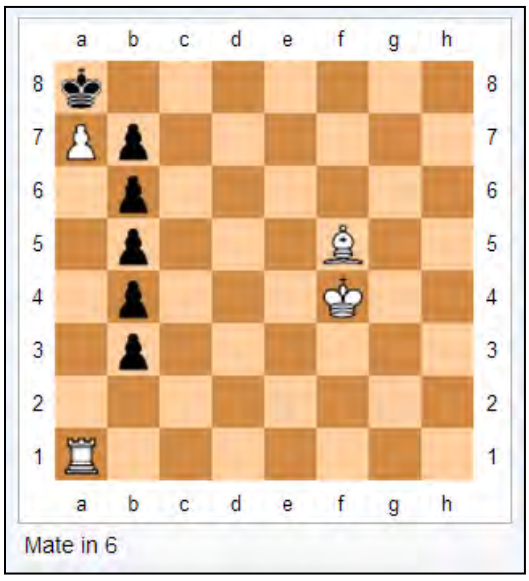
Cranium Cruncher

DR. STEVEN E. EVERETT

This month's problem is another one dealing with probability. Dr. U is developing a new radioisotope thermoelectric generator for a deep space probe, and he has on his workbench a large number of samples of material, some of which are radioactive and some of which are inert. The samples are indistinguishable upon casual observation, but if any two of the radioactive samples are placed adjacent to one another, a runaway chain reaction and meltdown will result. One night, the cleaning lady inadvertently upsets the table, and so she begins placing the samples back on the table in a neat row. Assume that as she picks them up and places them against each other, she is equally likely to pick up a radioactive or an inert sample. How many samples will it take for there to be at least a 50% chance of a meltdown?

Email answers to steven-dot-e-dot-everett at boeing-dot-com.





Shen Ge found this chess puzzle for Horizons. It is proposed by Tim Krabbé, a former championship chess player and puzzle maker. White can checkmate black in six moves. What are the moves?

Above: The Women's World Chess Championship 2013 was a chess match for the championship. The match was scheduled over ten games from 10 to 27 September 2013 in Taizhou, Jiangsu, China.

The match was played between defending champion Anna Ushenina, winner of the Women's World Chess Championship 2012, and challenger Hou Yifan, the previous champion and winner of the FIDE Women's Grand Prix 2011–2012.

After seven of ten games Hou Yifan won the match 5.5 to 1.5 to retake the title.

Source: Wikipedia. Image of Anna Ushenina: Andreas Kontokanis from Piraeus, Greece. Image of Hou Yifan: Federació d'Escacs Valls d'Andorra from Andorra.

Section News

Date: 05 December 2012
Satellite: BepiColombo
Depicts: Transport container with MPO PFM Structure and Propulsion hardware
Location: ESTEC, Noordwijk, The Netherlands
Copyright: ESA
The BepiColombo Mercury Planetary Orbiter (MPO) Proto-Flight Model (PFM) structure, with the chemical propulsion subsystem and heat pipes integrated, arriving at ESA's European Space Research and Technology Centre (ESTEC) in Noordwijk, the Netherlands, in December 2012. It has just travelled from the Stevenage (UK) facility of Astrium, where the first integration and testing activities were performed. Thales Alenia Space will perform further integration of the spacecraft under the direction of the Prime Contractor, Astrium GmbH. The orbiter is packed in a specially built transport container that provided it with protection against vibration and shocks and maintained a controlled internal environment (temperature and humidity).

Association Aéronautique et Astronautique de France (3AF)

Sister Section of AIAA Houston Section since 2007
Jumelée avec AIAA Houston Section depuis 2007

3AF Association Aéronautique Astronautique de France — Midi-Pyrénées

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- Critical Embedded Systems: G. Ladier

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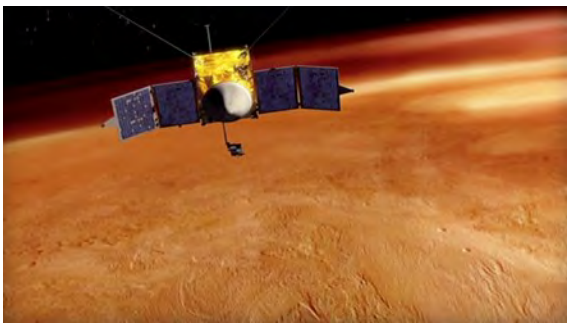
- Environment : (D.Collin: TBC)
- Exploration and Observation of Space: M. Rieugnié

Mars Atmosphere and Volatile EvolutioN (MAVEN) *is a planned space probe designed to study the Martian atmosphere while orbiting Mars. One of the stated mission goals is to possibly determine what caused atmospheric Martian water to be lost to space over time.*

If successfully launched on the first day of the launch window, November 18, 2013, MAVEN will be inserted on September 22, 2014 into an elliptic orbit 6,200 km (3,900 mi) by 150 km (93 mi) above the planet's surface. Source: Wikipedia.

AIAA Daily Launch: ***Work On MAVEN Mission Resumes.*** The Los Angeles Times (10/4, Khan) "Science Now" blog reports that after reviewing the MAVEN mission, NASA decided it met the requirements for necessary work during a government shutdown, thus avoiding a potential launch delay of two years. The article notes that there is an "enormous to-do list" to work through before the launch. Bruce Jakosky, MAVEN's lead scientist, said the mission is back "on track" for launch.

From a French National Center for Space Studies (CNES) website: CNES is on behalf of all national partners (laboratories), the contracting authority of the French instrumental contribution to MAVEN. [Last updated December 20, 2012.)



An artist's impression of MAVEN in orbit around Mars. Image credit: NASA. Image source: CNES.

The American Institute of Aeronautics and Astronautics (AIAA)

AIAA Houston Section
Since 1962

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July 01, 2013 - June 30, 2014

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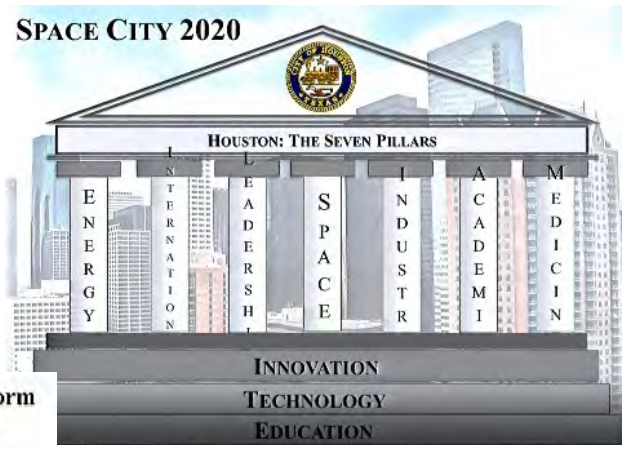
Updated August 14, 2013 , Executive Council Voting Members (20) are identified by:

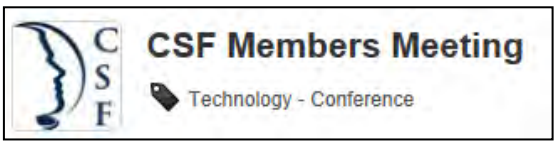
Student Section News

Rice University AIAA Student Section Advisor:
Professor Andrew Meade, *meade[at]rice.edu*
713-348-5880, www.ruf.rice.edu/~meade/

Above: Image credit: Rice University.



Left: Dr. David Alexander of the Rice Space Institute (RSI) speaks at the Commercial Spaceflight Federation (CSF) Members Meeting. See the related article on an earlier page in this issue. RSI and CSF are not associated with AIAA.



Above: Image credit: Rice University.

Student Section News

Please send inputs to Dr. Gary Turner, our College and Co-Op Chair. His e-mail address is: *collegecoop2012[at]aiaahouston.org* His backup for this task is Editor Douglas Yazell: *editor2012[at]aiaahouston.org*. Our Section's web page lists the related websites. We publish most bimonthly issues at www.aiaahouston.org by the last day of each even-numbered month, and the submissions deadline is three weeks earlier. The November / December issue is an exception. It is published by December 10, not December 31.

Student Section News

The Texas A&M University AIAA student section started work on its web site for the new year as of August 10, 2012: http://stuorg-sites.tamu.edu/~aiaa/

Faculty advisor: Professor John E. Hurtado, *jehurtado[at]tamu.edu*, 979-845-1659.

Brian Freno '08 Chair	Bob Cline '13 Speaker Chair	Chris Greer Graduate Representative
Rahul Venkatraman '13 Vice Chair	Nhan Phan '14 SEC Chair	Nicholas Ortiz '13 Senior Class Representative
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Erica Lovig '13 Treasurer	Nick Page '16 Publicity Chair/ Webmaster	Logan Hodge '15 Sophomore Class Representative
		Jacob Shaw '16 Freshman Class Representative

Professors Dessler and North wrote an October 6, 2013, article in the opinion / commentary section of the San Antonio Express-News, *Climate change is real and denial is not about the science*.

Thanks from AIAA Houston Section to our contacts in the Texas A&M University Department of Atmospheric Sciences

Left: Andrew Dessler, B.A., Rice University, Ph.D., Harvard University. Professor. Climate change; remote sensing; climate change policy.

Left: Gerald R. North, B.S., Physics, University of Tennessee, Ph.D., Physics, University of Wisconsin. Distinguished Professor of Atmospheric Sciences and Oceanography. Climate analysis; climate and hydrological modeling; satellite remote sensing, mission planning; statistical methods in atmospheric science.

Left: John W. Nielsen-Gammon. S.B., Massachusetts Institute of Technology (MIT), S.M., MIT, Ph.D., MIT. Regents Professor and Texas State Climatologist. Dynamics of jet streams and cyclones; air pollution and local-scale circulations; data assimilation; applied climatology.

Climate change and global warming are NASA subjects. These subjects are sometimes discussed at AIAA events and in AIAA literature.

For the AIAA Houston Section Annual Technical Symposium (ATS 2013) of May 17, 2013, we got in touch with Professors Dessler, North and Nielsen-Gammon. North and Nielsen-Gammon planned to give presentations, and Nielsen-Gammon filled in for North at the last minute. The two presentations by Nielsen-Gammon are online at our website www.aiaahouston.org. The exact link is provided here.

The Nielsen-Gammon audio file is now online there, too! That 33 MB file is in the Horizons directory, but the link uses someone's Dropbox Public Folder for now. Our webmaster Irene can set up a more sensible link there later.

Nielsen-Gammon's first presentation is the Essential Story of Climate Change, so you will not want to miss it! Using the above links, you can listen while following along with the charts.

Student Section News

Please send inputs to Dr. Gary Turner, our College and Co-Op Chair. His e-mail address is: *collegecoop2012[at]aiaahouston.org* His backup for this task is Editor Douglas Yazell: *editor2012[at]aiaahouston.org*. Our Section's web page lists the related websites. We publish most bimonthly issues at www.aiaahouston.org by the last day of each even-numbered month, and the submissions deadline is three weeks earlier. The November / December issue is an exception. It is published by December 10, not December 31.

Collier's 1952-54

Man Will Conquer Space Soon! (1952-54)

DOUGLAS YAZELL, EDITOR, WITH MELVIN SCHUETZ

The Horizons Collier's Team

Douglas Yazell, Editor
Scott Lowther, Aerospace Projects Review (APR)
Dr. Albert A. Jackson IV
Ron Miller, Black Cat Studios
Melvin Schuetz, bonestell.com
Frederick Ira Ordway III
John Sisson, Dreams of Space
Arthur M. Dula
Shirazi Jaleel-Khan

Quite a few more people make these articles possible, including the Horizons team listed on page 2. Thanks to all involved!

On July 26, 2013, Melvin Schuetz wrote, "… A year ago, in July 2012, I donated an original Chesley Bonestell painting of Mars (circa 1955) to the National Air and Space Museum. They are currently running an exhibition called High Art: A Decade of Collecting, which, 'showcases fifty works of art that the museum has acquired since 2003, all inspired by space exploration and flight.'" Schuetz provided

(Continued on page 43)

	"Man Will Conquer Space Soon!" in 8 Issues of the Weekly Magazine Collier's 1952-54	Cover Image	Page Count
1	March 22, 1952: Man Will Conquer Space Soon! What are we Waiting For? pp. 22-23, The Editors Crossing the Last Frontier, pp. 24-29, 72, 74, Dr. Wernher von Braun A Station in Space, pp. 30-31, Willy Ley The Heavens Open, pp. 32-33, Dr. Fred L. Whipple This Side of Infinity, pg. 34, Dr. Joseph Kaplan Can We Survive In Space? Pp. 35, 65-67, Dr. Heinz Haber Who Owns the Universe? Pp. 36, 70-71, Oscar Schachter Space Quiz Around the Editor's Desk, pp. 38-39	Yes	25
2	October 18, 1952: Man on the Moon Man on the Moon, p. 51, The Editors The Journey, pp. 52-58, 60, Dr. Wernher von Braun Inside the Moon Ship, pg. 56, Willy Ley	Yes	11
3	October 25, 1952: More About Man on the Moon The Exploration, pp. 38-40, 44-48, Dr. Fred Whipple & Dr. Wernher von Braun Inside the Lunar Base, pg. 46, Willy Ley	No	10
4	February 28, 1953: World's First Space Suit Man's Survival in Space, 10 Contributors & 3 Artists, edited by Cornelius Ryan pp. 40-41 Picking the Men, pp. 42-48	Yes	10
5	March 7, 1953: More About (Continuing) Man's Survival in Space Testing the Men, pp. 56-63	No	8
6	March 14, 1953: How Man Will Meet Emergency in Space Travel Concluding Man's Survival in Space: Emergency! pp. 38-44	Yes	9
7	June 27, 1953: The Baby Space Station: First Step in the Conquest of Space Baby Space Station, pp. 33-35, 40, Dr. Wernher von Braun with Cornelius Ryan	Yes	6
8	April 30, 1954: Can We Get to Mars? / Is There Life on Mars? Is There Life on Mars? pg. 21, Dr. Fred L. Whipple Can We Get to Mars? pp. 22-29, Dr. Wernher von Braun with Cornelius Ryan	Yes	10

This issue

Above: Man Will Conquer Space Soon!, a series of articles from 1952 to 1954, from the weekly magazine Collier's.
Source for most of the table: Wikipedia, Man Will Conquer Space Soon!, an article first written by John Sisson.

(Continued from page 42)

a link to a related Smithsonian Magazine article.

"The Bonestell painting I donated is part of this new exhibition. But there is more. To quote the Curator of Aeronautics, Dr. Tom Crouch: 'In addition to your painting, we included two Bonestell pencil sketches, one of his notion of an Earth satellite, and the other of the space station. He annotated both drawings and sent them to von Braun, who added his comments and returned them to Bonestell. They are unique historical documents.'

"I suspected, and have since confirmed, that the two pencil sketches are original drawings that Bonestell produced when working on the Collier's series! Sadly, I will not be able to attend the exhibition myself, but I am hoping to get photographs of the two sketches displayed with the painting."

I asked if the donation was temporary. On August 10, 2013, Schuetz wrote, "The donation is permanent. Mrs. Bonestell left it to me in her will. She died in late 1998 and after the estate was settled in early 1999 I was sent the painting. It was a big surprise! I had been corresponding with her for almost ten years before that and had sent her a pre-publication manuscript copy of my Bonestell bibliography (which was published in mid-1999), but it was not revealed to me about the painting until the day it arrived. Chesley had originally gifted it to Hulda, who then gifted it to me. As a result, after having it for over a dozen years, I thought that it needed to find a 'home for posterity' as it were. I

(Continued on page 44)

Collier's 1952-54

Above: Image credits: Scott Lowther, with help from other Horizons Collier's team members.

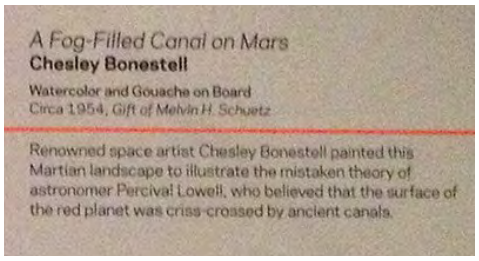
Collier's 1952-1954

(Continued from page 43)

offered the painting to the Smithsonian National Air and Space Museum (NASM). Their acquisitions committee voted unanimously to accept it into their collection."

(Continued on page 45)

Below: A Fog-Filled Canal on Mars, **Chesley Bonestell**, Watercolor and Gouache on Board, Circa 1954, *Gift of Melvin H. Schuetz*
Renowned space artist Chesley Bonestell painted this Martian landscape to illustrate the mistaken theory of astronomer Percival Lowell, who believed that the surface of the red planet was criss-crossed by ancient canals.



Above: From "High Art: A Decade of Collecting," which presents 50 works acquired by the Smithsonian's National Air and Space Museum from 2003 to 2013. The exhibition is open through December 1, 2013.

Collier's 1952-1954

(Continued from page 44)

Also on August 10, 2013, Schuetz mentioned this link to an article about that art display. The article appears on a George Washington University website magazine called George Washington Today.

This issue of Horizons presents (starting on the second page following this one) the Baby Space Station, the seventh of eight installments in the Collier's series. That fits perfectly with the two Bonestell sketches shown on this page. Our thanks go to Melvin Schuetz and all who worked on this museum display.

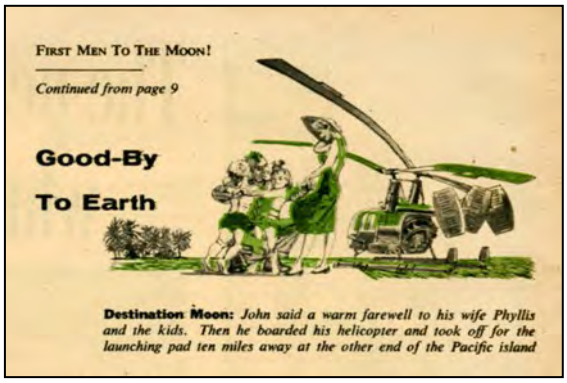
(Continued on page 46)

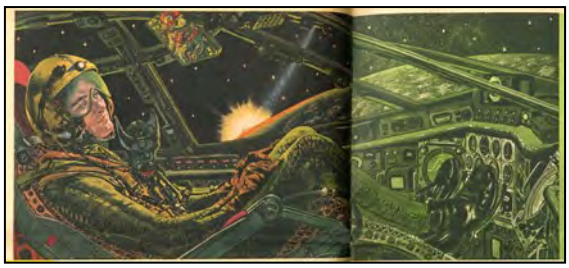
Below: Space Station, Chesley Bonestell.

Below: SHEET NO. 1, Chesley Bonestell. [Wernher von Braun added comments.]

Above: From "High Art: A Decade of Collecting," which presents 50 works acquired by the Smithsonian's National Air and Space Museum from 2003 to 2013. The exhibition is open through December 1, 2013.

Collier's 1952-54





Right: More Wernher von Braun writing and Fred Freeman art from the Dreams of Space blog by John Sisson.

"…This Week Magazine [a newspaper insert] for October 5, 1958, featured the serialization of Wernher von Braun's book…

"First Men to the Moon, Holt, Rinehart and Winston, New York (1958). This book was a fictional story of an expedition to the Moon. Written at a popular level it humanized the possibilities of how human might explore the Moon. Unfortunately I currently have only part 1 of the serialization. Imagine a story like this coming with your Sunday paper and a child picking it up after their parents were done with it."

Below: "Walt Disney's Mickey Mouse Club Magazine for Summer 1956 featured an article based on the Walk Disney's 'Man in Space' and 'Man and The Moon' television shows. I am fascinated how Disney and von Braun worked together to prepare 'propaganda' films to forward the idea of manned space flight.

"(See http://history.msfc.nasa.gov/vonbraun/disney_article.html)" These quotes are from John Sisson's blog Dreams of Space and were obtained on Saturday, October 5, 2013. The link was not working due to the shutdown of the federal government of the USA."

(Continued on page 47)

Collier's

JUNE 27, 1953 • FIFTEEN CENTS

Are You Afraid of LAWYERS?

I Worked for Three Presidents

A White House Diary on F.D.R.—TRUMAN—IKE

A DOZEN LAUGHS WITH BASEBALL UMPIRES

THE BABY SPACE STATION

First Step in the Conquest of Space

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June 27, 1953

ARTICLES

Do Umpires Have a Sense of Humor? ..... JAMES M. KAHN 12
Gentlemen Prefer Monroe ..... COLLIER'S COLOR CAMERA 16
A New Religion Rising in Asia ..... PETER KALISCHER 22
Baby Space Station ..... DR. WERNHER VON BRAUN WITH CORNELIUS RYAN 33
How to Make a Pass at a Bass ..... ALFRED M. LANSING 50
What F.D.R. Told MacArthur ..... (Beginning I WORKED FOR THREE PRESIDENTS) CMDR. WILLIAM McK. RIGDON, USN 58
Now It's Eddieeeee! 64
Are You Afraid of Lawyers? ..... PHOEBE RADCLIFFE 66

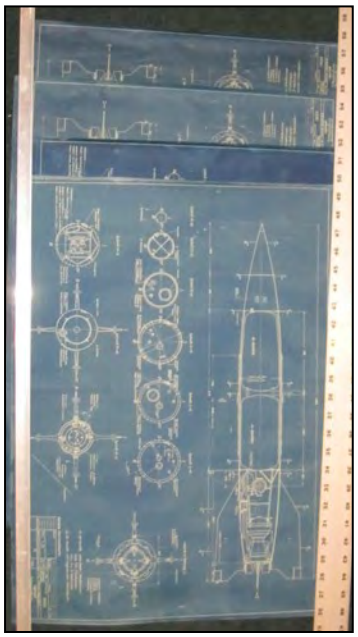
FICTION

The Deadly Mermaid ..... JAMES ATLEE PHILLIPS 9
(PART ONE OF THREE PARTS)
My Lady Wouldn't Wait ..... WILLARD H. TEMPLE 18
One Summer Day ..... LUCY GODOLPHIN 24
(THE SHORT SHORT STORY)
The Adventure of Foulkes Rath ..... ADRIAN CONAN DOYLE 26
(ANOTHER NEW SHERLOCK HOLMES STORY)
Six Greedy Loafers ..... FRANK O'ROURKE 42

48 States of Mind ..... WALTER DAVENPORT 49
Editorials 70
Cover ..... CHESLEY BONESTELL

The Cover

Its curved mirrors reflecting the starlit blackness of space, man's first artificial satellite sweeps over the East Coast of the United States—Boston, New York and Philadelphia are all visible—busily sending scientific reports to the experts waiting below. Altitude: 200 miles; speed: 17,200 mph; duration of flight: 60 days. Those are the bare statistics; the exciting story starts on page 33.



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BABY SPACE STATION

By DR. WERNHER von BRAUN with CORNELIUS RYAN

Chief, Guided Missiles Development Division, Redstone Arsenal, Huntsville, Alabama

An unmanned rocket, whizzing around the earth 200 miles high, pouring vital facts back to ground stations . . . Scientists now know that's the first step in the conquest of space

WE ARE at the threshold today of our first bold venture into space. Scientists and engineers working toward man's exploration of the great new frontier know now that they are going to send aloft a robot laboratory as the first step—a baby space station which for 60 days will circle the earth at an altitude of 200 miles and a speed of 17,200 miles an hour, serving as scout for the human pioneers to follow.

We rocket engineers have learned a lot about space by shooting off the high-flying rockets now in existence—so much that right now we know how to build the rocket ships and the big space station we need to put man into space and keep him there comfortably. We know how to train space crews and how to protect them from the hazards which exist above our atmosphere. All that has been reported in previous issues of Collier's.

But the rockets which have gathered our data have stayed in space for only a few minutes at a time. The baby satellite will give us 60 days; we'll learn more in those two months than in 10 years of firing the present instrument rockets.

We can begin work on the new space vehicle immediately. The baby satellite will look like a 30-foot ice-cream cone, topped by a cross of curved mirrors which draw power from the sun. Its tapered casing will contain a complicated maze of measuring instruments, pressure gauges, thermometers, microphones and Geiger counters, all hooked up to a network of radio, radar and television transmitters which will keep watchers on earth informed about what's going on inside it.

Speeding 30 times faster than today's best jets, the little satellite will make one circuit around the earth every 91 minutes—nearly 16 round trips a day. At dawn and dusk it will be visible to the naked eye as a bright, unwinking star, reflecting the sun's rays and traveling from horizon to horizon in about seven minutes. Ninety-one minutes later, it completes the circuit—but if you look for it in the same place, it won't be there: it travels in a fixed orbit, while the earth, rotating on its own axis, moves under it. An hour and a half from the time you first sighted the speeding robot, it will pass over the earth hundreds of miles to the west. The cone will never be visible in the dark of night because it will be in the shadow of the earth.

If you live in Philadelphia, one morning you may see the satellite overhead just before sunup, moving on a southeasterly course. Ninety-one minutes later, as dawn breaks over Wichita, Kansas, people there will see it, and after another hour and a half it will be visible over Los Angeles—again, just before the break of dawn.

That evening, Philadelphians—and the people of Wichita and Los Angeles—will see the speeding satellite again, this time traveling in a northeasterly direction. The following morning, it will

CHESLEY BONESTELL

Ready for launching. Rocket is divided nto three sections (separated by red bands), each with its own set of motors. Lower two wil be cast off when their power is spent. Only the topmost cone—equipped with TV cameras, other instruments—will get to 200-mile orbit

Monkeys in the trail-blazing satellite will prepare the way for the men who follow

be in sight again over the same cities, at about the same time, a little farther to the west. After about ten days, it will no longer appear over those three cities, but will be visible over other areas. Thus, from any one site, it will be seen on successive occasions for about 20 days before disappearing below the western horizon. In another month or so, it will show up again in the east.

And while you're gazing at the little satellite, it will be peering steadily back, through a television camera in its pointed nose. The camera will give official viewers in stations scattered around the globe the first real panoramic picture of our world —a breath-taking view of the land masses, oceans and cities as seen from 200 miles up. More than likely, commercial TV stations will pick up the broadcasts and relay them to your home.

Three more cameras, located inside the cone, will transmit equally exciting pictures: the first sustained view of life in space.

Three rhesus monkeys—rhesus, because that species is small and highly intelligent—will live aboard the satellite in air-conditioned comfort, feeding from automatic food dispensers. Every move they make will be watched, through television, by the observers on earth.

As fast as the robot's recording instruments gather information, it will be flashed to the ground by the same method used now in rocket-flight experiments. The method is called telemetering, and it works this way: as many as 50 reporting devices are hooked to a single transmitter which sends out a jumble of tonal waves. A receiver on earth picks up the tangled signals, and a decoding machine unscrambles the tones and prints the information automatically on long strips of paper, as a series of spidery wavelike lines. Each line represents the findings of a particular instrument—cabin temperature, air pressure and so on. Together, they'll provide a complete story of the happenings inside and outside the baby space station.

What kind of scientific data do we hope to get? Confirmation of all space research to date and, most important, new information on weightlessness, cosmic radiation and meteoric dust.

At a high enough speed and a certain altitude, an object will travel in an orbit around the earth. It—and everything in it—will be weightless. Space scientists and engineers know that man can adjust to weightlessness, because pilots have simulated the condition briefly by flying a jet plane in a roller-coaster arc. But will sustained weightlessness raise problems we haven't foreseen? We must find out —and the monkeys on the satellite will tell us.

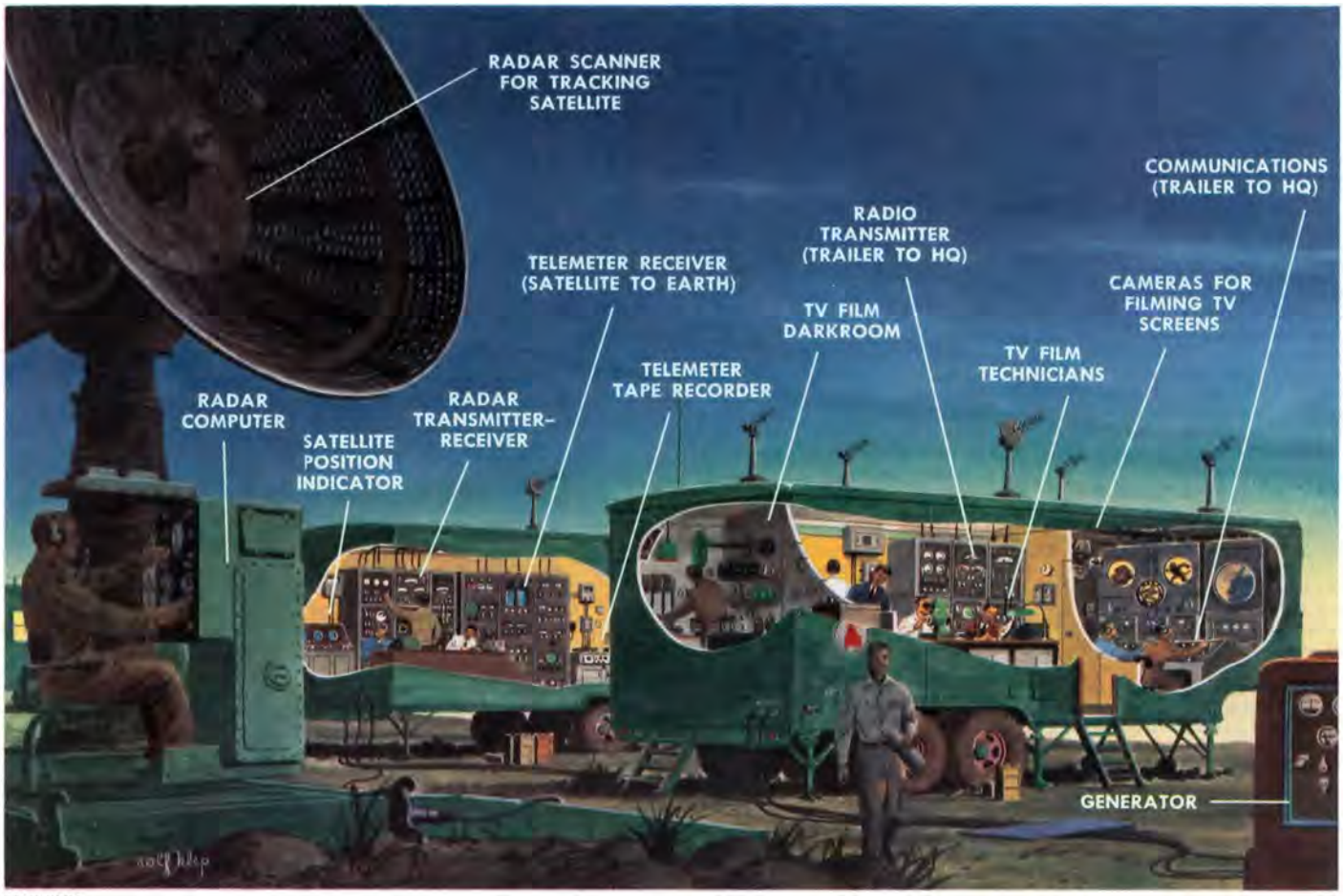
The monkeys will live in two chambers of the animal compartment. In the smaller section, one of the creatures will lie strapped to a seat throughout the two-month test. His hands and head will be free, so he can feed himself, but his body will be bound and covered with a jacket to keep him from freeing himself or from tampering with the measuring instruments taped painlessly to his body. The delicate recording devices will provide vital information—body temperature, breathing cycle, pulse rate, heartbeat, blood pressure and so forth.

The other two monkeys, separated from their pinioned companion so they won't turn him loose, will move about freely in the larger section. During the flight from earth, these two monkeys will be strapped to shock-absorbing rubber couches, under a mild anesthetic to spare them the discomfort of the acceleration pressure. By the time the anesthetic wears off, the robot will have settled in its circular path about the earth, and a simple timing device will release the two monkeys. Suddenly they'll float weightless, inside the cabin.

What will they do? Succumb to fright? Perhaps cower in a corner for two months and slowly starve to death? I don't think so. Chances are they'll adjust quickly to their new condition. We'll make it easier for them to get around by providing leather handholds along the walls, like subway straps, and by stringing a rope across the chamber.

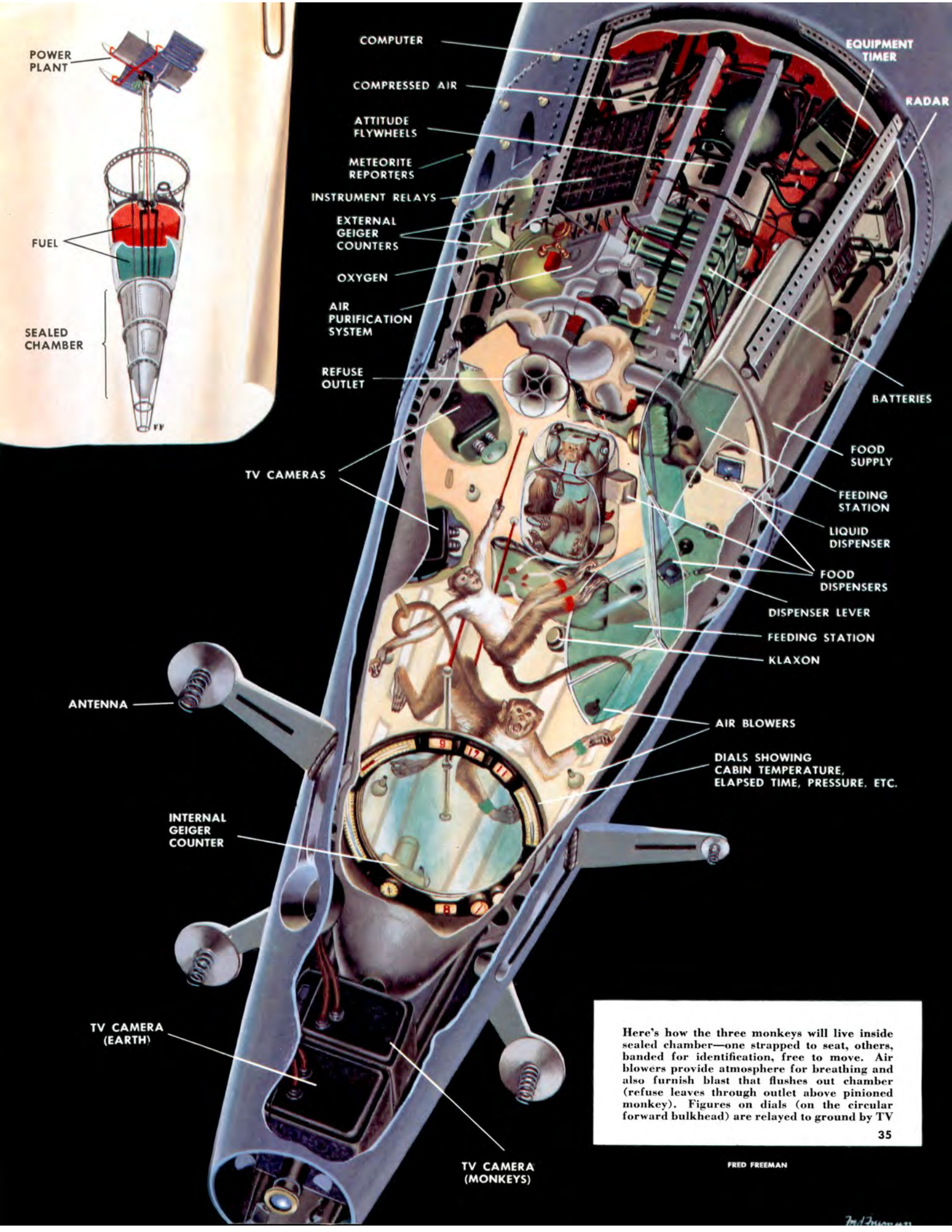
There's another problem for the three animals: to survive the 60 days they must eat and drink.

They'll prepare to cope with that problem on the ground. For months before they take off, the two unbound monkeys will live in a replica of the compartment they'll occupy in space, learning to operate food and liquid dispensers. In space, each of the two free animals will have his own feeding station. At specific intervals a klaxon horn will sound; the monkeys will respond by rushing to the feeding stations as they've been trained to do. Their movement will break an electric-eye beam, and clear plastic doors will snap shut behind them, sealing them off from their living quarters. Then, while they're eating, an air blower will flush out the living compartment—both for sanitary reasons



ROLF KLEP

One of the 20 field stations, scattered around the world, which will track the satellite and receive the reports it transmits by telemeter and TV. Information gathered here will be sent immediately to headquarters in the U.S.

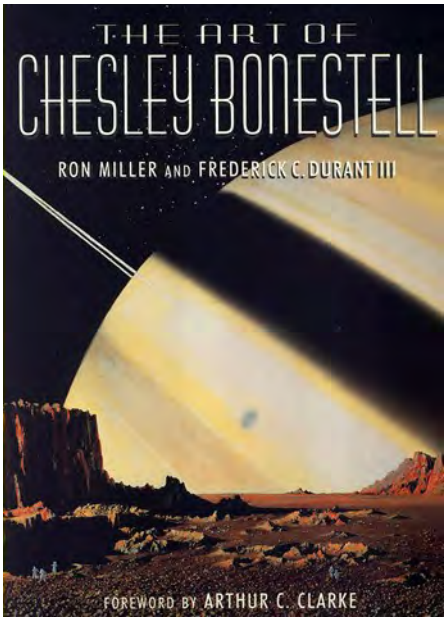


Here's how the three monkeys will live inside sealed chamber—one strapped to seat, others, banded for identification, free to move. Air blowers provide atmosphere for breathing and also furnish blast that flushes out chamber (refuse leaves through outlet above pinioned monkey). Figures on dials (on the circular forward bulkhead) are relayed to ground by TV

FRED FREEMAN

Dreams of Space
Books & Ephemera

Non-Fiction Children's Books about Space Flight from 1945 to 1975
http://dreamsofspace.blogspot.com/



Award winner Ron Miller & Black Cat Studios

Ron Miller, winner of the 2002 Hugo Award (World Science Fiction Society) for Best Related Work: The Art of Chesley Bonestell

The Chesley Bonestell Archives of Melvin H. Schuetz

www.bonestell.com

A former satellite controller in the U.S. Air Force and private industry, Melvin H. Schuetz has researched and collected publications from around the world containing Bonestell's art for more than four decades. His book, A Chesley Bonestell Space Art Chronology, is a unique reference bibliography containing detailed listings of over 750 publications which have included examples of Bonestell's space art.

Space scientist and well-known author of visionary books on spaceflight. Ordway was in charge of space systems information at the Marshall Space Flight Center from 1960 to 1963 and before that performed a similar function for the Army Ballistic Missile Agency. For many years he was a professor at the University of Alabama's School of Graduate Studies and Research. However, his greatest contribution has been to the popularization of space travel through dozens of books that he has authored or coauthored. He was also technical consultant to the film 2001: A Space Odyssey and owns a large collection of original paintings depicting astronautical themes. Ordway was educated at Harvard and completed several years of graduate study at the University of Paris and other universities in Europe.

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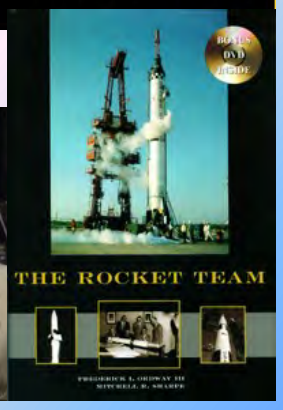


Frederick Ira Ordway III

Co-Author with Mitchell R. Sharpe of The Rocket Team

Dreams of Space, Books & Ephemera

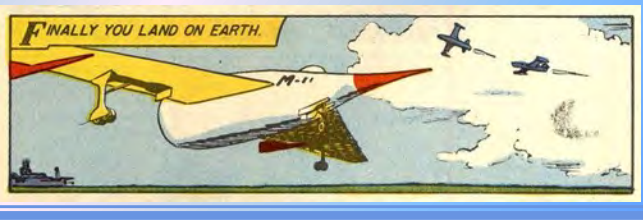
Non-Fiction Children's Books about Space Flight from 1945 to 1975

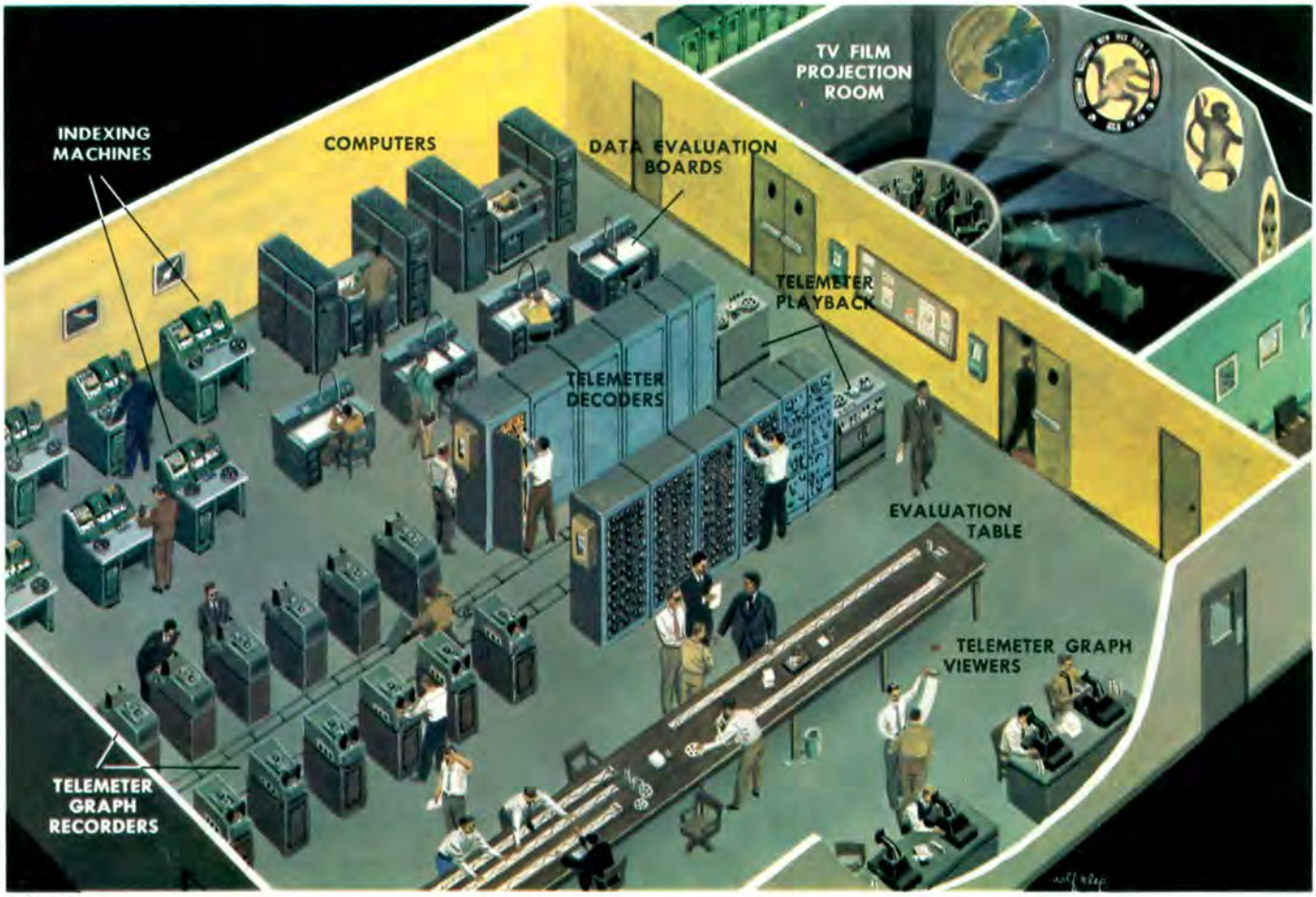
http://dreamsofspace.blogspot.com/

Classics Illustrated were comic books intended to educate as well as entertain. They often were fictional "classic" books in comic book form such as Moby Dick. They also had a special series called "The World around Us." These were non-fiction comic books about topics of interest.

Classics Illustrated. Illustrated by Gerald McCann, Sam Glanzman and John Tartaglione. The Illustrated Story of Space (80 pages), 26 cm, softcover.

Contains illustrated stories on training for space, the first rocket to the Moon, the history and use of the rocket, the launch of Vanguard 1 and the construction of a space station. "The World Around Us" (#5) January 1959.





ROLF KLEP

Main headquarters, where data transmitted by satellite—and relayed by field stations—will be decoded, interpreted and indexed for study

and to keep weightless refuse from blocking the television lenses. The plastic doors will spring open again when the housecleaning is finished.

The monkeys will drink by sucking plastic bottles. Liquid left free, without gravity to keep it in place, would hang in globules. To get solid food, each of the monkeys—again responding to their training—will press a lever on a dispenser much like a candy or cigarette machine. The lever will open a door, enabling the animals to reach in for their food. They'll get about half a pound of food a day—a biscuit made of wheat, soybean meal and bone meal, enriched with vitamins. The immobilized monkey will have the same food; his dispensers will be within easy reach.

For the two free monkeys, it will be a somewhat complicated life. The way they react to their ground training under the new conditions posed by lack of gravity will provide invaluable information on how weightlessness will affect them.

While the monkeys are provicing physiologists with information on weightlessness, physicists will be learning more about cosmic rays, invisible high-speed atomic particles which act like deep-penetrating X rays and were once feared as the major hazard of space flight. Theoretically, in large enough doses cosmic rays could conceivably cause deep burns, damage the eyes, produce malignant growths and even upset the normal hereditary processes. They don't do much damage to us on earth because the atmosphere dissipates their full strength, but before much was known about the rays people worried about the dangers they might pose to man in space. From recent experiments scientists now know that the risk was mostly exaggerated—that even *beyond* the atmosphere a human can tolerate the rays for long periods without ill effects. Still, the best figures available have been obtained by high-altitude instrument rocket flights which were too brief to be conclusive. These spot checks must be augmented by a prolonged study, and the baby space station will make that possible.

The concentration of cosmic rays over the earth varies, being greatest over the north and south magnetic poles. The baby space station will follow a circular path that will carry it close to both poles within every hour and a half, so it can determine if cosmic-ray concentration varies that high up.

Geiger counters inside and outside the robot will measure the number of cosmic particle hits. The telemetering apparatus will signal the information to the ground—and for the first time physicists will have an accurate indication of the cosmic-ray concentration in space, above all parts of the globe.

Besides cosmic rays, the baby satellite will be hit by high-speed space bullets—tiny meteors, most of them smaller than a grain of sand, whizzing through space faster than 1,000 miles a minute.

When men enter space, they'll be protected against these pellets. Their rockets, the big space station, even their space suits, will have an outer skin called a meteor bumper, which will shatter the lightning-fast missiles on impact. But how many grainlike meteors must the bumpers absorb every 24 hours? That's what we space researchers want to know. So dime-sized microphones will be scattered over the robot's outer skin to record the number and location of the impacts as they occur.

In the process of unmasking the secrets of space, the baby satellite also will unravel a few riddles of our own earth.

For example, there are numerous islands whose precise position in the oceans has never been accurately established because there is no nearby land to use as a reference point. Some of them—one is Bouvet Island, lying south of the Cape of Good Hope—have been the subject of international disputes which could be quickly settled by fixing the islands' positions. By tracking the baby space station as it passes over these islands, we'll accurately pinpoint their locations for the first time.

The satellite will be even more important to meteorologists. The men who study the weather would like to know how much of the earth is covered with cloud in any given period. The robot's television camera will give them a clue—a start toward sketching in a comprehensive picture of the world's weather. Moreover, by studying the *pattern* of cloud movement, particularly over oceans, they may learn how to predict weather fronts with precision months in advance. Most of the weather research must await construction of a man-carrying space station, but the baby satellite will show what's needed.

To collect this information, of course, we must first establish the little robot in its 200-mile orbit. All the knowledge needed for its construction and operation is already available to experts in the fields of rocketry, television and telemetering.

Before take-off, the satellite vehicle will resemble one of today's high-altitude rockets, except that it will be about three times as big—150 feet tall, and 30 feet wide at the base. After take-off it will become progressively smaller, because it actually will consist of three rockets—or stages—one atop another, two of which will be cast away after delivering their full thrust. The vehicle will take off vertically and then tilt into a shallow path nearly parallel to the earth. Its course will be over water at first, so the first two stages won't fall on anyone after they're dropped, a few minutes after take-off.

When the third stage of the vehicle reaches an altitude of 60 miles and a speed of 17,700 miles an hour, the final bank of motors will shut off auto-

matically. The conical nose section will coast unpowered to the 200-mile orbit, which it will reach at a speed of 17,100 miles an hour, 44 minutes later. The entire flight will take 48½ minutes.

After the satellite reaches its orbit, the automatic pilot will switch on the motors once again to boost the velocity to 17,200 miles an hour—the speed required to balance the earth's gravity at that altitude. Now the rocket becomes a satellite; it needs no more power but will travel steadily around the earth like a small moon for 60 days, until the slight air drag present at the 200-mile altitude slows it enough to drop.

Once the satellite enters its orbit, gyroscopically controlled flywheels cartwheel the nose until it points toward the earth. At the same time, five little antennas spring out from the cone's sides and a small explosive charge blasts off the nose cap which has guarded the TV lens during the ascent.

Finally, the satellite's power plant—a system of mirrors which catch the sun's rays and turn solar heat into electrical energy—rises into place at the broad end of the cone. A battery-operated electric timer starts a hydraulic pump, which pushes out a telescopic rod. At the end of the rod are the three curved mirrors. When the rod is fully extended, the mirrors unfold, side by side, and from the ends of the central mirror two extensions slip out. Mercury-filled pipes run along the five polished plates; the heated mercury will operate generators providing 12 kilowatts of power. Batteries will take over the power functions while the satellite is passing through the shadow of the earth.

With the power plant in operation, the baby space station buckles down to its 60-day assignment as man's first listening post in space.

At strategic points over the earth's surface, 20 or more receiving stations, most of them set up in big trailers, will track the robot by radar as it passes overhead, and record the television and telemetering broadcasts on tape and film. Because the satellite's radio waves travel in a straight line, the trailers can pick up broadcasts for just a few minutes at a time—only while the robot remains in sight as it zooms from horizon to horizon.

As the satellite passes out of range, the recorded data will be sent to a central station in the United States—some of it transmitted by radio, the rest shipped by plane. There, the information will be evaluated and integrated from day to day.

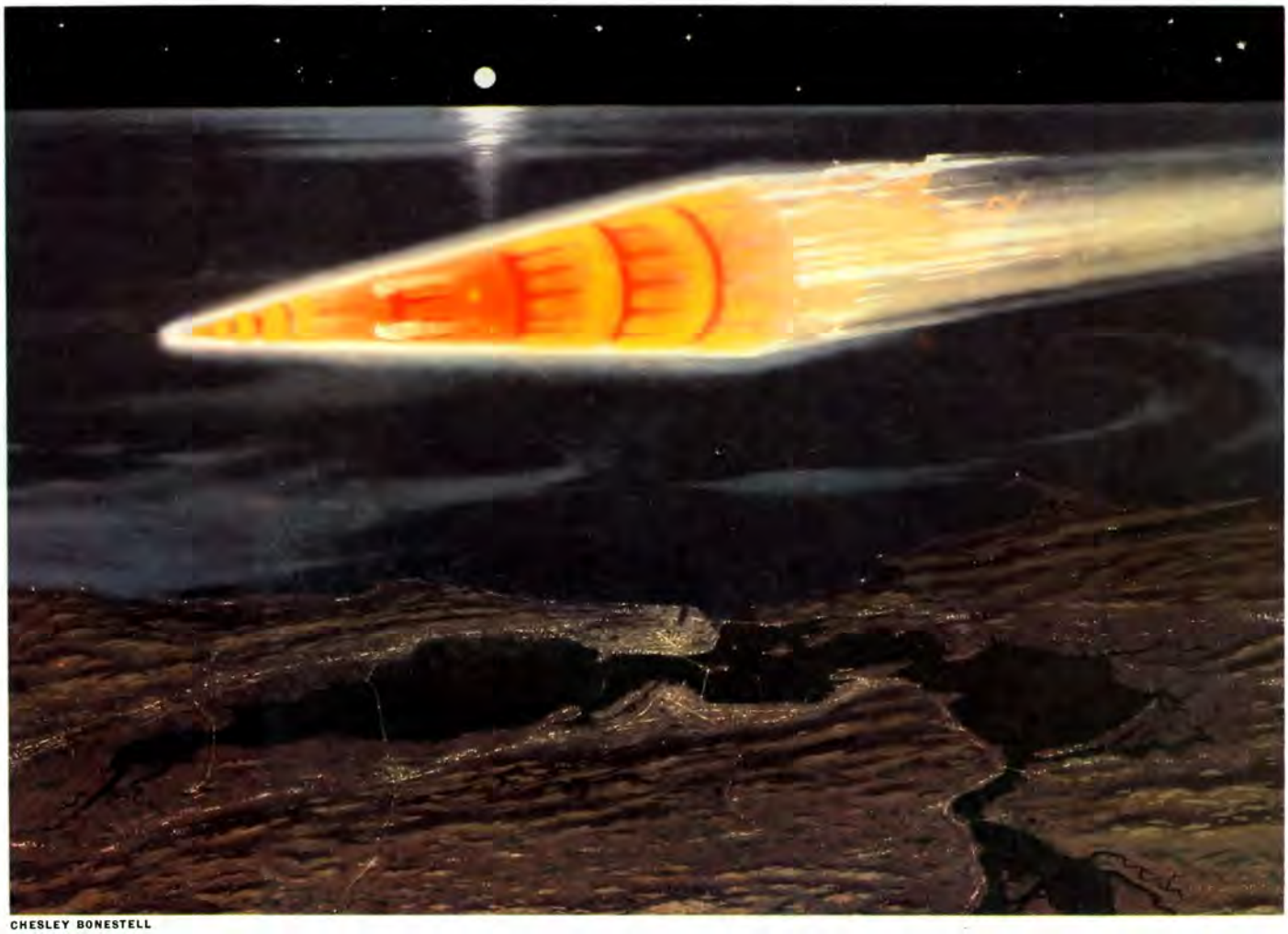
The monitoring posts will be set up inside the Arctic and Antarctic Circles and at points near the equator. In the polar areas, stations could be at Alaska, southern Greenland and Iceland; and in the south, Shetland Islands, Campbell Island and South Georgia Island. In the Pacific, possible sites are Baker Island, Christmas Island, Hawaii and the Galapagos Islands. The remaining monitors may be located in Puerto Rico, Bermuda, St. Helena, Liberia, South-West Africa, Ethiopia, Maldive Islands, the Malay Peninsula, the Philippines, northern Australia and New Zealand.

These points, all in friendly territory, would form a chain around the earth, catching the satellite's broadcasts at least once a day.

The monitor stations will be fairly costly, but they'll come in handy again later, when man is ready to launch the first crew-operated rocket ships for development of a big-manned space station, 1,075 miles from the earth.

The cost of the baby satellite project will be absorbed into the four-billion-dollar 10-year program to establish the bigger satellite. We scientists can have the baby rocket within five to seven years if we begin work now. Five years later, we could have the manned space station.

One of the monitoring posts will view the last moments of the baby space station. As the weeks pass, the satellite, dragging against the thin air, will drop lower and lower in its orbit. When it descends into fairly dense air, its skin will be heated by friction, causing the temperature to rise within the animal compartments. At last, a thermostat will set off an electric relay which triggers a capsule containing a quick-acting lethal gas. The monkeys will die instantly and painlessly. Soon afterward, the telemetering equipment will go silent, as the rush of air rips away the solar mirrors which provide power, and the baby space station will begin to glow cherry red. Then suddenly the satellite will disappear in a long white streak of brilliant light—marking the spectacular finish of man's first step in the conquest of space. ▲▲▲



CHESLEY BONESTELL

Baby space station's last moments. With San Francisco Bay in background, satellite plunges into atmosphere in fiery windup to 60-day flight

Exerpt from "Ray Guns and Rocketships"
first published in 1952

It was suggested that I comment on the writing of science fiction for children. I am not sure just how to do this as I am not sure that I have written any sciene fiction for children. It is true that I have a group of books which are catalogued as being intended for "boys of ten and older"—but I have found that this list is read by adults as well as by boys (and girls!) and that my books intended for adults are read by my younger readers as well as by adults. Science fiction is quite ambivalent in this respect. A book so juvenile that it will insult the intelligence of adults is quite likely to insult the intelligence of the kids.

When I was a child myself I used to get quite annoyed at authors who "wrote down." When I was first asked to do a book intended for kids I swore a solemn oath that I would never "write down"—it is better by far that a child should fail to grasp some portion of a story than it is to patronize him. So I believe and my experience seems to bear me out. In my own work I make just two minor distinctions between copy intended nominally for adults and copy intended nominally for not-yet-adults. In the boys' list I place a little less emphasis on boy-meets-girl and a little more emphasis on unadulterated science—but these are matters of slight emphasis only. On the first point I am obeying a taboo set up by adults, it being my own recollection that kids get interested in boy-meets-girl at a very tender age. On my second point it is my recollection and my more recent observation that kids are more interested in "how" and "why" than their parents usually are. The kids really want to know how the spaceship operates; the adults frequently don't care—so I try to give the kids enough detail in matters technological to satisfy them without giving so much that it will bore an adult. In any case a science fiction story should be a story first of all; it is not intended to replace science text books.

But most especially in writing for kids the science in it should be valid. When they spot an error they are not likely to forgive it.

In many ways science fiction belongs to the kids. They know that "it hasn't happened yet"—but they believe that it will happen. They expect to grow up to build space ships, to pilot them. They still believe in change and they are undismayed by the wonderful and terrifying future we have in front of us. If an adult enjoys science fiction, it is almost a guarantee that he has managed to carry over a youthful point of view, a mind not yet calcified, a belief in change and the future. It is for the youngster and for this adult who still has something of youth about him that we write.

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2

Exerpt from "All You Zombies"
First published in The Magazine of Fantasy and Science Fiction (March 1959)

2217 TIME ZONE V (EST) 7 Nov 1970 NYC—"Pop's Place": I was polishing a brandy snifter when the Unmarried Mother came in. I noted the time—10.17 p.m. zone five or eastern time November 7th, 1970. Temporal agents always notice time & date; we must.

The Unmarried Mother was a man twenty-five years old, no taller than I am, immature features and a touchy temper. I didn't like his looks—I never had—but he was a lad I was here to recruit, he was my boy. I gave him my best barkeep's smile.

Maybe I'm too critical. He wasn't swish; his nickname came from what he always said when some nosy type asked him his line: "I'm an unmarried mother." If he felt less than murderous he would add: "—at four cents a word. I write confession stories."

If he felt nasty, he would wait for somebody to make something of it. He had a lethal style of in-fighting, like a female cop—one reason I wanted him. Not the only one.

He had a load on and his face showed that he despised people more than usual. Silently I poured a double shot of Old Underwear and left the bottle. He drank, poured another.

I wiped the bar top. "How's the 'Unmarried Mother' racket?"

His fingers tightened on the glass and he seemed about to throw it at me; I felt for the sap under the bar. In temporal manipulation you try to figure everything, but there are so many factors that you never take needless risks.

Continued on page 4.

I saw him relax that tiny amount they teach you to watch for in the Bureau's training school. "Sorry," I said. "Just asking, 'How's business?' Make it 'How's the weather?' "
He looked sour. "Business is okay. I write 'em, they print 'em, I eat."
I poured myself one, leaned toward him. "Matter of fact," I said, "you write a nice stick—I've sampled a few. You have an amazingly sure touch with the woman's angle."
It was a slip I had to risk; he never admitted what pen-names he used. But he was boiled enough to pick up only the last. " 'Woman's angle!' " he repeated with a snort. "Yeah, I know the woman's angle. I should."
"So?" I said doubtfully. "Sisters?"
"No. You wouldn't believe me if I told you."
"Now, now," I answered mildly, "bartenders and psychiatrists learn that nothing is stranger than the truth. Why, son, if you heard the stories I do-well, you'd make yourself rich. Incredible."
"You don't know what 'incredible' means!"
"So? Nothing astonishes me. I've always heard worse."
He snorted again. "Want to bet the rest of the bottle?"
"I'll bet a full bottle." I placed one on the bar.
"Well—" I signaled my other bartender to handle the trade. We were at the far end, a single-stool space that I kept private by loading the bar top by it with jars of pickled eggs and other clutter. A few were at the other end watching the fights and somebody was playing the juke box—private as a bed where we were. "Okay," he began, "to start with, I'm a bastard."

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Above: A NASA camera accidentally captured an airborne frog as the agency's LADEE moon mission blasts off from Wallops Flight Facility in Virginia. Image credit: NASA Wallops Flight Facility/Chris Perry. Image source: National Geographic.

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