Horizons

Volume 38
Issue 6

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

May / June 2013
www.aiaahouston.org

The Biggest Myth about the First Moon Landing

Paul Fjeld, Space Artist

Also, Continuing in this Issue! Part 6 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.

May / June 2013
Horizons, Newsletter of AIAA Houston Section

Horizons is a bimonthly publication of the Houston Section of The American Institute of Aeronautics and Astronautics.
Douglas Yazell, Editor
Editing team: Dr. Steven E. Everett, Ellen Gillespie, Shen Ge, Don Kulba, Alan Simon
Regular contributors: Dr. Steven E. Everett, Philippe Mairet, Scott Lowther, Douglas Yazell
Contributors this issue: Paul Fjeld, Daniel R. Adamo, James C. McLane III, Michael Frostad, Harold Larson, Jim Wessel and Tony Brooks.

AIAA Houston Section
Executive Council

Daniel Nobles
Chair

Michael Frostad
Chair-Elect

Robert Plunkett
Secretary

Sean Carter
Past Chair

Clay Stangle
Treasurer

Michael Frostad
Vice-Chair, Operations

Brian Banker
Vice-Chair, Technical

Operations
Dr. Gary Turner
Dr. Pamela Loughmiller
Jennifer Wells
Melissa Gordon
Lisa Voiles
Rafael Munoz
Svetlana Hanson
Tom Horn
Angela Beck
Eryn Beisner
Douglas Yazell
Irene Chan
Shen Ge
Ryan Miller

Technical
Dr. Albert A. Jackson IV
Bebe Kelly-Serrato
Dr. Zafar Taqvi
Julie Mitchell
Dr. Satya Pilla
Sheikh Ahsan
Daryl Schuck
Roger Kleinhammer
Dr. Steven E. Everett
Gary Brown
Ted Kenny
Dr. Kamlesh Lulla
Ludmila Dmitriev-Odier

Councilors
Alan Sisson
Christopher Davila
Dr. Larry Friesen
Shirley Brandt
Sarah Shull
Dr. Michael Martin
Alicia Baker
Ellen Gillespie
Matt Johnson
Melissa Kronenberger

www.aiaahouston.org

TABLE OF CONTENTS

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

2004 2005 2006 2007

Cover: Original acrylic painting by Paul Fjeld.

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

Our Goals in Human Spaceflight May Now be Shortsighted...

From the Chair

Daniel Nobles, Chair

It has been my honor to represent you as chairman of the Houston Section. This last dinner meeting (described in an article in this issue) has had my mind spun up almost constantly. It has renewed my childhood dreams of reaching out to the stars and going beyond our own solar system, boldly where no one has gone before. While we squabble over an asteroid, the Moon, or Mars, I feel that Dr. Harold "Sonny" White given us a new vision. He has now proven the concept of faster than light travel, making it appear practical within the next decade.

I have to wonder if it would be easier to build this "warp drive" field, strap on a few VASIMR-type engines, and spend two months traveling to a more Earth-like planet around a nearby star. The infrastructure could be significantly easier if the planet is already full of water and breathable gases at a reasonable temperature. If the planet is inhospitable, the vehicle's occupants can turn around and be home in two months.

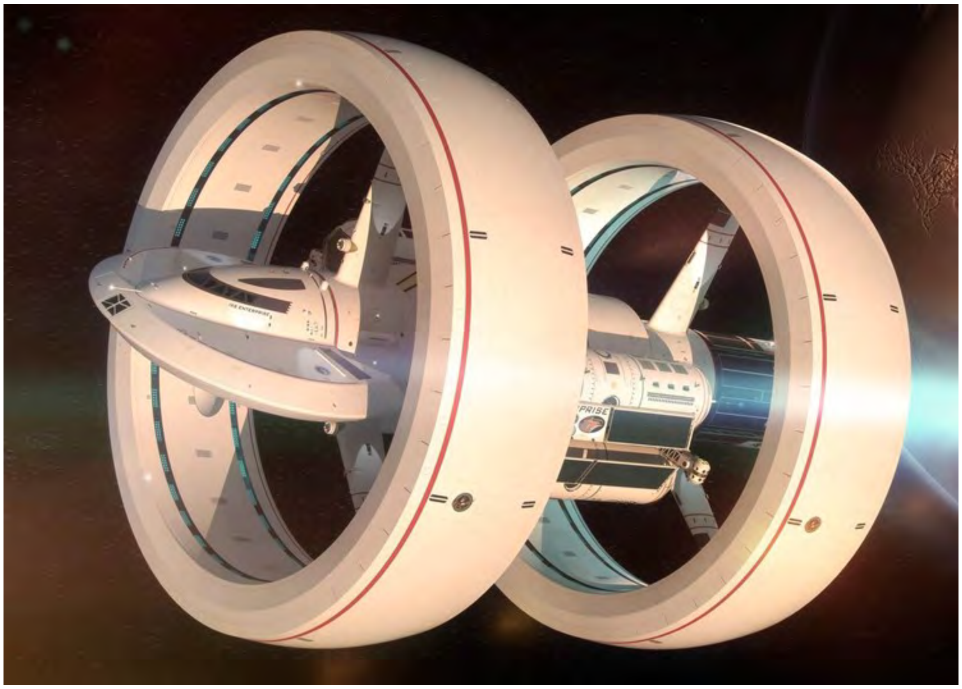
Let us not get hung up on the destination, when we now have the capability of reaching so far into the galaxy so quickly. Let us not argue over asteroids and moons when we now can go beyond not just the surly bonds of earth, but beyond our own solar system and visit another solar system. The future is ours for the taking. Let us reach out to our leaders and encourage them to support interstellar exploration within the next decade.

Thank you for your continued support of the AIAA Houston Section, and the opinions expressed above are those of my own, not those of my employer, NASA, or the AIAA Houston Section.

Sincerely,
Daniel Nobles, Chair

chair2012@aiaahouston.org
(Daniel A. Nobles)

Links:
https://people.nasa.gov



Left and Above: Updated artist concept based on Dr. White's theoretical findings, rendered by Mark Rademaker with artwork and inputs from Mike Okuda.

From the Editor

E-mail:
editor2012[at]aiaahouston.org

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

Submissions deadline:
August 10, 2013, for the July / August 2013 issue,
to be online by August 31, 2013.

Penguins, Alligators and a New Painting

DOUGLAS YAZELL, EDITOR

Paul Fjeld volunteered the cover story for this issue. We are fortunate to have his new work of art, an acrylic painting, appear here first.

James C. McLane, Jr. sent us the text of his speech from our June 13, 2013 dinner meeting. The meeting was dedicated to his late father, James C. McLane, Jr. Maybe in upcoming issues we can present that speech along with related images.

We welcome the Johnson Space Center Astronomical Society as regular contributors for Horizons.

The 100 Year Starship (*100YSS*) 2013 *Symposium* registration is now open: Houston, Thursday through Sunday, September 19-22, 2013. Paul Gilster of *Centauri Dreams* reports on a recent Starship Century symposium in San Diego. His first blog entry on that subject presents a photo that includes our Section member Dr. Albert A. Jackson IV.

I have been writing in this column about the Boeing Way alligator and the Park Shadows Trail (PST) alligator in the Bay area Blvd ditch that leads to the nearby Armand Bayou. I have not seen the Boeing Way alligator for a few weeks. I fear that after years of living in that same spot, it is now gone. The PST alligator is alive and well. A Game Warden killed a nearly ten-foot alligator on Clear Lake City Blvd (the 2900 block, not far from the Randalls grocery store and the Bay Oaks golf course). Two local television news reports from the *NBC* and *ABC* networks reported that story, as well as the Houston *Chronicle* and the *Citizen* newspapers.

Above: The Southwest Airlines jet Penguin One in Portland, Oregon. Hobby Airport in Houston is one of the biggest and one of the first two hubs for this airline. This jet was born (via a new paint job) on June 20, 2013. Thanks to Phil Hyde of HoustonSpotters.net for putting us in touch with the photographer. A Southwest website page provides details about Penguin One and the other twelve Southwest Specialty Planes. One of them is California One, shown on a later page in this issue. Image credit: Russell Hill.

The Biggest Myth about the First Moon Landing

Cover Story

PAUL FJELD, SPACE ARTIST

We all know the Apollo 11 story. Many of us were "there." If you're older than 44 years, you were watching TV that summer of '69, even if you were a baby, though babies didn't understand what all the fuss was about. Neil Armstrong was guiding himself and his crewmate, Buzz Aldrin, in that odd creation of the early space program, Eagle, the Lunar Module (LM), nearer and nearer to the Moon's surface. It was very exciting to listen. Aldrin was calling out numbers relating to where they were and how fast they were going as they worked to make that final first touch by humanity on a celestial object. The other voice was that of Houston (NASA Mission Control), CAPCOM (capsule communicator) Charlie Duke, mostly saying that things were going okay, but, at the end, doing a countdown. "Sixty seconds." Then, "Thirty seconds!" Finally we heard, "Contact light!"

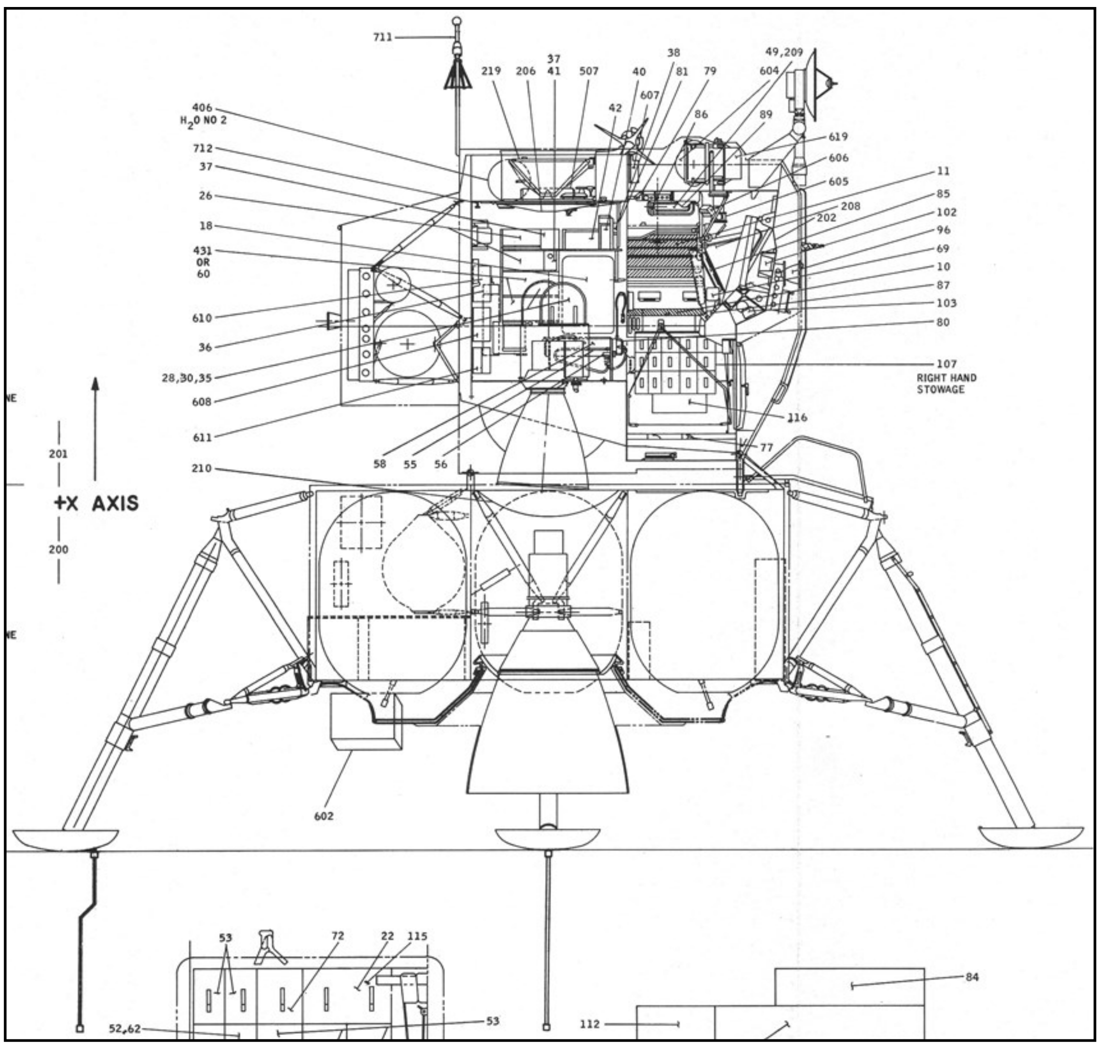
Ever since then the story headline has been, "The dramatic first Moon landing of Apollo 11 succeeded with only twenty seconds of fuel remaining!"

No! The biggest myth about the first Moon landing is those twenty seconds. Armstrong and Aldrin could have stopped their approach a few feet above the lunar surface and stayed there for more than a minute before letting Eagle drop safely to the surface.

The countdown that Charlie Duke was radioing to the crew was actually to a "bingo" point, a modified version of a call that many pilots on combat missions have heard, "Turn back now or you won't have enough fuel to get home!" The Lunar Module had two options worth thinking about during its descent, a touchdown and an abort. Its main propulsion system was a 9,700-pound-thrust throttleable engine. During final descent, it needed to put out about 2,600 pounds of thrust, 25% of its design maximum of 10,500 pounds of thrust, to hover the LM in its half empty state under lunar gravity. If that descent engine suddenly quit, Armstrong would punch an "Abort Stage" button, initiating a sequence that would cut loose the descent stage from the ascent stage, where the crew lived, and ignite the ascent engine.

This abort was a tricky thing. It would take a couple of seconds for the sequence to complete, and all the while the Moon would be pulling them down closer to a potential crash landing. If for some reason they knew they had to abort, the best way would be to burn full throttle on the big descent engine until it ran out of propellant, then separate from it and ignite the smaller 3,500-pound-thrust ascent engine. If, during a landing, they were in trouble and got near the point where the descent engine would be starved of fuel, the mission planners saved five seconds of descent engine burn time at full throttle to loft them to a safer alti-

(Continued on page 6)



Above: Side profile showing the Lunar Module Ascent and Descent Stages with the Descent Propellant Tanks surrounding the main engine. For complete drawing set go to: http://www.ibiblio.org/apollo/Documents/LM_Structures/

Cover Story

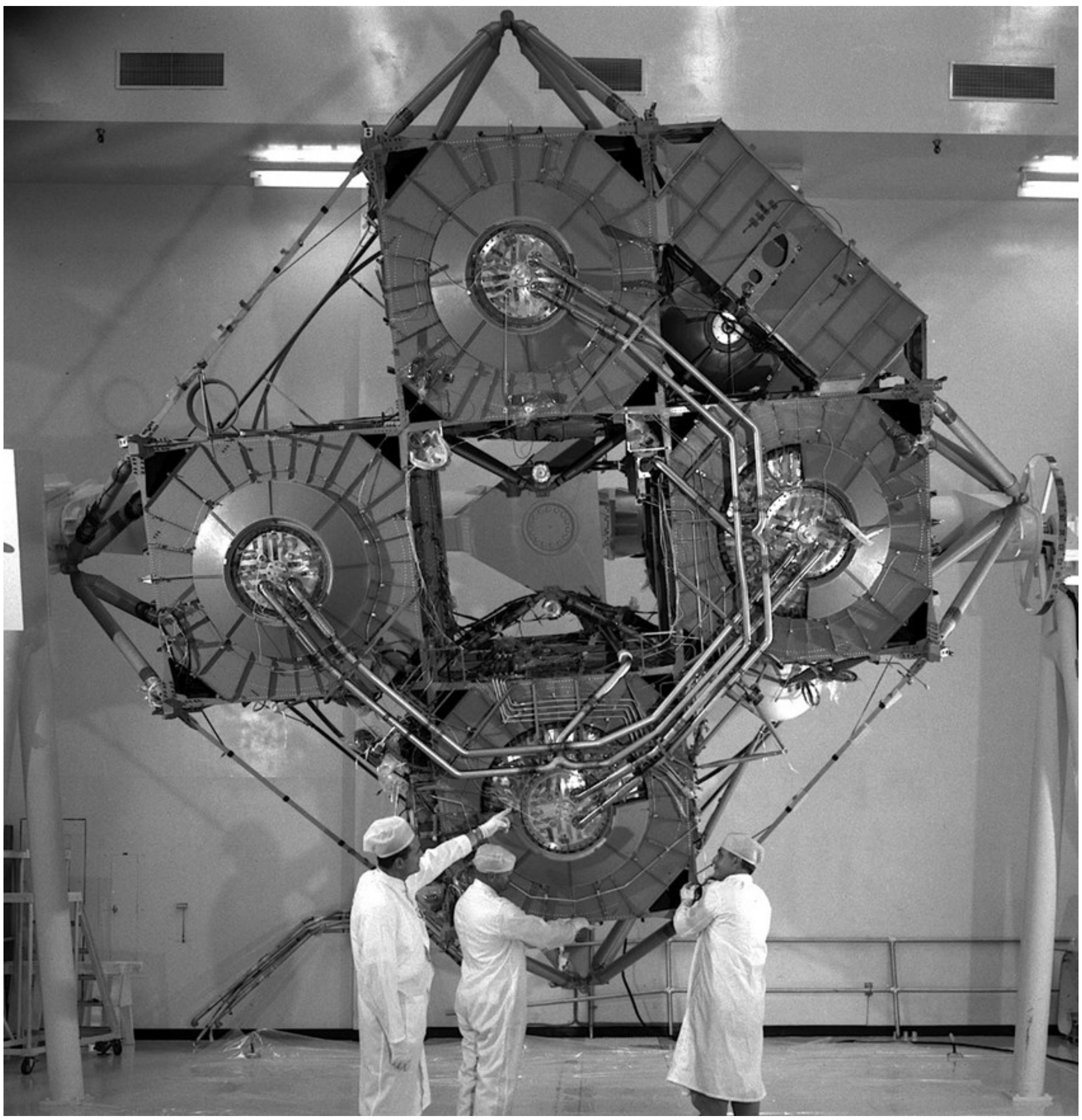
(Continued from page 5)

tude. During those five seconds, they would have time for staging, pressurizing of the ascent tanks, and ignition of the ascent engine.

Five seconds of thrust at full throttle corresponds to twenty seconds of thrust at 25% of full throttle. This is why the bingo call was actually a "Land in twenty seconds or abort now!" decision point. For example, if Armstrong had been flying when Duke's countdown reached zero and Armstrong was still 60 feet above the lunar surface, but coming down smoothly with a three-feet-per-second velocity to a safe spot, his decision would definitely have been to continue with the landing.

That adds another twenty seconds to the mythical twenty seconds, getting us to forty seconds of flight time left at landing. The remaining part of that "more than a minute" is a tale of slosh in the propellant tanks.

When Grumman engineers designed the LM propellant storage, they settled on four domed cylindrical tanks mounted in the descent stage's cruciform structure (cross-shaped as seen from above), two tanks for the oxidizer (one in front and one in back) and two tanks for the fuel (one on the left side and one on the right side). Each tank was identical. Propellant in a tank is excited by sharp movement or rhythmical pulses. The propellant can swirl, rock or even plunge up and down relative to the bottom exit. This was understood at the beginning of the Apollo program. Grumman built a plexiglass half-tank to study these motions. After eight months of testing in 1965, Grumman decided that a small anti-vortex baffle surrounding a zero-g can, where the propellant was pushed into the engine feed lines, would be sufficient to keep the fluid from sloshing about too much.



Above: Descent Stage cruciform structure mounted in a rotate and clean facility at Grumman plant. Four propellant tanks surround a central opening where the Descent Engine will be installed. Note the feed and balance lines leading to a single Oxidizer line (upper) and Fuel line (lower) in the center. (Courtesy Northrop Grumman History Center)

A propellant quantity measuring gauge was bolted to the bottom of each tank near the feed port. It sensed how much remained in the tank and would latch a low-propellant-level light in the cockpit when there was 5.6% of the propellant left. For the first Apollo Moon landing, as Armstrong maneuvered past a boulder field, the low-propellant-level light was latched to the on position well before touchdown. Flight controllers had expected the fuel gauge's low-propellant-level light to turn on at about the time of touchdown. That's what happened during the training runs.

For this first Moon landing, Armstrong flew the Eagle LM for more than a minute past a nominal (as designed) descent trajectory. But there is more to this part of the story. When Armstrong made some vigorous control inputs during the final landing phase, fuel slosh uncovered the DES 2 (Descent #2) tank gauge. Well after the flight, engineers concluded the low-propellant-level light was turned on between 30 to 45 seconds early!

So we now know that Armstrong had at least 20 + 20 + 30 = 70 seconds of flight time

(Continued on page 8)

Cover Story

Above: Lunar Module Eagle moments after the left-hand probe contacts the moon's surface (shown on right) still nearly five feet up, its engine blasting a dust sheet in all directions. The spacecraft attitude is shown four seconds before final touchdown as Neil Armstrong has arrested a leftward drift (north) but overcorrected so the LM is here beginning to slide to the right (south) in the picture. Original acrylic painting by Paul Fjeld.

Cover Story

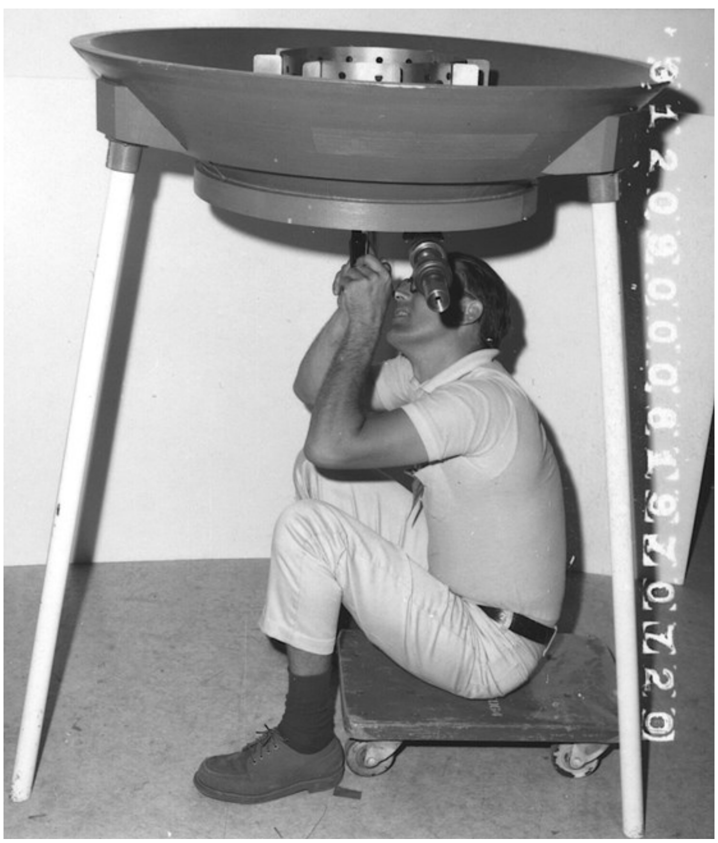
(Continued from page 6)

remaining (even though the LM crew and Houston could only count on 40 of them) before he would have crashed into the Moon in an Eagle LM starved of vital fuel.

The Apollo 11 Moon landing was nonetheless very dramatic for many reasons, including:

- When the Eagle LM separated from its mothership Columbia and spent an orbit preparing for the landing, a combination of single jet maneuvering (uncoupled firing) and un-modeled lunar mass concentrations (mascons) put the LM slightly off of its expected orbit plane. When Houston controllers put a measured velocity into Eagle's computer without updating Eagle's position, it approached an abort boundary early.
- Later, a poor interface between how the primary and abort guidance systems reported some unneeded radar pointing angles caused the Eagle LM guidance computer to waste more than ten percent of its cycles and overload five times.
- As Armstrong began the final landing in earnest, his maneuvering was “flinging” the Inertial Measurement Unit (IMU) fore and aft about the center of mass of the LM, causing the guidance computer to calculate a wildly fluctuating throttle command for a fictitious drop or rise of the spacecraft. This “IMU bob” was the first indication of a serious instability in the throttle control logic of the LM’s computer.
- This instability was exacerbated by a bad constant number the computer used for the lag between when it issued a throttle command and when it expected the command to be realized by a certain thrust. The computer’s lag value was 0.2 second when the real lag was only 0.075 second. It's quite possible that the computer would have commanded full throttle at some point, wrecking the landing and causing an abort, if Armstrong had been flying

(Continued on page 9)



Above: Technician demonstrating “ship in a bottle” installation of a slosh baffle in a tank mockup at Grumman, Bethpage NY on August 19, 1970. (Courtesy Northrop Grumman History Center)

Above: Plexiglas slosh rig at Grumman, 1965. Results from these tests led to the small anti-vortex baffle which was insufficient to cope with propellant slosh. (Courtesy Northrop Grumman History Center)

Above: Technicians demonstrating the baffle install technique on a LM Test Article at White Sands, New Mexico. Note the small 2.4 inch diameter hole where the Propellant Quantity Gauge is bolted to the bottom of the tank. (Courtesy Northrop Grumman History Center)

(Continued from page 8)

more erratically than what he admitted to.

- Armstrong was confused by the dust streaming away from the descent engine's plume slamming into the Moon, which made it difficult to judge his real speed relative to the surface. He ruefully called his control just before touchdown “spastic,” overcorrecting for a right drift and landing with a velocity of two feet per second going left. His LM had also drifted in yaw, turning slightly more towards the Sun, putting the shadow of Eagle to the right of his window, depriving him of a useful guide to his final seconds before landing.

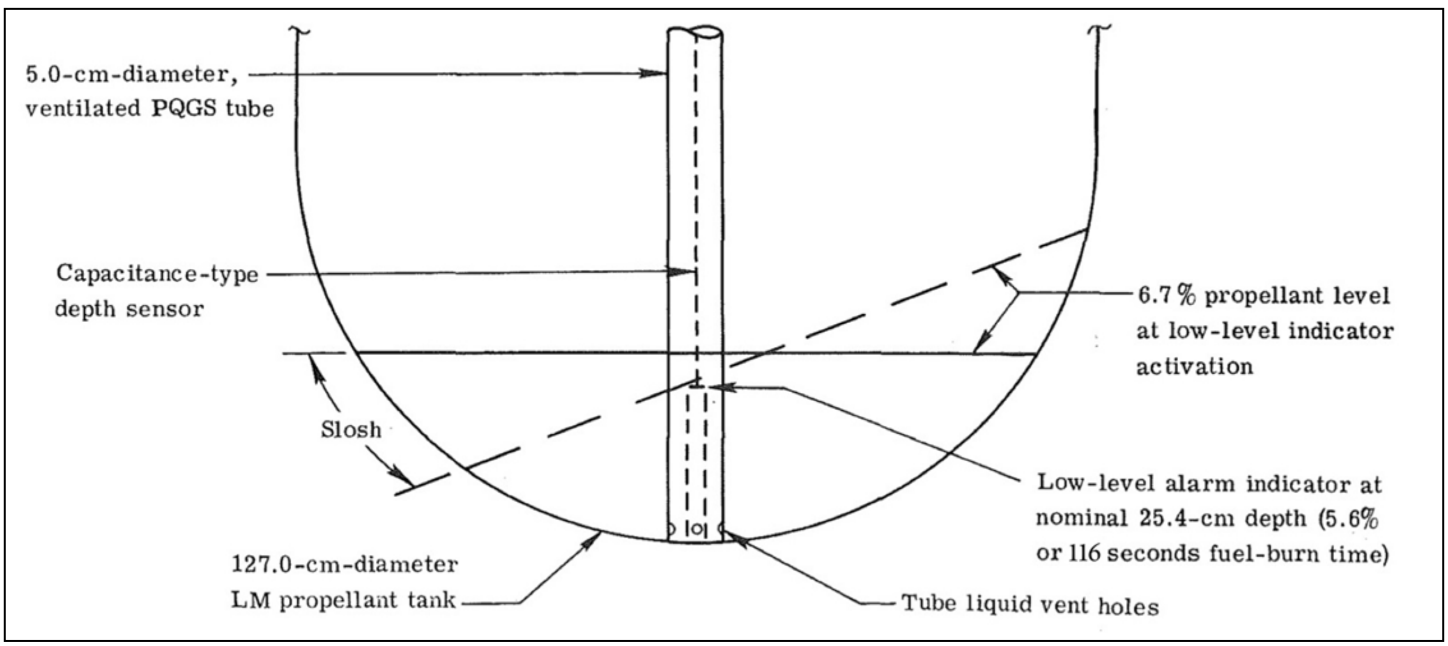
There is plenty of drama in the real story of Apollo 11. The fact that Neil Armstrong landed Eagle with more than a minute (much more than twenty seconds) of fuel remaining does not diminish the thrill of the accomplishment.

Lunar Module Propellant Slosh after Apollo 11

The loss of half a minute of flight time due to slosh was important. NASA engineers had planned for some contingencies in the delta-V (change in velocity) budget for the LM, but the weight of the spacecraft was so critical that nothing could be wasted. On the next flight after Apollo 11, Pete Conrad and Alan Bean landed their Apollo 12 LM, but the low level light was turned on early again. Apollo 13 went to the Moon with its LM propellant tanks wired for high-rate telemetry that would characterize the slosh dynamics, but the moon landing never happened. (Apollo 13 astronauts Jim Lovell and Fred Haise were even more disappointed than the propellant tank engineers.)

By that time, Grumman and Langley Research Center engineers had done more exhaustive tests than those done with a plexiglass slosh rig five years earlier. They came up with a design for baffles that they believed would work, but now they faced the remarkable problem of how to get that design into the already-built tanks for the next LM to fly. The final three LMs (for Apollo 15, 16 and 17 missions) were to have their tanks expanded for extended-stay flights, so baffles could be installed when the tanks were cut open, but the Apollo 14 LM needed a special solution.

In August of 1970, Grumman technicians demonstrated a way to build a 17-inch-diameter, 8-inch-high multi-finned baffle through the hole where the propellant quantity gauge was bolted and secure it to the base of the tank. The hole was 2.4 inches in diameter! NASA program managers were impressed after witnessing this clever design and careful work. It was like building a ship in a bottle. Grumman installed the baffle in a flight configuration LM at their test site in White Sands, New Mexico, before committing to installing it in the next LM in the NASA Kennedy Space Center clean room. When Apollo 14 flew with Alan Shepard commanding, his LM Pilot Ed Mitchell remarked on how smooth their descent was with very little thruster firing needed to counter any wayward torque. They landed with no loss of nominal flight time.

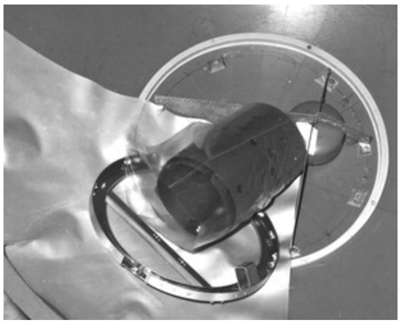


Above: Schematic showing a slosh wave uncovering a low light sensor in the Propellant Quantity Gauge System indicating 5.6% remaining instead of 6.7%. (From: NASA TM X-2362: “Investigation of Slosh Anomaly in Apollo Lunar Module Propellant Gage”)

(Continued on page 10)

Cover Story

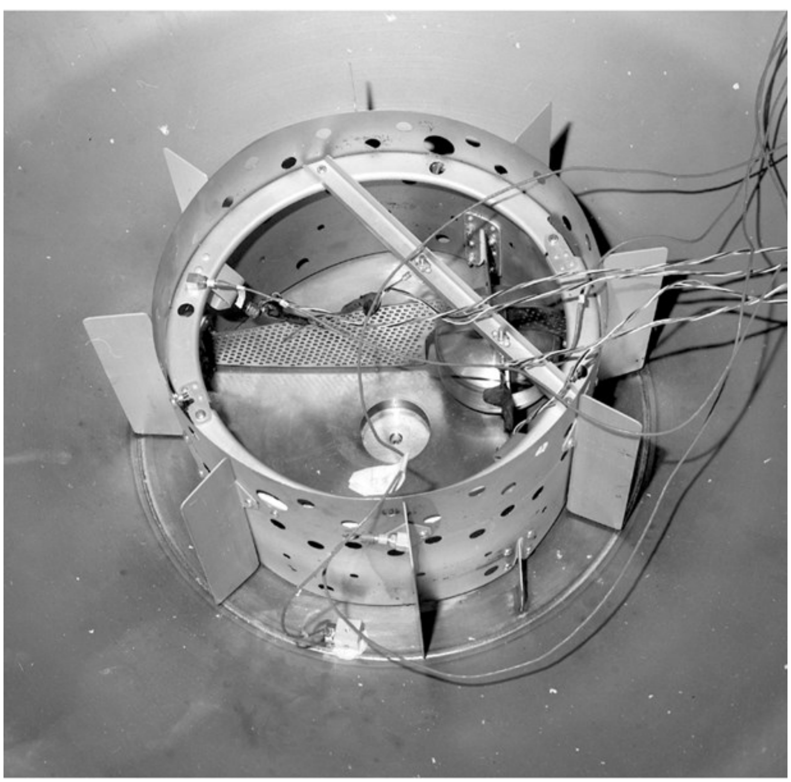
(Continued from page 9)



Above: Slosh baffle halfway installed in a Grumman tank mockup. The thin wall of the cylindrical baffle structure permitted it to be rolled up and inserted through the 2.4-inch diameter hole at the base of the tank. Note the small zero-g can and perforated anti-vortex baffle which was part of the original design. (Courtesy Northrop Grumman History Center)

Above: Author Paul Fjeld in 2001 trying out the KSC Lunar Module Simulator, now displayed at the Cradle of Aviation Museum, East Garden City, New York. Fjeld was the LM-13 spacecraft exhibit manager there. He was also the last NASA Artist of the Apollo program. He is currently working on a series of paintings showing the drama of the early US manned space program from Mercury to Apollo. Image: J. Randy Attwood.

Above: The author Paul Fjeld in front of the Lunar Module #13 display at the Cradle of Aviation Museum in East Garden City, New York. Fjeld was the spacecraft manager for the exhibit. Image credit: Alan Contessa.



Above: 17-inch diameter flight baffle installed in LM-10 (for Apollo 15) before the propellant tank was enlarged and re-welded. (Courtesy Northrop Grumman History Center)

Above: Neil Armstrong in the NASA KSC (Cape Canaveral) Lunar Module (LM) simulator in June of 1969. Image credit: NASA.

TARC 2013 (Team America Rocketry Challenge)

Harold Larson

TARC, or Team America Rocketry Challenge, is a national contest for grades 7-12, requiring teams of students to design, build and launch a rocket containing one or two raw, grade-A large eggs to a target altitude of about 800 feet, and spend 48-50 seconds in the air while doing so. About 750 teams enter nationally. When they are ready, they conduct local, witnessed "qualification" flights. The best 100 of these teams (based only on altitude and air time results) are invited to the finals at The Plains, Virginia, about forty miles west of Washington DC. This annual contest has been sponsored by the Aerospace Industries Association (AIA) and the National Association of Rocketry for the last 12 years (www.rocketcontest.org). Teams close to Johnson Space Center have practiced and qualified with the NASA Houston Rocket Club in the field behind Building 14 since TARC began.

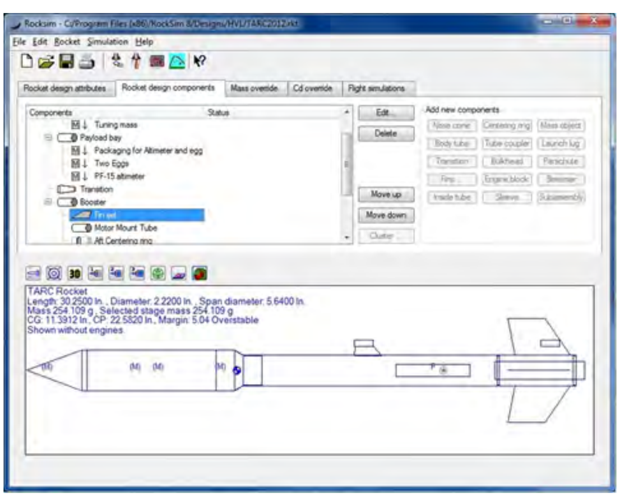
Air time is measured visually by stopwatch, while altitude is measured by an onboard barometric altimeter (www.perfectflite.com). Of course, the egg(s) must remain unbroken. Rocket motors are either Estes black-powder motors or the newer Aerotech "composite" motors, available commercially in larger hobby shops. Rockets must be designed and built by the students teams involved, and several Computer-Aided Design (CAD) programs exist for model rocketry to aid in this effort.

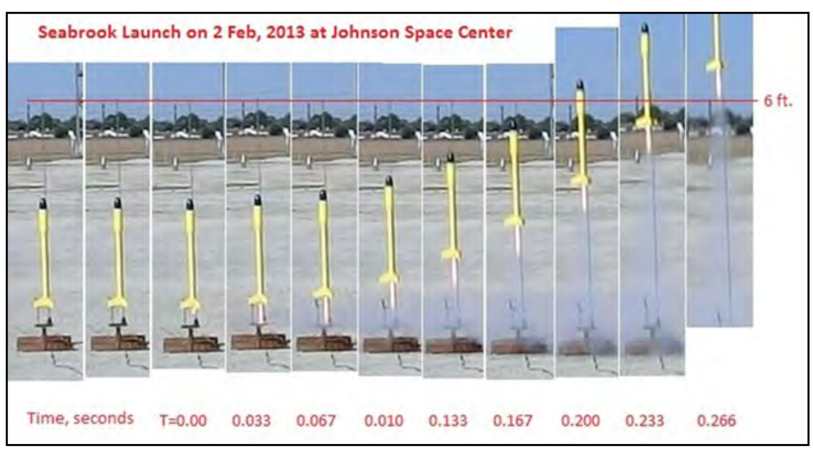
Of course, there will be differences between the actual performance of the rocket and the design. This will require additional team design work to understand and correct what happened. The CAD simulation only estimates a drag coefficient, and does not incorporate Computational Fluid Dynamics (CFD). Aerodynamic drag is very important to model rocketry, so craftsmanship and quality of the painted finish will affect performance of the rocket. Additionally, predicted and as-built masses are usually different, and the wise team will include provision for ballast in the nose cone.

Locally, Seabrook Middle School, St. Thomas High School (HS), Clear Falls HS, and Clear Lake HS have participated in TARC. A Seabrook Middle School launch appears in the figure. Scale is provided by the launch rod, which is six feet long. The rocket, which had a launch mass of 420 grams, clears the rod in about 0.25 seconds, implying a thrust of 31 Newtons. This calculated thrust is in reasonable agreement with the published thrust curve of the E15W motor that the Seabrook team used (www.thrustcurve.org).

Teams from Seabrook Intermediate and Clear Falls HS were among the 100 TARC finalists. They participated in the national fly-offs at The Plains, Virginia. Seabrook finished 42nd, while Clear Falls finished in 6th place. The Clear Falls Purple Pumas were presented with their prizes and a trophy by AIA President and CEO Marion Blakey (left), NASA Administrator Charles Bolden, and NAR President Ted Cochran (behind).

A related article appears on a later page in this issue.





ATS 2013

Our Section's Annual Technical Symposium

Dr. Steven E. Everett, Chair, Our Section's GN&C Technical Committee, and Douglas Yazell, Editor

Above: John C. Melcher: *Combustion Instability in the Project Morpheus Liquid Oxygen/ Liquid Methane Main Engine*. Image credit: Douglas Yazell.

Above: The International Council on Systems Engineering (INCOSE). Tom Anderson is asking presenter Lenny Delligati a question on model-based systems engineering with SysML. Image credits: Douglas Yazell.

AIAA Houston Section held its 2013 Annual Technical Symposium (ATS) at the NASA Johnson Space Center Gilruth Center on 17 May for affiliates from the space center and the numerous surrounding companies and education institutions in South Texas. Before a crowd which eventually grew to over 120 by day's end, General Chair Ellen Gillespie introduced the morning's first keynote speaker, Alires Almon, Orchestrator of Engagement for the 100 Year Starship (100 YSS) project. Almon began the discussion by showing the manifesto video of the non-profit foundation. 100 YSS was funded in 2011 by grants from DARPA and NASA Ames Research Center to work toward achieving interstellar travel in the next 100 years. After reviewing the group's vision and mission, Almon stressed that despite the far-reaching goals of the program, the development effort would benefit Earth now in ways such as revitalization of research, as a guide for collaboration, job creation, and acceleration of technology development. She continued by listing partners to the 100 YSS Foundation, from SETI to Nichelle Nichols of Star Trek fame. Almon then talked about the public outreach events planned, including the 100 YSS Public Symposium scheduled for 19-22 September 2013 in Houston.

AIAA Houston Section then welcomed Anousheh Ansari as the morning's second keynote speaker. She is the first Iranian in space and co-sponsor of the Ansari X Prize. She provided comments on the inspiration for the X Prize Foundation, potential additional prizes, and the importance of space travel in improving life on Earth and understanding ourselves. Ansari showed a video highlighting her self-funded trip to the International Space Station. Ansari was also present for the remainder of the day to sign copies of her book *My Dream of Stars*.

The day proceeded with three simultaneous tracks on a range of themes such as

- Aero/Astro (Aeronautics/ Astronautics),
- Propulsion,
- GN&C (Guidance, Navigation & Control),
- Systems Engineering,
- Aerosciences,
- EVA (Extra-Vehicular Activity),
- Climate Change,
- Automation, and
- Space History and Education.

During lunch, questions were posed to a panel comprised of

- Anousheh Ansari, co-founder and CEO of Prodea Systems and first female private space explorer;
- Franklin Chang Diaz, seven-time Shuttle astronaut and president and CEO of Ad Astra Rocket Company;
- Art Dula, space lawyer, patent attorney, and founder of the private spaceflight company Excalibur Almaz;
- Beth Fischer, Director of the Engineering Center of Excellence for Honeywell Technology Solutions, Inc.;
- Mike Fossum, Shuttle astronaut and Expedition 29 ISS commander;
- Jack Bacon, noted futurist and technological historian;
- Richard Phillips, founder and president of Phillips & Company;
- Paul Spudis, Senior Staff Scientist at the Lunar and Planetary Institute in Houston;
- Scott Kelly, three-time Shuttle astronaut and Expedition 26 ISS commander; and
- Alires Almon, 100 Year Starship Orchestrator of Engagement.

The esteemed panel members each provided their perspectives on questions posed by panel moderator Beatriz Kelly-Serrato, including their vision for life beyond low Earth orbit, the benefits of space exploration, and the risks and rewards of space travel.

In addition to the continuing sessions after lunch, attendees were treated to a display of

(Continued on page 13)

(Continued from page 12)

NASA's next generation Z-1 spacesuit and the working mock-up of NASA's Small Pressurized Rover, which would provide a mobile, shirt-sleeve environment for two to four astronauts on the lunar surface, with the capability for entrance and exit via spacesuits docked to the rover without depressurization of the vehicle. A lucky few, including afternoon panel members Anousheh Ansari and Alires Almon, even drove the rover around the grounds outside the Gilruth Center.

Among the afternoon's more popular sessions was a demonstration of some of the advanced exploration and robotics technologies in the Alamo Ballroom. Amy Ross invited our presenters to talk about the new spacesuit while it was on display there. In the history track, a panel discussion was held with engineers Ken Young, Gary Johnson, and Allen Louviere. They presented a retrospective on the Skylab program in honor of its 40th anniversary. They were followed by Dr. Albert A. Jackson IV making a presentation about a weekly magazine's eight 1952-1954 installments of articles about the future of human spaceflight, the Collier's series *Man Will Conquer Space Soon!* Jackson called attention to the *Horizons* Collier's project. *Horizons* is the bimonthly newsletter of AIAA Houston Section. *Horizons* appears to be the first to reprint this series page by page in high resolution. The original articles were created by a team of writers, editors and artists led by Wernher von Braun.

Attendees were also invited to a 5:00 PM post-symposium cash bar social event in the nearby Hilton Hotel on NASA Road 1 (NASA Parkway). About fifteen people attended and enjoyed some great conversation.

Presentation charts from about twelve of the speakers are already online (uploaded with their permissions after the symposium) at the AIAA Houston Section ATS 2013 web page. Dr. John Nielsen-Gammon gave permission to add an audio recording from his two climate change presentations in addition to his charts. That audio file upload to the web page is in work.

The 2013 symposium was a great one thanks to a team led by General Chair Ellen Gillespie. She is creating a document about our procedures leading up to this event every year, so next year's symposium is already in good hands.

(Continued on page 14)

Above: Yvonne Vigue-Rodi. Meteor Entry Trajectory Dispersion Analysis. Image credit: Yazell.

Above: Dr. Kumar Krishen presenting *Analysis of Voyages, Charting the Course for Sustainable Human Space Exploration*. Image credit: Douglas Yazell.

Above: (left to right) Gary Johnson and Al Louviere in the Skylab 40th anniversary session. Image credit: Dr. Steven E. Everett.

Above: Kenneth A. Young in the Skylab 40th anniversary session. Image: Steve Everett.

ATS 2013

(Continued from page 13)

Images on this page:

Top row:
Left: Spacesuit on the back of the Constellation Moon rover.
Right: Dr. Albert A. Jackson IV making a presentation about Near-Earth Asteroids. Image: Douglas Yazell. Image credits for the rest of this page: Dr. Steven E. Everett.

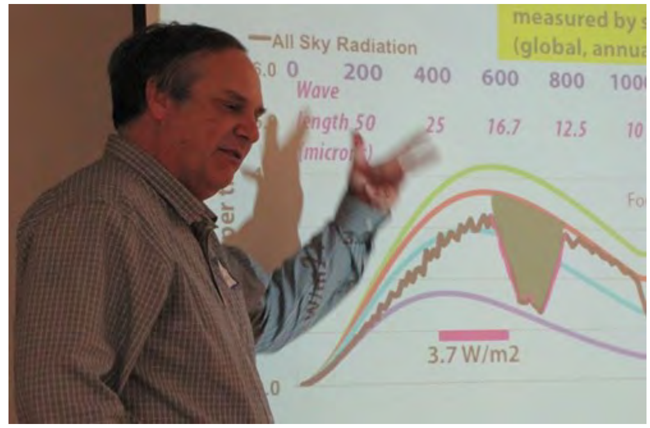
Second row:
Left: Dr. Steven E. Everett and the Constellation Moon rover.
Right: Jerry Woodfill making an Apollo history presentation.

Third row:
Left: ATS 2013 General Chair Ellen Gillespie drives the Constellation Moon rover.
Top right: The Constellation Moon rover.
Bottom right: Dr. Steven E. Everett drives the Constellation Moon rover. (Alires Almon, Anousheh Ansari and others also drove the rover.)

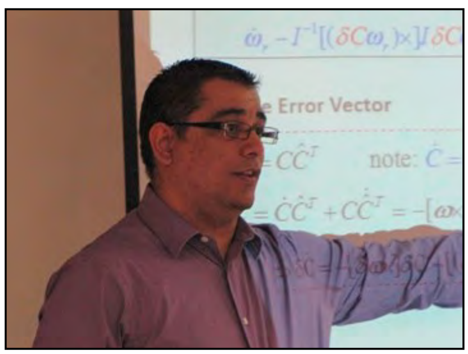
(Continued on page 15)

(Continued from page 14)

Above: Amy Ross, NASA / JSC, lined up this spacesuit display. Dr. Steven E. Everett, our Section GN&C technical committee Chair, is shown in the photograph. Image credit: Steve Everett.



Above: Dr. John Nielsen-Gammon of Texas A&M University delivered two climate change presentations. He is the Texas State Climatologist. His Houston Chronicle blog is called the Climate Abyss. Image credits: Douglas Yazell.



Above: Ahmad Bani-Younes of Texas A&M University. Image: Yazell.

Above: Shen Ge (CEO, SPACE), makes a presentation about the Space Academy for Cosmic Explorers (SPACE). This is discussed in the following issues of Horizons: January / February 2013 (page 32), July / August 2012 (page 20). Image credit: Douglas Yazell.

Right: Dr. Albert A. Jackson IV makes a presentation (with co-author Douglas Yazell) about the Horizons 1952-1954 Collier's series *Man Will Conquer Space Soon!* Part 6 of 8 appears later in this issue. Horizons is printing this series page by page in high resolution. A summary of these magazine articles appears later in this issue. Image credit: Dr. Steven E. Everett and Douglas Yazell.

(Continued on page 16)

ATS 2013

(Continued from page 15)

The web page for ATS 2013 is:

http://www.aiaahouston.org/2013-annual-technical-symposium/

It contains the Program, publicity flyers and more. Below is a copy of the links for presentations as of June 23, 2013.

AIAA Houston Section ATS 2013 Presentations, May 17, 2013:

- Session A-1: Aero / Astro
- Session A-2: Propulsion
  - On-Orbit Propulsion System Performance of ISS Visiting Vehicles (Microsoft PowerPoint) – Mary Regina M. Martin
- Session B-1: Aerosciences
  - The Latest Developments in the X51A and X37B (Open Office Presentation) – John M. Dilorio
  - Orion Program EFT-1 Status (Microsoft PowerPoint) – Blaine Brown
  - Economics of Asteroid Mining (Microsoft PowerPoint) – Shen Ge
- Session B-2: EVA (Extra-Vehicular Activity)
- Sessions A-3 and B-3: Guidance, Navigation, & Control
  - Enhanced Optimal Control for Uncertain Spacecraft Tracking Problem (PDF) – Ahmad Bani-Younes (A-3.1)
  - Attitude Error Kinematics: Applications in Optimal Control of Dynamical Systems (PDF) – Ahmad Bani-Younes (Presentation B-3.1)
  - New Approach for Real-Time Inertia Estimation (PDF) – Donghoon Kim (Presentation B-3.2)
  - B-3.3: These presentation charts will not be provided for our web site. Please refer to other documents such as the program document containing the abstract.
- Session C-1: C & T (Communications & Tracking)
- Session C-2: Skylab's 40th Anniversary
- Session C-3: Climate Change
  - The Essential Story of Climate Change (PDF) – Dr. John W. Nielsen-Gammon filling in for Dr. Gerald R. North (Presentation C-3.1)
  - Climate Change, Climate Variability, and Extreme Events (PDF) – Dr. John W. Nielsen-Gammon (Presentation C-3.2)
  - Audio file: This file is 36 MB and its duration is one hour and twelve minutes. This is the audio for both of the above presentations by Dr. John Nielsen-Gammon. It was recorded on an iPad 1 using an Apple app store app named Voice Recorder. Its format is MPEG-4 (filename.m4a). It starts just a few seconds after Nielsen-Gammon starts talking. It ends with climate change session chair and track organizer Douglas Yazell thanking the speaker and presenting a speaker gift.
- Session D-1: Automation
  - An Optimized Neural Network Approach for Rapid Aircraft and Spacecraft Venting Predictions (PDF) – Dr. Patrick E. Rodi
  - Aircraft/Spacecraft Mass Distribution Optimization Using Genetic Algorithms (PDF) – Dr. Patrick E. Rodi
- Session D-2: Space History and Education
  - D-2.1: No charts provided (yet?).
  - D-2.2: No charts provided (yet?). (Horizons and the Collier's series Man Will Conquer Space Soon! by Dr. Albert A. Jackson IV and Douglas Yazell.)
  - Space Educational Module (Microsoft PowerPoint) – Shen Ge (Presentation D-2.3)
- Session D-3: Risk Analysis
  - PRA and Conceptual Design (Microsoft PowerPoint) – Bryan Fuqua
  - PRA: Participation vs. Validation (Microsoft PowerPoint) – Rick Banke
  - HRA Aerospace Challenges (Microsoft PowerPoint) – Diana DeMott
- Session 4 (A, B, C & D): Systems Engineering (INCOSE: International Council on Systems Engineering)

Left: The miniature NASA / JSC Gilruth Center version of the JSC Building 2 (Teague Auditorium) Robert McCall mural. Image credit: Douglas Yazell.

Right: A snapshot of a presentation slide from Alires Almon, Orchestrator of Engagement for the 100 Year Starship.

(Continued on page 17)

(Continued from page 16)

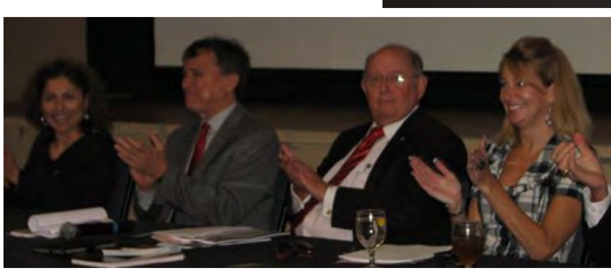
The luncheon panel discussion was a very popular event. Panelists are listed here again (repeated from a previous page). Panelist biographies are available on the ATS 2013 web site. The panel moderator was Beatriz Kelly-Serrato. Shirley Brandt, a past Section Chair, helped to facilitate this event.

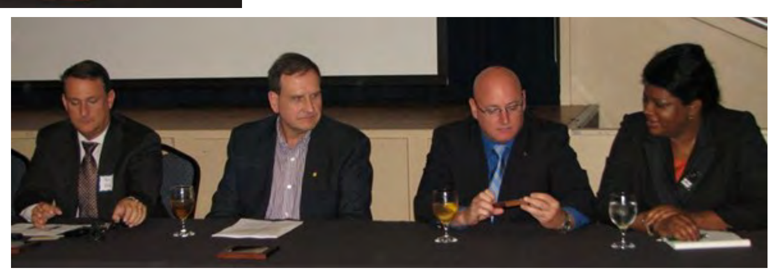
1) Anousheh Ansari, author of the book, *My Dream of Stars: From Daughter of Iran to Space Pioneer*, available at Amazon.
2) Franklin Chang Diaz
3) Art Dula
4) Beth Fischer
5) Mike Fossum
6) Jack Bacon
7) Richard Phillips
8) Paul Spudis
9) Scott Kelly
10) Alires Almon

The panelists appear in photographs on this page. The list above is the order in which they are seated from left to right.

We have an audio recording for most of this panel discussion. That might be useful for additional articles in upcoming issues of Horizons. The recording is not of high quality, but contact the Horizons Editor if you would like to obtain a copy of it via Dropbox. A panel discussion video is coming soon to our ATS 2013 website.

Above: Morning keynote speakers Anousheh Ansari (above) and Alires Almon. Image credits on this page: Dr. Steven E. Everett.





Astrodynamics

Highway in the Sky (Speed Limit 7.7 km/s)

DANIEL R. ADAMO, ASTRODYNAMICS CONSULTANT

This photo was taken from my home looking north toward the city of Salem, Oregon with the state capitol about 10 km away, so please forgive a little light pollution. It shows an early stage of the European Space Agency's (ESA's) Automated Transfer Vehicle-4 (ATV-4, christened *Albert Einstein*, see http://esamultimedia.esa.int/HSO/Publications/ATV4-EN/) rendezvous with the International Space Station (ISS).

The photo's exposure began on June 7 at 10:28:59 PM PDT when only ATV-4 (dimmer, lower trail) was in the camera's field of view, and exposure was terminated 55 sec later when only ISS (brighter, higher trail) was in the field of view. Because the two spacecraft are orbiting in nearly the same plane with ATV-4 at a slightly lower altitude and higher speed, their trails are parallel but displaced during the exposure. Orbit motion among the stars is down and to the right in the photo, which shows a maple and a fir tree in silhouette against Salem's sky-glow at bottom. There's also a very faint trail at lower left running nearly perpendicular to that of ISS, but I have no idea what Earth satellite caused it.

For those unfamiliar with constellations, I've "connected the dots" for Ursa Minor, alias The Little Dipper, using faint gray lines. The star at the end of the Dipper's handle, and closest to the end of the ISS trail, is Polaris.

Launched on June 5 at 2:52 PM PDT, ATV-4's docking with ISS was planned for June 15 at 6:46 AM PDT. The June 7 PDT photo below catches ATV-4 just after it had "lapped" ISS and moved ahead of it in orbit. On the previous PDT evening, ATV-4 was on the other side of Earth from ISS, making a single exposure capturing both spacecraft impossible for Earthbound photographers. The following table shows daily differences in the times ISS and ATV-4 appear in Salem's sky after sunset. This *Dt* is reckoned by subtracting the ISS time from the ATV-4 time for a particular PDT evening, so a negative value implies ISS trails ATV-4. The concept of trailing or leading degenerates near +45 min or -45 min *Dt* when ISS and ATV-4 are on opposite sides of the Earth.

PDT Date	*Dt* (min)
June 5	+10
June 6	-44
June 7	0
June 8	+44
June 9	-11
June 10	+40
June 11	-3
June 12	-43
June 13	+16
June 14	0

From data in the table, ATV-4 can be inferred to pass beneath ISS on multiple occasions at roughly 2-day intervals prior to about a day before docking. If you're interested in sighting opportunities for ISS or various other satellites from your location, point your web browser at http://spotthestation.nasa.gov/sightings/ to obtain predictions.

Wishing you clear skies!

A related article appears on the next page.

Rendezvous Endgame

Astrodynamics

DANIEL R. ADAMO, ASTRODYNAMICS CONSULTANT

About 8 hours before ATV-4 docked with ISS at 7:07 AM PDT on June 15, the attached image was obtained from my home south of Salem, Oregon. Both spacecraft are recorded moving southeastward past the star Deneb in the constellation Cygnus. The 30-second exposure began at 11:14:42 PM PDT on June 14 with ISS leading ATV-4 at a point near its closest approach to Deneb. For those unfamiliar with constellations, I've "connected the dots" for Cygnus, alias The Northern Cross, using faint gray lines.

Note how much closer the two trails are to overlaying each other in this late phase of rendezvous than they were in the image obtained a week earlier [as shown on the previous page]. Because ISS elevation above the horizon is similar in both images, about 40 degrees, the ATV-4 trail has shifted closer to that of ISS in the later image due to its increased orbit altitude. This is a typical signature in "rendezvous from below and behind" operations. In the endgame, the spacecraft about to dock with ISS progressively reduces its catch-up rate by incrementing its orbit altitude to more closely match that of ISS. By carefully timing these increments, ATV-4 achieved an altitude match just as it caught up with ISS, allowing docking operations to proceed safely at low relative speeds.

Yet another faint unidentified satellite trail is visible in the attached image. For scale, assign angular distance *d* to the apparent separation between Deneb and the star *Gamma Cygni* at which the two Northern Cross members intersect. From *Gamma Cygni*, proceed in the 4 o'clock direction about 0.7 *d* to the trail, which is about 0.2 *d* in length. Because the trail is so short compared to those of ISS and ATV-4, it's undoubtedly from a satellite at much higher altitude.

Congratulations to ESA for a successful (and picturesque) rendezvous and docking with ISS!

A related article appears on the previous page.

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

Learn to fly! That was the theme of the May 2013 Wings & Wheels. This monthly lunch-hour-centered event usually takes place on the third Saturday of the month. The annual Wings Over Houston Air Show (Saturday & Sunday, October 26 & 27, 2013, at Ellington Airport) might cause a change in that monthly Wings & Wheels date once a year. Support the museum by attending Wings & Wheels!

Above: A memorable view of two airplanes seen by visitors at the May 2013 Wings & Wheels event. Image credit: Museum web site.

Who was the *second* person to fly solo across the Atlantic Ocean?

Hint:
She took off five years to the day after Charles Lindbergh's historic flight of May 20-21, 1927.

Answer:
Amelia Earhart.

Above: Amelia Earhart and President Hoover at the White House, January 2, 1932. Image credit: Wikipedia.

Above: Southwest Airline's California One jet in view during the May 2013 Wings & Wheels event. Image credit: Museum web site.

Above: Will the new raffle airplane be yours for only $50? Image credit: Museum web site page for the May 2013 Wings & Wheels.

Above: The California flag. Source: Wikipedia. Author: Devon Cook.

Above: "Southwest #361 inbound from Phoenix." This Southwest jet is named California One. Image source: Wikipedia. Image credit: Dylan Ashe from San Jose, USA.

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.

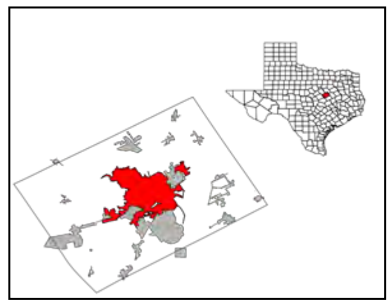
Every individual and organization with an interest in aviation and aviation technology is encouraged to participate. (EAA membership is not required, but encouraged.) Meetings are generally from 6:30 PM to 9:00 PM at Ellington Field in Houston Texas. We welcome everyone. Come as you are and bring a guest; 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)



Above: Map of McLennan County, Texas, highlighting Waco. Source: Wikipedia. Credit: 25or6to4.

Other Chapters in this part of Texas

Arlington
Dalworth Chapter

Brookshire
Greater West Houston Area

Waco

Conroe

Climate Change

Climate Change and Local Responses

DOUGLAS YAZELL, EDITOR

My opinions are not necessarily the positions of AIAA or AIAA Houston Section.
editor2012@aiaahouston.org

Above: It is good to see that a NASA climate web page (http://climate.nasa.gov) has a NASA Climate Day link. For now, it appears to be limited to middle and high school students in the Los Angeles area in October or November of each year. Image credit: NASA.

Global Warming Consensus

Agreement among scientists confirmed, again

By Erik Conway, NASA JPL

June 13, 2013. A new paper has revisited the question of whether there's a consensus among climate scientists about the reality of anthropogenic (human-caused) global warming (AGW). The study, by John Cook, of the University of Queensland's Global Change Institute in Australia and the Skeptical Science site, and several co-authors, confirms that climate scientists have not only accepted the existence of global warming, but also its human causation, as a matter of fact for the last two decades.

Full story (NASA website)...

May / June 2013

Here is a useful paragraph from that Erik Conway NASA article below:

"But some polls and market research have shown that, for quite a few people, their views about government action change when they think the science is settled. This was a key finding of market research sponsored by the Western Fuels Association, a coal industry trade association, in the early 1990s — just as the scientific consensus on anthropogenic warming was emerging — and a major reason why they funded campaigns to persuade the American people that the science was unsettled. The idea was (and remains) to challenge the science to prevent action. And it was, of course, the guiding idea behind tobacco industry disinformation campaigns as well. So to the extent that this strategy works, it's important to continue to point out that it is based on a fallacy."

This NASA climate web site presents images of change, including 31 cities. Looking for images from the USA among these 31 images:

- Minnesota (#4)
- Alabama (#10)
- Florida (#13)
- Missouri (#14)
- Arizona (#16)
- Texas (#17)
- Colorado (#18)
- Texas, again (#22)
- Louisiana (#23)
- Massachusetts (#28)
- Louisiana, again (#30)
- Nevada (#31)

That Erik Conway NASA article appears in the NASA climate web site blog *My Big Fat Planet*, a blog hosted by Dr. Amber Jenkins. She presents a Blogroll list and a list called Other Sites. I omit her list of five NASA sites for now. Where I have room, I add a few words about each blog.

Blogroll

- Climate 411 *(the Environmental Defense Fund)*
- Climate Ark *(news portal)*
- Climate Feedback *(no longer updated)*
- Climate Progress *(edited by Joe Romm)*
- Climate Watch *(KQED blog now moved to join Quest, a KQED science program)*
- DeSmogBlog *(Clearing the Public Relations Pollution that Clouds Climate Science)*
- Elegant Figures *(a NASA Earth Observatory blog)*
- George Monbiot's Blog *(in the Guardian, the English newspaper)*
- Green Inc. *(New York Times Science / Earth / Environment page)*
- Green Living Tips *(no longer exists)*
- Greenversations *(It's Our Environment, EPA's Blog about our World, from the U.S. Environmental Protection Agency)*
- Grist *(Environment news and commentary with a wry twist since 1999)*
- It's Getting Hot in Here *(Dispaches from the Youth Climate Movement)*
- Notes from the Field *(NASA Earth Observatory news and notes)*
- Open Mind *(Science, Politics, Life, the Universe, and Everything)*
- RealClimate *(Climate science from climate scientists)*
- Treehugger *(very green…)*
- What on Earth *(a NASA blog)*
- Worldchanging *(Change Your Thinking, Architecture for Humanity)*

Other Sites

- Climate Central *(Researching and reporting the science and impacts of climate change)*
- Dot Earth *(Andrew Revkin in the New York Times)*
- Greenhouse Gas Online
- IPCC
- Oxfam International Climate Change
- Skeptical Science
- The Climate Project
- The Earth Institute of Columbia University: Media Outreach Guide
- The Good Human
- Yale Climate Change & Media Forum

That Climate 411 blog above presents two very useful paragraphs (below) in this blog entry, *New IEA Roadmap Sets a Road Map to a Cleaner Energy Future*, June 10, 2013.

The cost of delay

"IEA's report also discusses the vulnerability of the energy sector to climate change, and emphasizes that delaying climate action will drive up the costs of meeting a 2 degree target later. The report estimates that putting off action until 2020 would trim near-term investment by $1.5 trillion in the short run – but at the cost of requiring an additional $5 trillion to be spent in subsequent years. In present-value terms, using a 5% discount rate, delay doubles the cost of action: from $1.2 trillion to $2.3 trillion.

"This is an argument that we at EDF — and others — have been making for some time. But it is a crucial one nonetheless – and the IEA analysis gives some added analytical weight to the argument."

The JSC Astronomical Society
Building an Astronomer's Chair Complete with Sketch Desk and Red Lighting (Part 1 of 7)

JIM WESSEL, JSCAS EDUCATIONAL OUTREACH CHAIRMAN

What have I gotten myself into?

Like a lot of people these days, I am on a budget, and funds for my astronomy hobby are rather limited. As a result, I try to maximize the things that I can make on my own to suit my needs at a less than manufactured cost. A homemade astronomer's stool fits that criterion. Post hoc, the "economy" of this do-it-yourself seat is rather comical, as you will find out as we go. The second reason for this undertaking is that I enjoy sketching what I see at the eyepiece, so a comfortable sitting posture is a necessity rather than standing for extended periods. The final major drivers for the construction of the stool are that I wanted to be able to transport it to dark sites and it had to fit into the trunk of my car. I am very satisfied and happy to report that our improvements to the original design have achieved that goal. Assembly of the stool for observing or break down for storage in my trunk takes only about ten minutes. I would like to take a moment and mention that any concerns with potential engineering faults, design criticisms, or suggestions for improvement that you might offer would be welcomed in personal communication.

To start my construction project, I reviewed a fair number of existing designs on the internet for astronomer's chairs, ranging from the commercially available models to designs creative individuals had come up with on their own. Then with the help of my immensely talented handyman partner, John Boyd, I started considering the pluses and minuses of the different designs, and whether or not they would work well with a Newtonian scope on an EQ mount. Remember, one thing you have to consider is that you can be really up there in height looking through an eyepiece near zenith, so some chairs are quickly ruled out. Additionally, John provided lots of insight to the capabilities of the different designs and the feasibility to successfully construct them in his workshop. One of chair designs that resonated with me wasn't truly a chair at all, but a stool. The original idea for this project came from Rod Nabholz's website at *www.homebuiltastronomy.com/stool*. A stool fit the bill for capabilities (owing to the fact that we would have to scale it substantially larger to safely compensate for the higher altitude I would need), as well as simplicity to build. My final cost was bumped up a lot versus the original design due to the fact that I wanted reasonable lower back support and a good seat cushion that didn't completely compress under my weight. You can adjust your total cost against your own requirements accordingly.

I think it's appropriate to discuss the seat decision in a bit more detail, since it is the major driver to my final tally, and in the process, I may answer a few questions along the way. I knew right away that a traditional stool (just a round seat) wasn't going to work for me, so I started considering fold-up boat seats at local retailers. After trying a few for fit and comfort and noting their prices, John suggested one way to save some money might be to actually make my own seat instead. So, I went out and started that process. Well, the first thing I found out was that exterior fabric isn't cheap. Reasonable quality Naugahyde-like material that will hold up to heavy dew and cold temperatures is more than $15.00 per square yard. After consulting with the fabric store's attendant, I found out I would need 2.5 square yards (for my ample posterior and a back rest). So, I could figure roughly $35.00 as a starting place for a make-it-yourself seat. Then, I quickly found out that regular old closed cell foam (my original target, as it's cheap in cost) isn't the choice for exterior padding as once moisture gets inside the fabric, mold is the eventual and unavoidable outcome. That meant using special foam padding that rejects water. Well, the fabric store thinks rather highly of this foam, to the tune of more than $23.00 per foam blank, and I would need a minimum of three (two for the seat, owing to compression under my weight, and one for the back support). At this point, the make-your-own seat hits a minimum cost of $104.00, and that's before you consider the plywood and hardware. As you might imagine, this completely caught us off guard, and I quickly reverted back to my preferred commercially available boat seat, at a cost that seems comparably economical at $65.00 including tax. Here's the model that I decided on:

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

This article first appeared in the August / September 2010 *issue* of *Starscan*, the JSCAS newsletter.

Let's go shopping!

Next, I think it's reasonable to provide the reader a complete listing of all the compo-

(Continued on page 24)

Astronomy

(Continued from page 23)

nents needed for a homemade Astronomer's Stool (and a sketch desk). Please accept my apologies in advance if I happen to have omitted something, but I think you will find all of the major items and associated representative prices listed. My other caveat is that John generously offered me the use of any and all of his "scrap" materials around his workshop, and that defrayed my total cost immensely. A few of the prices of the more costly "scrap" items are included in my tally to help provide a better estimate for the reader, while some the cheaper priced scrap items are left out. All materials will certainly factor into your construction.

The red Light-Emitting Diode (LED) lighting system is also an option that can be avoided, if you are watching your budget, and the electronics related parts required for the LED are a separate sub-total. My total cost for the construction of the chair would be $215.94, with an additional $15.95 for the sketch desk, and an additional $38.15 for the red LED lighting system.

* Items marked with an asterisk are used for the sketch desk and can be ignored if that's your choice.

Listing of Components

1) Seat: $65.00

Boat seat of choice – The primary user of the astronomer's stool should get a boat seat from a marine equipment retailer / re-seller that is

- comfortable to sit in,
- good for lower back support,
- unlikely to compress or break down on the front edge under the user's sitting weight, and
- long enough in the seat for comfortable upper leg support.

This is **THE MOST** important decision, because if you skimp on the cost here, or you get something that doesn't fit you right, you will regret it on the final product.

2) Lumber: more than $21.50

- 1/2 sheet of 3/8" plywood (for trapezoidal shaped leg to pedestal supports) = $11.50
- 2 8ft 2x4s (used for pedestal and feet) = ~ $10.00
- 9" X 9 1/2" X 3/4"plywood (the unique size for this particular chair seat). This size will vary by chair model and forms the attachment site under your seat, Scrap
- 18" 2x4 (for a foot rest), Scrap
- * 1/4" plywood, 18" x 22" (sketch desk top), Scrap
- * 1x6, 2 x 18" (sides of sketch desk), Scrap
- * 1x6, ~ 17" long (front cross brace for sketch desk), Scrap
- * 2x4, ripped 2 x, ~ 17" each (cross braces for Sketch desk), Scrap

3) Hardware: more than $97.94 (an additional $15.95+ to build out the sketch desk)

- 4 longer (appropriate to the chair), screws (these attach your chair to the 3/4" plywood base and replace the short screws supplied with the chair) = Cost and size are dependent on your seat's existing screw size, mine were $0.68 ea.
- 1, 1" pipe floor flange = $6.41
- 1, 3/4" pipe floor flange = $4.91
- 1, 3/4" X 20 1/2" pipe (w/ threads on one end), cut and smoothed on opposite end, Scrap, would be $6.54.
- 8 appropriate screws (for connecting the 2 pipe floor flanges to wood), Scrap, would be ~$1.00
- 4, 1/4-20 'T' nuts, (these form the permanent attachment points holding the 1" floor flange to the chair's
- 9" x 9.5" 3/4" plywood base), Scrap, would be ~$1.00
- Carpenter's glue, Scrap
- Wood putty, Scrap
- 36, 3" wood screws, Scrap, figure a couple of dollars
- 2, 3/16" x 1" x 4' steel flats (these form the armrest supports) = $16.58
- 1, 1/8" x 1.5" x 6', steel flat (this provides additional lateral support to the armrest supports) = $12.19
- 4, #8, 1/2" screws (these attach the armrest supports to the armrests) = ~$1.00
- 10, #8 X 3/4" flathead wood screws (to attach the armrest supports to the wood piece under the seat) = $3.00
- 4 Threaded rods (1/4-20 X 8 1/2"), (these hold the lower section of the removable legs in place and could be replaced with bolts), Scrap, would be $0.98 ea.

(Continued on page 25)

(Continued from page 24)

- 8 matching wing nuts (for the 'removable legs' of the pedestal) = $2.00
- 8 matching flat washers, Scrap, $0.50
- 4, 1/4-20 X 5 1/2" bolts for the 'removable' legs = $0.49 ea.
- 4 matching wing nuts = $1.00
- 2, #2 Screw Eyes for attachment of a hanging footrest under the seat = $0.95
- 2, "S" hooks (quick disconnect for ropes supporting the hanging footrest) = $0.60
- 1, 8' piece of 3/8" channel, cut into 4 x 18" (gives outside edge protection on the plywood supports) = ~$12.00
- 1, 8' piece aluminum angle, cut into 4 x 18" (gives protection to the hanging foot rest), Scrap, would be ~$12.00
- ~ 7' of Nylon rope (for the hanging foot rest, and to secure the sketch desk to the chair), Scrap
- 1, 1/2" X 8" Hex head bolt, cut to length and drilled to accept a retaining cotter pin (this provides the basis for the seat height adjustment, large diameter for strength), Scrap, would be $1.51
- 1 appropriate sized flat washer, Scrap, would be $0.19
- 1 cotter pin, Scrap, would be $0.50
- 2 carrying handles, scrap
- * 2, #208 Screw Eyes for sketch desk restraint, Scrap = $0.95
- * 20, 3/4" #6 wood screws (to attach Plexiglas cover to sketch desk) = $2.00
- * 1/8" X 20" x 20" sheet of Plexiglas (provides smooth writing surface for sketch desk top), Scrap, it would be ~$13.00
- * ~16, 2" wood screws to build out sketch desk braces, Scrap, ~1.00

4) Primer and Paint(s) of choice: more than $31.50

- Exterior Primer = $15.00
- Exterior Paint = $15.00
- Rustoleum primer, Scrap, would be ~$4.00
- Rustoleum paint = $4.00

5) Electronics – red LED lighting system only: more than $38.15

- 4, pkg of 2, 2.6V 5mm red LEDs @ $1.49 ea. = $5.96
- 2, pkg of 5, 150Ω resistors @ $0.99 ea. = $1.98
- 1, pkg of 5, 33Ω resistors @ $0.99 ea. = $1.98
- 1 project box (becomes the 'junction box')= $2.49
- 2, pkg of 2box , 1/8" mini plugs @ $2.99 ea. = $5.98
- 2, pkg of 2, 1/8" mini jacks @ $3.29 ea. = $6.58
- 50'spool of 2 conductor cable = $9.89 (leftover shielded audio cable was used and actual length required could vary according to your own design)
- 1, 2.1 mm power jack = $3.29 (accepts the plug from the battery box to supply power to the junction box)
- Power supply (a battery for 4 "C" batteries) = price not pursued, as John had a suitable one on hand

In the next installment of this seven-part series, I will cover the necessary measurements and the construction of the all-important center pedestal.

Right: ***M57: The Ring Nebula.*** *Except for the rings of Saturn, M57 is probably the most famous celestial band. Its appearance is understood to be due to our own perspective, though. The recent mapping of the expanding nebula's 3-D structure, based in part on this clear Hubble image, indicates that the nebula is a relatively dense, donut-like ring wrapped around the middle of a football-shaped cloud of glowing gas. The view from Earth looks down the long axis of the football, face-on to the ring. Of course, in this well-studied example of a planetary nebula, the glowing material does not come from planets. Instead, the gaseous shroud represents outer layers expelled from the dying, once Sun-like star. That star is now a tiny pinprick of light seen at the nebula's center. Intense ultraviolet light from the hot central star ionizes atoms in the gas. The blue color in the center is ionized helium, the cyan color of the inner ring is the glow of hydrogen and oxygen, and the reddish color of the outer ring is from nitrogen and sulfur. M57 is about one light-year across and 2,000 light-years away. Credit: NASA, ESA, and the Hubble Heritage (STScI / AURA)- ESA / Hubble Collaboration.*

(Continued on page 26)

Astronomy

(Continued from page 25)

JSC Astronomical Society Calendar

Upcoming Items from the JSCAS Calendar (Copied on June 18, 2013)

2013

July 12, 2013:	Dr. Aaron Clevenson, Title: TBA
August 9, 2013:	Dr. Timothy Giblin, Title: TBA
August 2013:	Tentative: United Space School Star Party in Algoa, TX
September 6, 2013:	Haak Wine Star Party
September 13, 2013:	Paul Maley, Title: TBA
September 14, 2013:	Family Space Days Star Party at LPI
October 3 - 6, 2013:	Our Trip to Fort McKavett
October 11 & 12, 2013:	All-Clubs/ADAY (no club meeting this month)
November 1, 2013:	Haak Wine Star Party
November 8, 2013:	Dr. Stanley Love, JSC, Title: TBA
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*

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

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

STEM

Are You Smarter than an Eighth Grader? Or, A View of TARC by a Participant

TONY BROOKS

If you are in any grade higher than the eighth, or out of school, you probably think of course you are smarter than an eighth grader. But, if someone came up to you and asked you how to place an egg 750 feet in the air using commercially-available rocket motors, and bring it down safely in 48 to 50 seconds under a parachute having a diameter of 15 inches, would you be able to do it?

Well, middle and high schools across the country attempt to do exactly that for a chance to compete in the TARC national competition in Washington, D.C. My school, Seabrook Intermediate of Seabrook Texas, is home of the Clear Creek Independent School District (CCISD) Science Magnet Program. One of the most popular extracurricular activities for Science Magnet students is the Team America Rocketry Challenge (TARC).

In the challenge, we are put into teams of five and work to build a rocket to deliver a Grade A Large egg to 750 feet, as measured by an onboard barometric altimeter, and return the unbroken egg to the ground in 48 to 50 seconds. If we use more than 50 seconds, or less than 48 seconds, points are added to our score (low score wins). We also need to reach the altitude target of 750 feet. Points are added to our score if our peak altitude is any higher or lower than the target altitude. This is one of the most difficult challenges I have ever faced, but it is fun. When else can you launch a 500-gram object into the air, moving 100 feet per second? It's awesome to spend a Saturday morning shooting rockets into the bright Texas sky over the NASA Johnson Space Center (JSC) in Houston.

Rocket club is also a great way to learn about leadership and perseverance. Although my team was smart and hard-working, we had the worst luck possible this season. We had to completely rebuild our rocket from scratch twice. I led my team in the rebuilding of both rockets because I was the only eighth grader at the launch when they crashed.

The first rocket crashed during the first launch of the day. We had a good liftoff. It was beautiful. But, after the rocket reached about 50 feet, the ejection charge fired early. This charge is supposed to fire at apogee, deploying the parachute. However, the early firing created a path for combustion gases to exit the top of the motor, through the cardboard body tube, rather than as thrust-producing exhaust. The payload section was blown off, and the rocket was damaged beyond repair.

For a moment, every single one of us looked on in shock. Nobody wanted to say anything for a moment, as our hard work and dreams of going to the nation's capital crashed and burned along with the rocket. That moment lasted an eternity, yet it was only a second. A few seconds after the launch I looked at my friends and said, "That was the coolest launch I have ever seen." With those nine words the moment ended. We knew we needed to rebuild in a single week the rocket we had spent months building. If we finished any later, and we would miss the competition's deadline.

We had to make the new rocket to the exact specifications of the first. It had to be the same weight, size, density – everything. It took several hours of hard, long and tedious work to finish it. When we finished, the rocket was as close to the first rocket as possible. The next week was the last week to qualify for the national competition.

We arrived at NASA bright and early for the launch. However, cloud cover was too low, and it is against the National Association of Rocketry safety code to launch into clouds. So, the next day, Sunday, we went back to NASA / JSC and were preparing to launch. But again, it was against the safety code to launch, this time because of the 20 MPH wind. I was sure that my middle school rocket club career was over.

The next day we were informed that we could launch in the afternoon after school. On our first attempt, we were disqualified because the back of our rocket did not fall properly to Earth, and was damaged on landing. In the 40 minutes remaining to launch, we made repairs. It was now or never.

We attached the rocket to the pad and pressed the big red button. It was a truly amazing flight. It went up, and up, and up, then down, and down, and down. However, there was a motor malfunction. Instead of firing the ejection charge too early, it did not fire the ejection charge at all. We all ran out into the field to see our last hope in pieces. I turned to my teammates and said, "If the rocket had to crash, at least it went down with style."

And it did. I was glad that we tried our hardest and didn't give up, down to the very last minute. I will always remember my three years in rocket club. I learned so many things about life there, in addition to being able to calculate the center of pressure on a model rocket.

A related article appears on an earlier page in this issue.

Calendar

All calendar items are subject to change without notice.

Section council meetings: email secretary2012[at]aiaahouston.org

Time: 5:30 - 6:30 PM usually
Day: First Monday or Tuesday of most months except for holidays.
Location: NASA/JSC Gilruth Center is often used. The room varies.

Recent Section events

June 13, 2013 annual awards dinner meeting. Speaker: Dr. Harold “Sonny” White, warp drive work at NASA / JSC.

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*.
August 2013: The Section’s annual leadership retreat is often held in August. The new AIAA year starts on July 1, 2013.

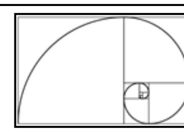
2013 Conferences www.aiaa.org (Events link)

14 - 18 July 2013 Vail, Colorado, 43rd International Conference on Environmental Systems
15 - 17 July San Jose, California, 49th AIAA/ASME/SAE/ASEE Joint Propulsion Conference & Exhibit & 11th International Energy Conversion Engineering Conference (IECEC)
11 - 15 August Hilton Head Island, SC, AAS/AIAA Astrodynamics Specialist Conference
12 - 14 August 2013 Los Angeles, California, AIAA AVIATION 2013
15 - 16 August 2013 Los Angeles, CA, 2013 Regional Leadership Conference
19 - 22 Aug. Boston, AIAA GN&C & Co-located Conf’s & AIAA Infotech@Aerospace 2013
10 - 12 September 2013, San Diego, California, AIAA SPACE 2013 Conference & Exposition
14 - 17 October 2013, Florence, Italy, 31st AIAA International Communications Satellite Systems Conference (ICSSC)

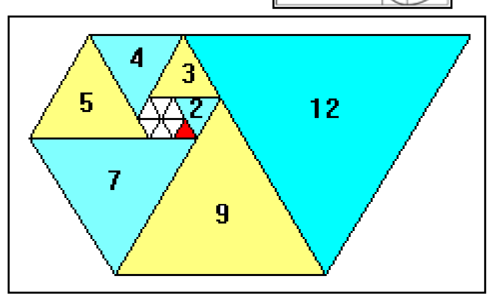
2014 Conferences www.aiaa.org (Events link)

13 - 17 January 2014, National Harbor, Maryland, AIAA SciTech 2014
30 April 2014, Washington, DC, 2014 Aerospace Spotlight Awards Gala
5 - 9 May 2014, Pasadena, California, SpaceOps 2014
16 - 20 June 2014, Atlanta, Georgia, AIAA AVIATION 2014
28 - 30 July 2014, Cleveland, Ohio, AIAA Propulsion and Energy 2014
5 - 7 August 2014, San Diego, California, AIAA SPACE 2014

Cranium Cruncher



DOUGLAS YAZELL, FILLING IN FOR DR. STEVEN E. EVERETT



Last issue we used Morley’s trisection theorem for plane triangles from Kevin Brown’s *MathPages.com*. Brown’s history article was memorable: a 2,000-year gap between the bisection and trisection theorems! Let’s change the subject: Brown’s *Number Theory* web page presents this fun image with no explanation.

Start with the red equilateral triangle whose sides have a length of one. Repeat that six times as shown for the white triangles. Then construct the blue equilateral triangle with sides of length two. The shape we created so far is similar to the overall shape. Sequence: 1, 2, 3, 4, 5, 7, 9, 12, 16, 21, 28, 37, 49…? Comments (*editor2012[at] aiaahouston.org)*?

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

Our Section's Annual Awards Dinner Meeting

MICHAEL FROSTAD, CHAIR-ELECT AND ELLEN GILLESPIE, COUNCILOR

Our Section's annual awards dinner meeting, dedicated to the late James C. McLane, Jr. this year, attracted a crowd of more than 150 attendees at the NASA / JSC Gilruth Center Alamo Ballroom on June 13, 2013.

James C. McLane III delivered a presentation about his father's NASA career, service to AIAA, and related activities.

AIAA Houston Section Chair Daniel Nobles and Honors and Awards Chair Jennifer Wells presented service awards for five people in attendance. These awards are presented for service anniversaries of 25, 40, 50, or 60 years. Nobles and Wells presented several kinds of awards as the evening began. One award was for Dr. Myron Diftler, NASA / JSC Principal Investigator for the Robonaut team. That Robonaut 2 (R2) team won the national AIAA Space Automation and Robotics award for 2013.

Our Section also awarded almost $8,000 to the Houston Museum of Natural Science Challenger Learning Center,

(Continued on page 30)

Above: Jennifer Wells (left) and Daniel Nobles (right) present 25-year membership service awards to (left to right) William D. Eatwell, Thomas R. Hatfield, and Wendell W. Mendell. Image credit: Michael Frostad.

Above: Jennifer Wells (left) and Daniel Nobles (right) present 50-year membership service awards to (left to right) Eleuterio ("Teyo") de la Garza and Chester A. Vaughan. Image credit: Michael Frostad.

Above: The Section's annual awards dinner meeting was dedicated to the late James C. McLane, Jr. His son James C. McLane III delivered a presentation about his father's NASA career. Image credit: Michael Frostad.

Section News

(Continued from page 29)

thanks to volunteers working with the 2013 Yuri's Night 5-kilometer fun run.

(Continued on page 31)

Above: Jennifer Wells (left) and Daniel Nobles (right) with Special Service Citation awardees (left to right) Shen Ge, Irene Chan, and Eryn Beisner. Image credit: Michael Frostad.

Above: Jennifer Wells (left) and Daniel Nobles (right) with Dr. Myron Diftler. Image credit: Michael Frostad.

Above: Jennifer Wells (left) and Daniel Nobles (right) with Ellen Gillespie, Councilor and General Chair for our Section's Annual Technical Symposium (ATS 2013) of May 17, 2013. Image: Michael Frostad.

Above: Jennifer Wells (left) and Daniel Nobles (right) and (from left to right) Dr. Albert A. Jackson IV, Ellen Gillespie, Dr. Steven E. Everett, Irene Chan, Michael Frostad and Clay Stangle. Image credit: Michael Frostad.

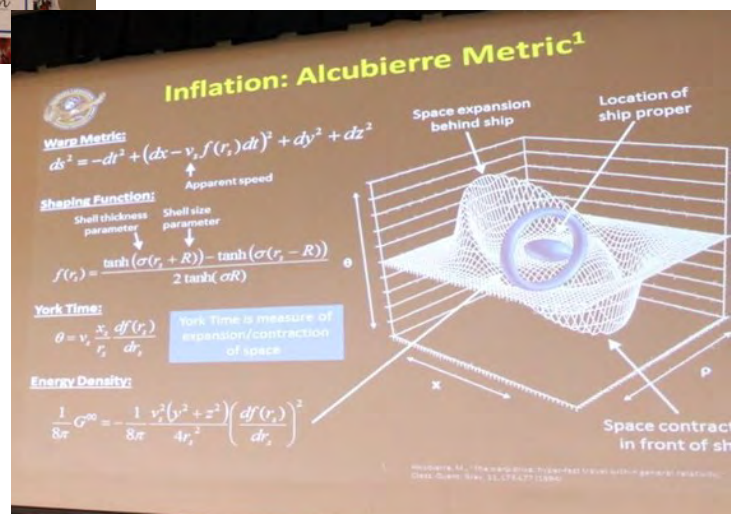
Above: Council members (left to right) Jennifer Wells, Alan Sisson, Shen Ge, Daniel Nobles, Dr. Steven E. Everett, Ryan Miller, Irene Chan, Eryn Beisner, Dr. Albert A. Jackson IV, Clay Stangle, Ellen Gillespie, Dr. Michael Martin and Dr. Larry Jay Friesen. Image credit: Michael Frostad.

Section News

(Continued from page 30)

Our featured speaker, Dr. Harold "Sonny" White, ended the evening with a presentation about his NASA / JSC work on warp drive.

Our new AIAA year starts July 1, 2013. Thanks to all who made this such a great year for AIAA Houston Section and our community.



Above: Yuri's Night is an international event celebrating the April 12 anniversary of Yuri Gagarin's 1961 launch as the first person in space and the 1981 launch of the first space shuttle mission, STS-1. The Yuri's Night Houston 5 km fun run generated nearly $8,000 for the Houston Museum of Natural Science BP America Challenger Learning Center. All three images above show Race Director Mana Vautier. Image credits: Michael Frostad.

Above: Door prizes. Left to right: Alan Sisson, Jennifer Wells, and Clay Stangle. Image credit: Michael Frostad.

Above: Dr. Harold "Sonny" White, NASA / JSC, delivers his presentation about his NASA work on warp drive, including inflation and the Alcubierre metric. Image credits: Michael Frostad.

Section News

Right: Celebrating the success of the fourth Automated Transfer Vehicle (ATV-4) from the European Space Agency, we present images here and on the next page. Daniel Adamo also presents two pages about ATV-4 earlier in this issue.

Right: JSC2013-E-061222 (15 June 2013) --- Inside the space station flight control room in JSC's Mission Control Center, a live television downlink appears on a giant screen for the benefit of flight controllers who are managing the docking of the ATV-4 Albert Einstein. The fourth European space station resupply spacecraft docked with the orbital outpost on June 15, 2013. Image credit: NASA.

Association Aéronautique et Astronautique de France (3AF)

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

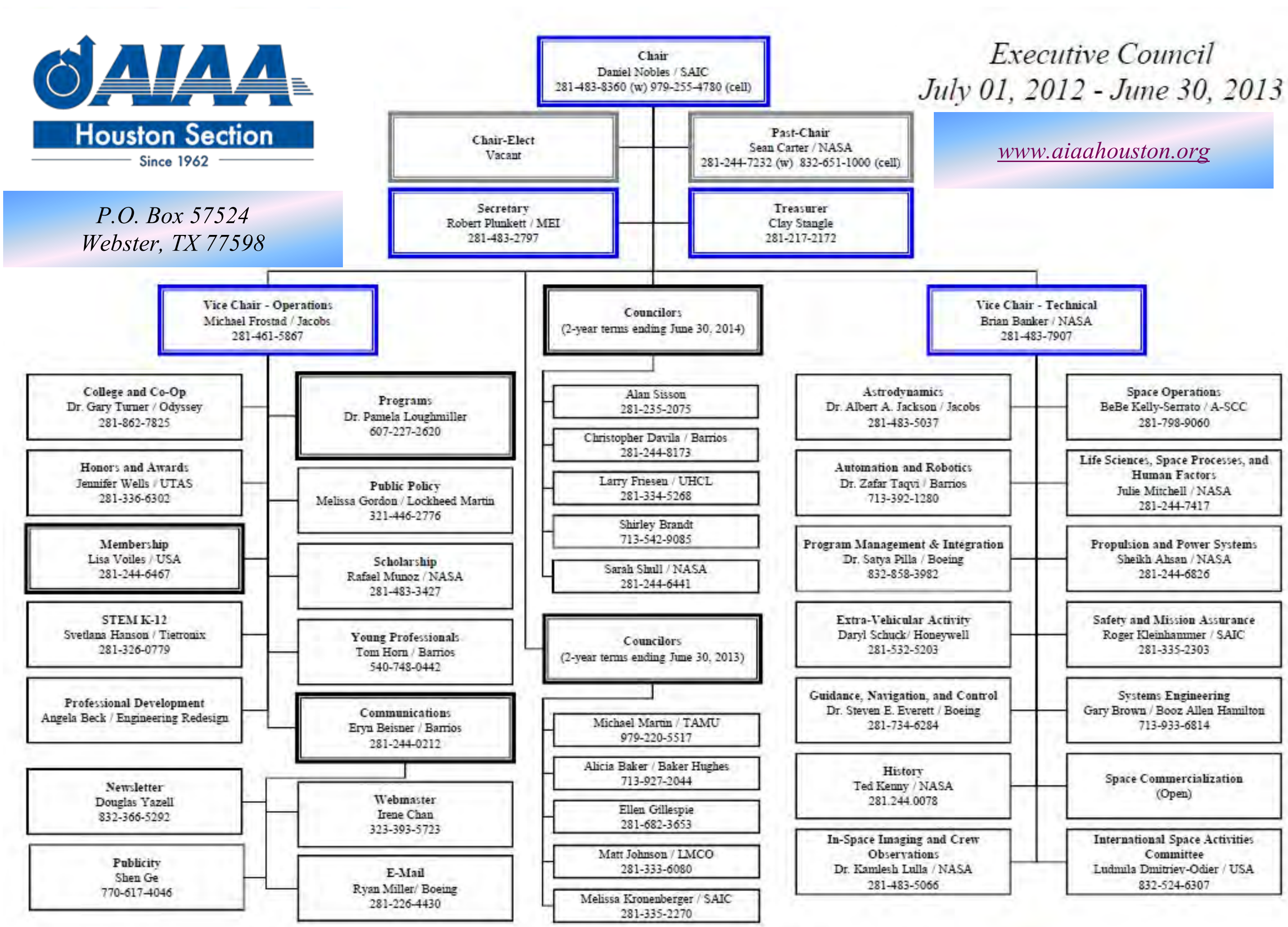
Below: ISS036-E-007747 (15 June 2013) The European Space Agency's Automated Transfer Vehicle-4 (ATV-4) "Albert Einstein" is about to dock to the orbital outpost at 2:07 GMT, June 15, 2013, following a ten-day period of free-flight. Image credit: NASA.

Left: Celebrating the success of ESA's ATV-4, we present images here and on the previous page. Daniel Adamo also presents two pages about ATV-4 earlier in this issue.

The 2013-2014 Executive Council will consist of:

Chair: Michael Frostad
Chair-Elect: Michael Martin
Vice-Chair, Technical: Clay Stangle
Vice-Chair, Operations: Eryn Beisner
Secretary: Shen Ge
Treasurer: Jennifer Wells
Councilor: Irene Chan (Two year Term, 2013-15)
Councilor: Robert Plunkett (Two year Term, 2013-15)

The American Institute of Aeronautics and Astronautics (AIAA)



Downloaded February 17, 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.

Fall 2012 Schedule

September 12, 2012
Failure is Not an Option
Gene Kranz
Retired NASA Flight Director
Retrieve archived webcast

This lecture commemorates the 50th anniversary of President Kennedy's "To the Moon" speech from Rice Stadium

October 23, 2012
Lights, camera, blast-off! Making IMAX movies in space
Toni Myers
Producer/Director
IMAX Corporation
Retrieve archive webcast

November 1, 2012
The Boldest Mission to Mars Ever
Bobak Ferdowski & Ravi Prakash
NASA's Jet Propulsion Laborator
Retrieve archived webcast

Above: We mentioned the Alan Bean lecture in our last issue. Three additional recent lectures in the Space Frontiers Lecture Series are shown here. The related Rice University web page allows users to view the archived lectures. The Space Frontiers Lecture Series is not affiliated with AIAA in any way, but we mention it because of AIAA's interest in astronautics.

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
John Guthery '11 Secretary	Travis Dawsey Activity Chair	Alejandro Azocar '14 Junior Class Representative
Erica Lovig '13 Treasurer	Nick Page '16 Publicity Chair/ Webmaster	Logan Hodge '15 Sophomore Class Representative
		Jacob Shaw '16 Freshman Class Representative

Below: These are a few of the Texas A&M University professors who supported our Section's Annual Technical Symposium or lunch-and-learns over the years.

Hurtado, John E.

Associate Professor

Dynamics and Control

Hyland, David

Professor

Mortari, Daniele

Professor

Pollock, Tom

Professor

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

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!

Scott Lowther does a great job every issue as we prepare these installments in the Collier's space series. He prepares these scanned magazine pages so that they are ready for publication. I recall that his copy of this May 14, 1953 issue of Collier's has an address sticker covering the spacecraft's needle nose and its pitot tube. In fact, the excellent cover image scan at www.UNZ.org has the same problem with an address sticker in that location. We asked our Horizons Collier's team for a complete scan of that cover image. John Sisson was able to help us fulfill that request. For this issue, Scott mentioned that colors bled through from the other side of several magazine pages, making the cleanup of these scans a bit more difficult than usual.

Horizons Collier's team member Fred Ordway is a priceless addition to the team. We are pleased to have him communi-

(Continued on page 37)

	"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.

Collier's 1952-54

(Continued from page 36)

cating with us. As co-author of the book, the Rocket Team, he writes about his acquaintance with that great American, Wernher von Braun, and their discussions about Ordway's work on this book. A later page in this issue contains an advertisement about that excellent book. That page provides a short Ordway biography. Fred Ordway wrote a quick email note to me containing these comments, presented here with his permission:

"I of course have all the Collier's series; and, by the way, was introduced to Wernher von Braun by Professor Fred L. Whipple at a Hayden space symposium in 1952 in New York [City]. Dr. Whipple chaired the Department of Astronomy when I studied the subject at Harvard--class of 1949.

"Back in 1952 I was working at the Guided Missiles Division of Republic Aviation on Long Island and frequently attended American Rocket Society [ARS] meetings in New York; I had joined the ARS as a student member when I was only 13--in January 1941!"

The American Institute of Aeronautics and Astronautics (AIAA) started in 1963 by merging ARS and the Institute of Aerospace Sciences (IAS). AIAA claims 1931 as its first year when celebrating anniversaries, since ARS was founded in 1930 and IAS was founded in 1932.

The following pages from this installment of the Collier's space series are impressive, to say the least. They must have been amazing to readers in 1953, though we know from letters to the editors that not everyone was favorably impressed. As shown below, the last two installments are number seven, *The Baby Space Station*, and number eight, *Can We Get to Mars? Is There Life on Mars?*

A John Sisson Dreams of Space (blog) advertisement on a later page in this issue presents a von Braun novel, by the way.

(Continued on page 38)

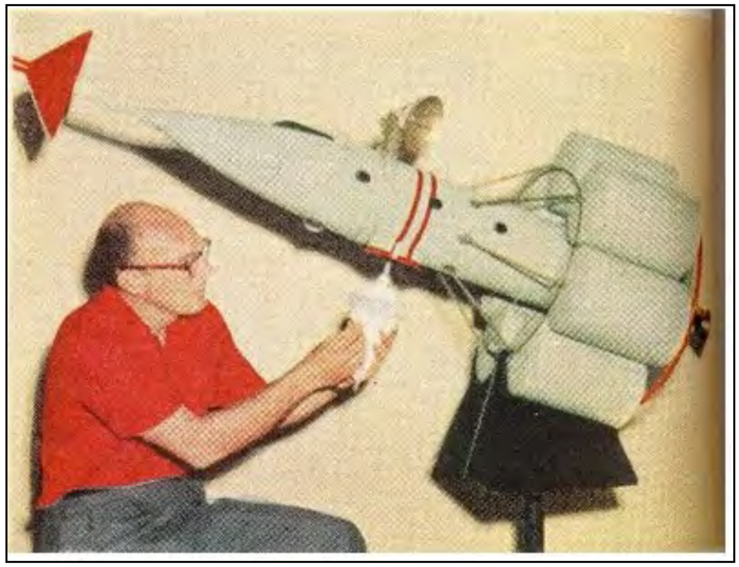
Above: Image credits: Scott Lowther, with help from other Horizons Collier's team members.

Collier's 1952-1954

(Continued from page 37)

Thanks to this blog, we present another von Braun spaceship design, and a surprising look at some 1962 post-Apollo Moon exploration plans.

Above: Image repeated from an earlier [page](#) in this issue.



In a Dreams of Space blog post, John Sisson writes about this spaceship: "It is RM-1, designed by Wernher von Braun for the Walt Disney television film called 'Man And The Moon' broadcast December 28, 1955. RM-1 was meant to illustrate what a factual around the Moon space ship might look like. In the film it was portrayed by this model." Image [credit](#): Dreams of Space.

PAGE FOUR — AEROJET-GENERAL SPACELINES — PAGE FIVE

SPACESHIPS FOR 12 MAN EXPEDITION ON MOON
"Umbrella" on suit protects wearer from solar radiation.

Mock-up of Moon Suit in action.

Moon Man has controls for suit and vehicle.

CREW / CARGO COMPLEMENT

EXPEDITION WOULD TAKE ALONG EVERYTHING FOR WORK, SURVIVAL ON MOON
Each man would specialize in one or more fields of science, technology.

After Apollo—Exploring the Moon

After the Apollo spacecraft lands its three-man crew on the moon and brings them back safely, what's the next step in lunar exploration?

A 12-man expedition to make a 500-mile research trip across the surface of the moon is proposed by Allyn B. Hazard, an engineer at Aerojet's subsidiary, Space-General Corporation.

It could be done in this decade, he says.

The spacemen would travel to the moon in four rockets — three round-trip passenger vehicles, the other a one-way cargo ship with 30,000 pounds of supplies to support the men and their scientific studies.

Each of the 12 astronauts would be a highly trained scientist or technologist in some particular field; some would be experts in several areas. On the moon, only four of them would make the trans-lunar journey, while the others remained at the rockets' landing site to conduct research.

The four explorers would wear special tub-like spacesuits in which they would have to live and work, eat and sleep, for the entire trip. They couldn't get out of the suits because of the airlessness and super-cold of the moon.

That's the reason for the suit's peculiar shape — the wearer can slip his arms out of the sleeves to eat, adjust controls, make notes, or even to scratch his nose.

Umbilical connections would link each suit to a tractor-like "moon mobile" carrying the oxygen and life support system for two men. These would carry their passengers across the lunar landscape at five miles an hour. A 500 mile journey (for instance, from Crater Gruithuisen to Crater Aristarchus and back) would take 10 earth days. It would be made during the 330-hour lunar night, to avoid exposing the men to the sun's radiation.

★ A 500-Mile Trans-Lunar Journey ★

INTEGRATED SPACE SUIT – MOONMOBILE
DESIGN CONCEPT

JOURNEY TO ARISTARCHUS

Moon mobile carries two explorers, life-support systems.

Explorers could train in three-domed moon simulator.

Above: A double-page magazine spread from 1962 showing post-Apollo Moon exploration plans. The magazine is Aerojet-General Spacelines and Rocket Review. Image [credit](#): Dreams of Space.

Saturn V Inboard Profile Prints Now Available

Approximately six feet long, this full-color print is a reproduction of NASA-MSFC drawing 10M04574, the Apollo 8 Saturn V. Looks great ! Hang one on your wall and be the envy of all your co-workers. Available for $35 plus postage at up-ship.com

http:/www.up-ship.com

Lunar Module Equipment Locations diagrams

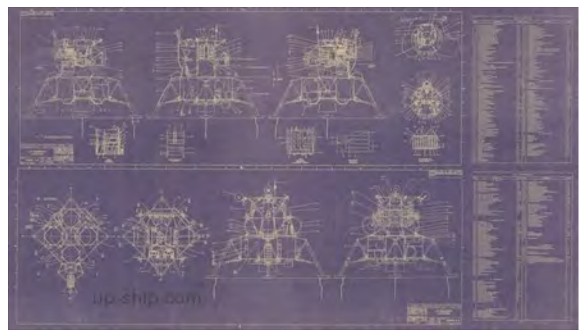
Full color, high quality print of NASA-MSC drawing dated January 1969 showing the Lunar Module and many of the important bits of equipment that went into it.

Prints are about 32 inches/81 cm wide by 18 inches/46 cm tall.

The original was B&W. It has been converted to a full-color "blueprint" using the Saturn V as a color reference.

http://www.up-ship.com/drawndoc/saturnvprints.htm

$25



Dreams of Space
Books & Ephemera

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


April 24, 1960

This Week MAGAZINE

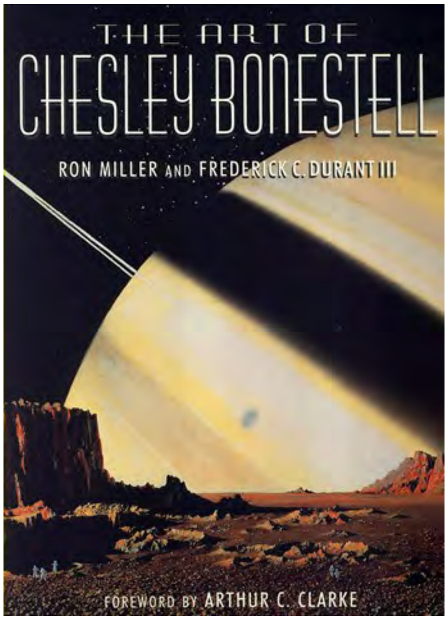
THE MILWAUKEE JOURNAL

Beginning in this issue—exclusive:

By Dr. WERNHER von BRAUN

"Life on Mars"

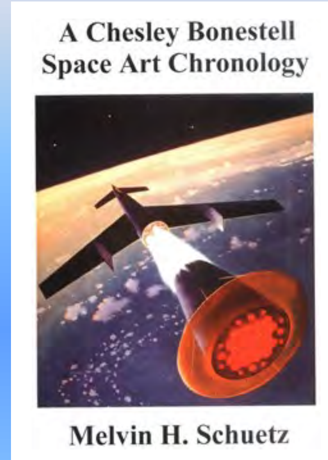
One of the most exciting and important scientific novels of the 20th century! America's genius of rocketry brings his lifetime of experience to a fabulous vision of modern man's greatest adventure .... page 8



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.

www.cgpublishing.com

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.fr

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.

Collier's

MARCH 14, 1953 • FIFTEEN CENTS

Who Will Be THE NEXT POPE?

• **How Man Will Meet EMERGENCY In Space Travel**

• **What Is Your SEX IQ?**

ALBERT E. WINGER
Chairman of the Board

CLARENCE E. STOUCH
President

Collier's

EDWARD ANTHONY, *Publisher*
ROGER DAKIN, *Editor*

RICHARD CHAPLIN, *Assistant Publisher* GORDON MANNING, *Managing Editor*
DAVID MANESS, *Assistant Managing Editor*

MACLENNAN FARRELL, *Fiction Editor*
ALLEN CLEATON, *Senior Associate Editor*
JAMES THRASHER, *Editorials*
WILLIAM O. CHESSMAN, *Art Director*
GURNEY WILLIAMS, *Cartoon Editor*
JAMES A. QUIGNEY, *Photo Editor*

Associate Editors · JEROME BEATTY, JR. · WARREN BROWN · GERTRUDE BUCKMAN
JEAN B. CAMPBELL · SEY CHASSLER · HOWARD COHN · WALTER DAVENPORT
BILL DAVIDSON · HELEN WORDEN ERSKINE · EVELYN HARVEY · DIANA HIRSH
HOMER JENKS · CHARLOTTE KNIGHT · JERRY KORN · ALFRED M. LANSING
JOHN LEAR · FRANKLIN C. LORANGER · TOM MEANY · BUCKLIN MOON
JOHN C. PELLEW · ROGER PIPPETT · ELEANOR PORTER · CORNELIUS RYAN
JANET SHEPS · FRANCIS WALLACE · WILLIAM WEAVER
MARTHA WEINMAN · ELIZABETH WOODY

Editorial Research · ROSANNE McVAY, *Chief* · MADELIN ALK · DOROTHY D. BENNETT
DIANE DOWNS · ALAN M. LEVENSOHN · JANICE MOSES · JOHN NEWHOUSE

Bureaus
WASHINGTON: JAMES C. DERIEUX, *Chief*; TODD WRIGHT
WEST COAST *(Los Angeles)*: THEODORE STRAUSS, *Chief*; ROBERT CAHN, JOHN FLOREA
MIDWEST *(Chicago)*: BILL FAY
EUROPE *(Paris)*: SEYMOUR FREIDIN, WILLIAM RICHARDSON
FAR EAST *(Tokyo)*: PETER KALISCHER

March 14, 1953

ARTICLES

FICTION

The characters in all stories and serials in this magazine are purely imaginary. No reference or allusion to any living person is intended.

Subscription Department, 204 W. High Street, Springfield, Ohio
Editorial and Executive Offices, 640 Fifth Avenue, New York 19, N. Y.

COLLIER'S THE NATIONAL WEEKLY. Vol. 131. No. 11. **PUBLISHED WEEKLY** by The Crowell-Collier Publishing Company, Springfield, Ohio, U.S.A., Publishers of Collier's, Woman's Home Companion, The American Magazine. Executive and Editorial Offices, 640 Fifth Ave., New York 19, N. Y. Albert E. Winger, Chairman of the Board; Clarence E. Stouch, President; E. A. Schirmer, Executive Vice-President; T. L. Brantly, Peter J. Dennerlein, Edward Anthony, E. P. Seymour, Ralph G. Smith, John W. McPherrin, Wm. A. Sittig, Vice-Presidents; Denis O'Sullivan, Secretary; C. F. Norsworthy, Treasurer.

SUBSCRIPTION PRICES: United States and Possessions, Canada and Philippine Islands, 1 year \$5.00; 2 years \$8.00; 2½ years (130 issues) \$9.00; 3 years \$10.00; 4 years \$12.00. Pan-American countries in the Postal Union, 1 year \$6.00. All other countries, 1 year \$9.00. Payments from foreign countries, except Canada, must be in United States funds, and addressed to The Crowell-Collier Publishing Company, Springfield, Ohio.

ENTERED as second-class matter at the Post Office, Springfield, Ohio, under Act of March 3, 1879. Authorized as second-class mail, Post Office Department, Ottawa, Canada.

MANUSCRIPTS or art submitted to Collier's, The National Weekly, should be accompanied by addressed envelopes and return postage. The Publisher assumes no responsibility for return of unsolicited manuscripts or art.

CHANGES OF ADDRESS should reach us five weeks in advance of the next issue date. Give both the old and new addresses.

The Cover

Inbound from space, a fast-moving rocket ship noses down toward the earth, its crew alert—as always—for signs of danger. Disaster won't occur often in space, but rocketeers will be prepared: most of the paraphernalia shown in the cutaway sections of artist Fred Freeman's picture is emergency equipment. To see how it is used, turn to Emergency! on page 38.

Week's Mail

Survival in Space

EDITOR: Your article of February 28th on the dangers which human beings will encounter in flights at high altitudes (Man's Survival in Space) should go far to debunk the exaggerated fears prevalent in some quarters. Especially significant is the point that cosmic radiation, even at its worst, will not produce an important amount of damage to the hereditary constitution which later generations receive.

Unfortunately, however, the reason for this conclusion is stated in a misleading way. It is true, as your article states, that even a large amount of radiation would seldom produce striking abnormalities in the descendants of an exposed person. Yet this does not imply the absence of important damage. Even though the harmful changes resulting from a high exposure were hard to detect, they would be distributed over so many descendants that the total harm done would be very serious, and would usually include several premature deaths. That is why the present writer has always maintained that in the medical use of X rays more efforts should be exerted to keep the exposures as low as possible.

The real reason why the effects of cosmic radiation on heredity are not to be feared is because it would take so tremendous a time before a person could absorb any considerable amount of this radiation. An X-ray examination of the abdomen by a fluoroscope commonly delivers more radiation to the reproductive cells than six months' continuous exposure to cosmic radiation would give.

H. J. MULLER, Indiana University,
Bloomington, Ind.

In editing Dr. Muller's contribution to the Man in Space symposium, Collier's inadvertently omitted the words "in space" from his statement that a man exposed to radiation for a long time would rarely pass on marked changes to his descendants.

The Barrier of Language

EDITOR: Your editorial Barriers to Western Unity (Feb. 7th) is excellent and timely. The next to the last sentence in the article stands out: "They must cultivate friendly relations and mutual understanding."

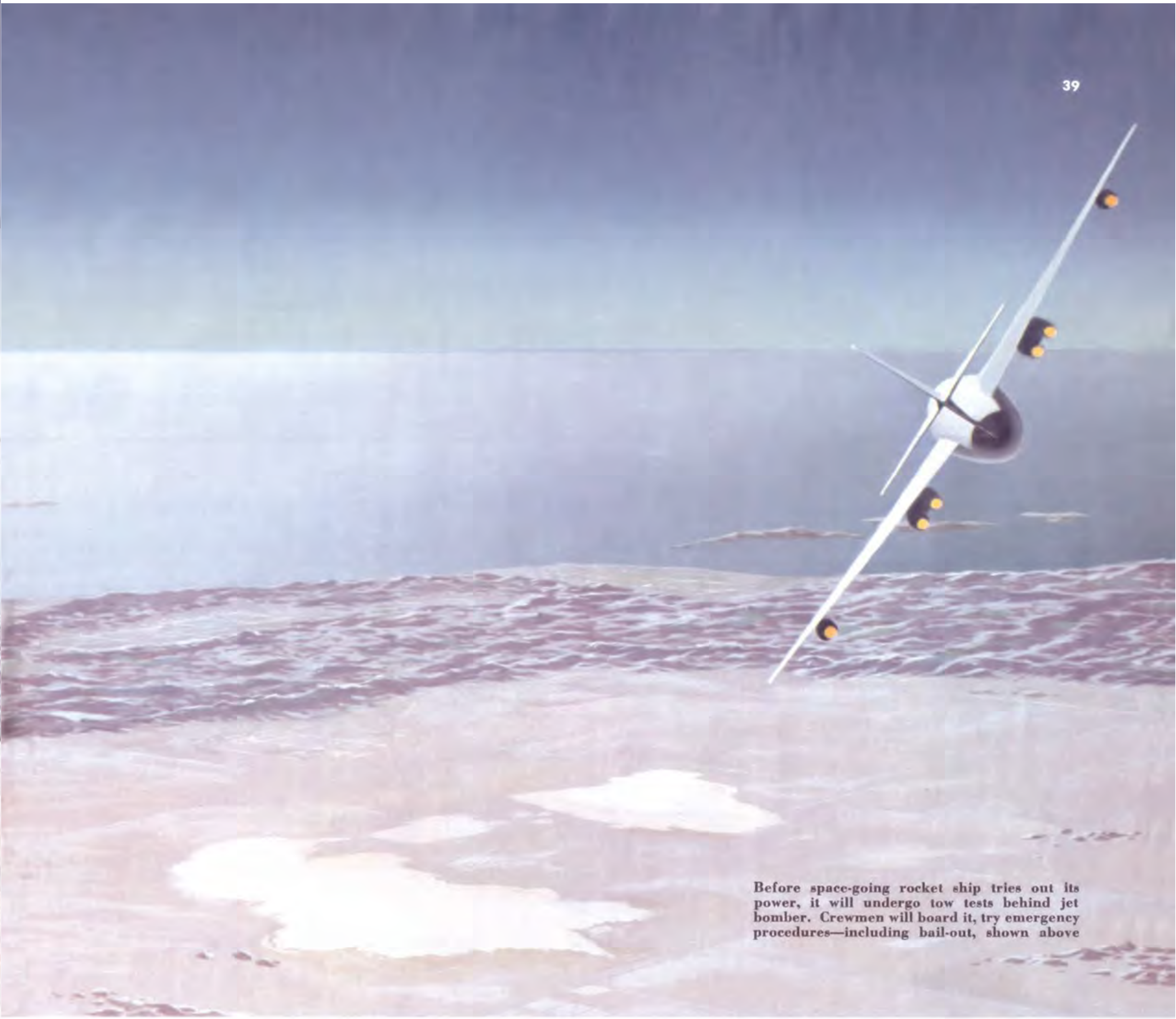
There seems to be one serious problem to uniting the West European nations. They will never cease being suspicious of one another as long as they cannot understand one another. They need a common, easily and quickly learned language that in itself would help bind them together.

Many will say this would take too long and that our present problems are

Man's Survival in Space

EMERGENCY!

Authorities whose papers were the basis for this article, last of a three-part series, are Dr. Wernher von Braun, chief of the Army Guided Missiles Laboratory; Dr. James P. Henry, of the Air Force Aero Medical Laboratory and rocket expert Willy Ley. Contributors to the other two parts included Col. Don Flickinger, Director of Human Factors at the Air Force Air Research and Development Command; Capt. James E. Sullivan, director, Airborne Equipment Division of the Navy Bureau of Aeronautics; and Drs. Hermann J. Muller of Indiana University; Hubertus Strughold, head of the Air Force Department of Space Medicine; Fritz Haber of the same agency; Donald W. Hastings, National Psychiatric Consultant to the Air Force; James Van Allen of the State University of Iowa; and Heinz Haber of the University of California. The material for the entire series was collected by Collier's Cornelius Ryan



Before space-going rocket ship tries out its power, it will undergo tow tests behind jet bomber. Crewmen will board it, try emergency procedures—including bail-out, shown above

What happens when disaster strikes in space? Can the crew of a 15,000-mile-an-hour rocket ship bail out or land their disabled craft? Here, for the first time, famous scientists disclose the answers

A ROCKET ship is cruising serenely through space at 15,000 miles an hour, its crew relaxing within the pressurized cabin. Suddenly the calm is shattered by an explosion: one of the double-paned portholes has blown out; in an instant the artificial atmosphere has vanished and the five men are exposed to the blood-boiling, suffocating vacuum of space. What can they do?

Or suppose the time is shortly after launching; the ship is picking up speed on a vertical flight path—and suddenly the fuel lines feeding the roaring bank of rocket motors burst into searing flame! Can the crewmen trapped inside bail out—or, perhaps, bring their multimillion-dollar vehicle in for a successful crash landing?

What can men do when disaster threatens their rocket ship during a supersonic dash through the atmosphere, or in the strange, airless environment of space?

If the crew is well trained, there are few emergency situations that can't be licked. The captain may have to make hair-trigger decisions; it may be necessary to throw away machinery and equipment that cost millions of dollars and years of work to develop; it may be necessary to take risks. There'll be plenty of excitement. But for almost all foreseeable crises, there will be an emergency procedure providing a good chance for safety. *If* the crew is well trained.

The first space crews will be more than well trained. They'll be selected with infinite care, superbly conditioned, educated in the special problems of space for five years. Every ground training device our scientists can conceive will give them the feel of space flight—and the problems of space flight—before they ever step into a rocket ship (Collier's, February 28, March 7, 1953).

But the big moment, and the best preparation for danger, will come when they get aboard a space vehicle and go roaring skyward.

There will be some preliminaries. Before they start space flights, the pilot and copilot, both jet-trained, will take many hours of transition flying in single- or double-seat supersonic rocket planes like the present Bell X-2 and Douglas Skyrocket.

Rocket flight is different from any other flight, and the important difference is that it's unpowered, except for a few minutes. (Three rocket blasts lasting a total of five minutes will carry a rocket ship beyond the earth's dense atmosphere; then it will simply coast the rest of the way to its destination.)

Flying in small rocket-powered aircraft, the crew captain and his copilot will learn to expect a sudden power cutoff after a brief burst—and will learn to make every landing glider-fashion, without power, as all rocket pilots must.

Then, with the rest of the crew, the two men

PAINTING BY CHESLEY BONESTELL

will climb aboard their new space-going rocket ship—but not for rocket-propelled flight.

The pioneer space crews and the first space ships will be developed together. All the time the men—and women; they'll probably be on rocket crews, too—are taking their training, engineers will be hard at work perfecting the vehicles. Crews and ships will be ready to undergo testing at about the same time. They'll do that together, too.

The vehicle that takes man into space will consist of three sections, or stages. Two of them will simply be power packages which will hurl the third section spaceward at a great speed and then be discarded. Only the third stage will actually enter space; it will carry the crew and cargo, and it will have wings and other control surfaces, like those of an airplane, necessary to make landings on earth.

A Start in Basic Escape Training

Since the third stage poses the greatest engineering problems, it will be the first section built. Once it's considered ready for flight, it will be towed aloft by a powerful jet bomber and put through a series of tests. The crew will board it at that time, to get used to it, to help the engineers perfect the internal layout, and—especially—to start basic escape training.

After each test is finished, the towrope will be cast loose and the two pilots will make the unpowered landing at the home base.

Finally, the day will come when the third stage and its crew are ready for a rocket launching. The ship will be set on a launching platform, tail down, nose pointing skyward. A few final checks, a moment's pressure on a button beside the captain's chair and the four main rocket motors will roar. The needle-nosed ship will rise slowly into the air, picking up speed rapidly until it hits 4,000 miles an hour.

From the moment the craft leaves the ground, the crew must be prepared for breakdowns, for malfunctions, for the early symptoms of danger. The trip—and each such third-stage flight thereafter—will last only about 20 minutes; there's barely enough fuel for a 300-mile trip, up to an altitude of about 30 miles. Into the few minutes of flying time on each flight, the crew members will cram an intense course in emergency procedures.

What emergencies?

Most of the troubles that can crop up in rocket flight are fairly easily handled. Instrument failure? The ship has double sets of instruments—two sets of flight instruments for the captain and copilot, and two of functional instruments for the engineer. Pump trouble may affect a space-bound rocket ship so that it can't make its destination; it will remain aloft long enough to burn up its heavy fuel load, then, light enough to land, it will return to base.

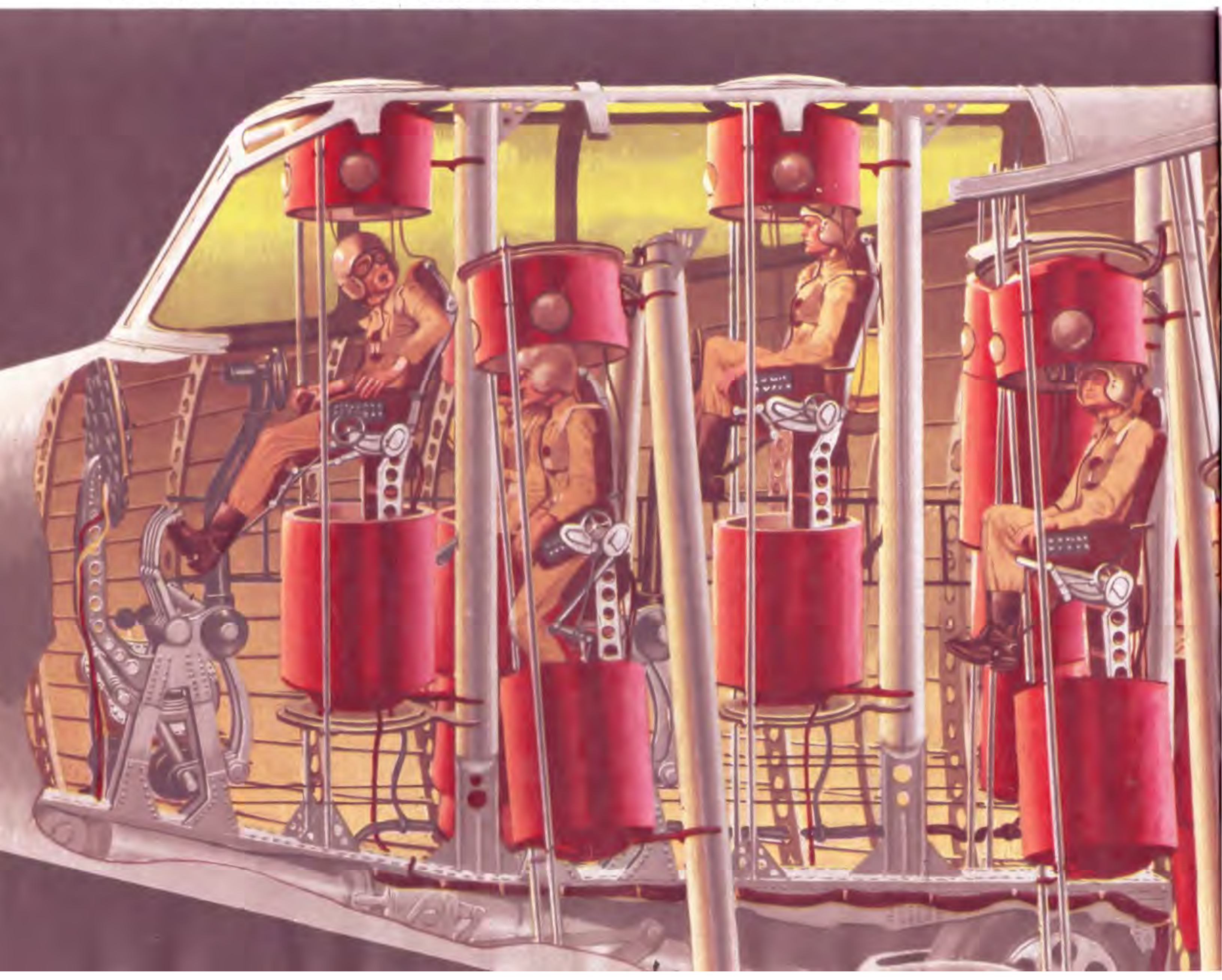
But four difficulties may spell real danger: mechanical trouble in the power plant or hull; failure of specific pieces of electrical equipment for which there are no duplicates; fire, and the sudden loss of cabin pressure. Fortunately, all such breakdowns should be rare.

Effects of Sudden Decompression

Swift decompression could be caused by the accidental opening of an escape hatch or by the sudden blowout of a porthole. It would subject the crew to an enormous pressure change: from the normal cabin pressure of eight pounds per square inch (equal to a 15,000-foot altitude) to the complete vacuum of outer space.

Can men stand such instant decompression? Tests have proved that carefully picked men can. The change would be uncomfortable but not fatal. But unless the crewmen could find swift protection, they would quickly die from exposure to the low pressure, which provides little or no oxygen for breathing, and which very quickly causes the blood, saliva and other body fluids to boil. Space

In emergency (as when broken porthole lets cabin pressure escape, as pictured), crewman and passengers press buttons on chair arms; contour seats straighten automatically, capsules clap shut, seal. Capsules are connected to cabin pressure system, also have own pressure for bail-out



suits? They'll be invaluable in space, to keep men supplied with pressure and oxygen outside their pressure cabins, but they won't be worn inside a rocket ship; they're too clumsy in such cramped quarters under conditions calling for fast movement. And they take a long time to put on.

The solution is a fast-closing personal pressure cabin for each man. Such a cabin already has been designed by Dr. Wernher von Braun, one of the world's foremost rocket engineers. The moment a crew member becomes aware of the cabin leak, he will press two buttons, one on each arm of his contour chair. One button would do, but two will force the crewman to pin both arms to his sides. That's important, because the instant the buttons are pressed, the chair will straighten slightly, and two metal cylinders will zip out of the floor and ceiling and snap shut around the man, encasing him completely in a sealed tube. The tube, called an emergency capsule, is connected to the ship's central air supply. It also has its own pressure-atmosphere system, if needed.

The capsule protects the crew member from the low outside pressure—but isn't he helpless?

Far from it. All the control switches he has been using to do his assigned job are located on the arms of the chair, and the chair arms are inside the capsule with him. Even before the cylinder clapped shut, the control wires were connected to the ship's electrical system through breakaway plugs at the bottom half of the capsule. Chances are good that, even encased within their capsules, the crew members can save the ship.

At the very least, the captain can start back for the earth; when the space craft descends below 20,000 feet, he and the other crew members can emerge from their metal shells and bring the ship in for a normal landing.

Landing May Be on Space Station

Suppose he has a destination in space. Once scientists have the first space-going ships in operation, they will start building a permanent station 1,075 miles from the earth, as a combined military observation point and astronomical observatory (Collier's, March 22, 1952). The station will circle the globe endlessly, once every two hours—an unpowered satellite, like the moon. If our decompressed rocket ship is on its way to the satellite, it might be wise to continue on course. After its arrival, the crew members in their capsules will be removed from the damaged vehicle by space-suited men from the satellite, and taken to the pressurized station. The rocket ship will be repaired before its return flight.

With proper emergency equipment, decompression can be licked fairly simply.

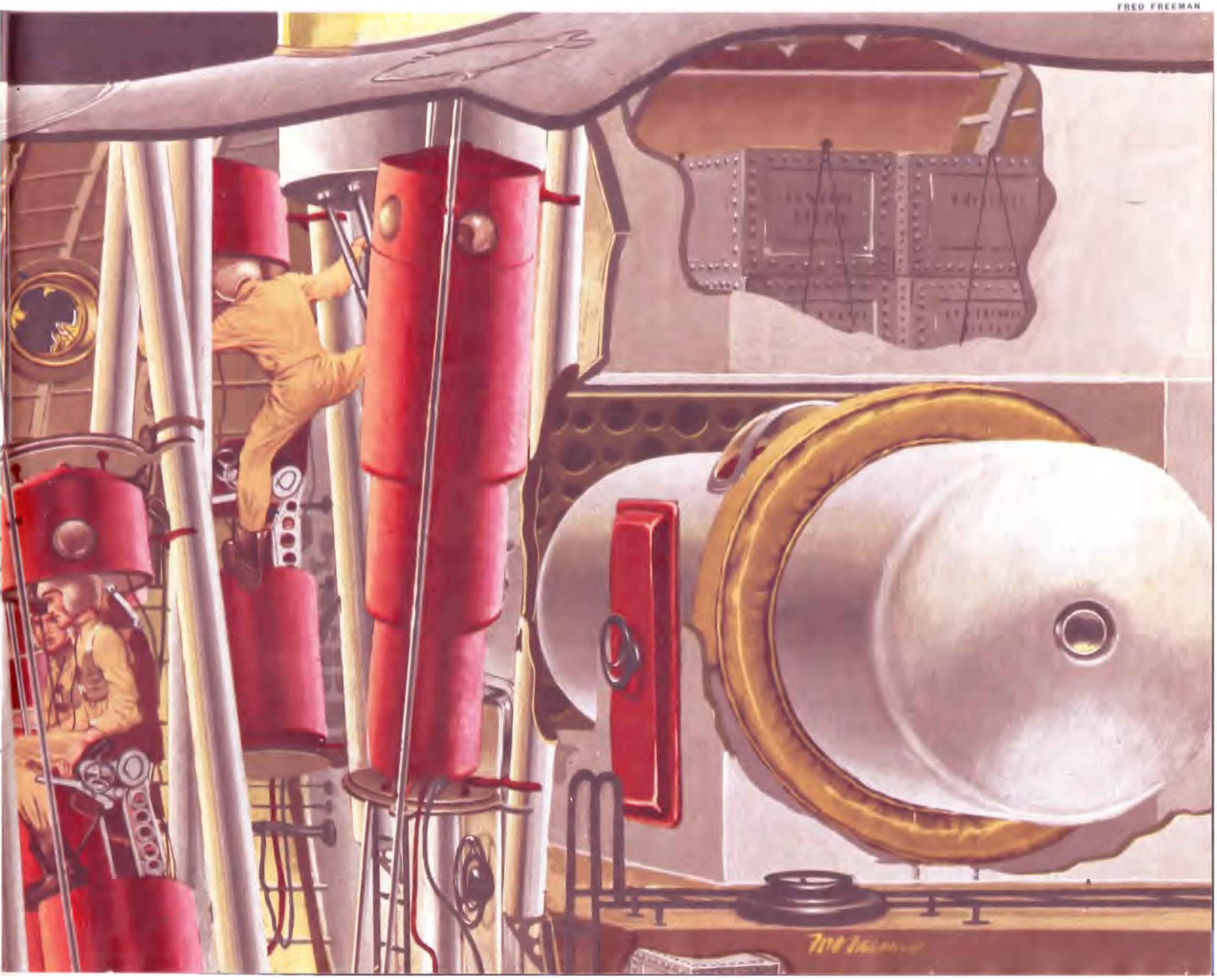
Fire is something else again. Suppose the turbine driving the fuel pump flies apart and a hot splinter rips through the fuel tanks. A stream of ammonialike hydrazine would engulf the motor and fuel systems in searing flame. What then?

It depends on where the fire is located, how bad it is, how bad it's likely to get—and where the rocket ship is in space. The ship starts its flight from the ground with three sets of rocket motors, mounted one behind another. The first part of each flight is over the ocean. The bottommost, or first, stage provides power until it runs out of fuel, then drops into the sea. The second stage takes over, to be discarded in turn two minutes later. If fire occurs in either of the first two stages, the pilot will immediately jettison it. If he works fast enough, that will end the danger. He will glide the third stage back to earth, after dumping most of its fuel.

But what if the blaze starts just after departure, with the ship only a few thousand feet off the ground? A jettisoned stage, especially if it's aflame, might wipe out the entire launching installation—and hundreds of men. For the rocket captain, it's a tough decision: if he waits too long, he and his crew (and their costly vehicle) might be lost; if

To abandon ship, men push another button. Capsules, guided by rails, are ejected by powder charge, drop safely into ocean with men inside. When possible, men will remain in ship, operating controls from within capsules, until they are close enough to the earth to land normally

FRED FREEMAN



Emergency capsule is ejected from rocket ship with crewman inside, drops into sea. Speed is slowed by metal chute, impact is cushioned by small rocket in capsule base. The picture shows radar-equipped plane, rescue vessels converging on area to pick up four crew members—one in sea, two being slowed by rockets, and one (foreground) still so high rocket hasn't blasted yet. Cutaway shows man in capsule, strapped to contour chair, with rocket and frozen air under feet. Metal arms on base guide capsule during ejection

An ingeniously engineered bail-out device gives the rocketeer his margin of safety

he acts too quickly, he may cause catastrophe on the ground. His best bet is to turn the rocket into a shallow flight path, and attempt to cast loose the burning section where it can do no harm.

Luckily, fires are likely to be rare. Most of the risk comes during launching, and for the five minutes after launching, when the motors are operating and quantities of fuel remain. How about an explosion? The two propellants, nitric acid and hydrazine, are in separate tanks; a hot fragment of metal wauld have to pass through both sets of tanks, causing the propellants to mix, before an explosion could occur. The fragment would have to be traveling at terrific speed.

Yet it *could* happen. If it did, there probably would be no emergency procedure: rocket ship and crew would be blasted to bits instantly.

If fire or explosion should occur, it will probably be on the way up, while the ship is still in the atmosphere—almost never in space, or in the atmosphere on the way back. First, after the ship has left the atmosphere outbound, there will be little fuel left to burn—just enough for brief maneuvering and to provide insurance against a bungled landing attempt on the return to earth. Second, there's no oxygen in space to kindle the flame. Third, the motors won't be running, which means no pumps to spray fuel out of a leaky connection, and no working parts to start a fire even if there is a flow of fuel.

If decompression and fire are both unlikely—and easily manageable when they do happen—what other dangers are there?

Helpless Without Electric Power

Electrical equipment can fail. If the equipment isn't duplicated on the rocket ship, the failure could cause serious trouble. Some of the navigator's most vital instruments are electrically operated, and could not be easily replaced in flight. If one of them suddenly broke down, the navigator might be almost totally unable to operate; he would have to depend on advice from the ground. But the radio is electrical, too. It could fail, halting all communication with the home base. Even under the most favorable circumstances, the navigator relies on some ground help for difficult computations; if he were deprived of this help, he could use only rough estimates for the exceedingly tricky navigational problems of space flight.

Or the electrically operated valves between fuel tanks and pumps could break down, stopping the motors.

Actually, motor trouble could be caused by many kinds of breakdown. Among the possible hazards of space flight, it falls in a major category of its own, posing problems something like those caused by fire.

If motor failure occurs during the first seconds after take-off—catastrophe. If it happens later during the ascent, the captain probably would jettison the stricken stage, pump out excess fuel and head in for a landing.

The most complicated situation occurs when the third stage is out in space and lacks the power to maneuver into a circular orbit around the earth. What happens then?

Eventually it would start back around the earth, pulled by gravity into a lopsided orbit, about 1,100 miles from the earth on one side and 60 on the other. On the low side of the orbit, the ship would drag briefly through the atmosphere, and that would slow it down slightly. After perhaps 24 hours, and a dozen round trips, it would be low enough so that the control surfaces would take hold in the denser air. The pilot might then be able to land the ship like an airplane.

During this long flight, the damage which caused the power failure could prove much greater than first believed, possibly bad enough to ruin any chance of landing. Other rocket ships would hurry to the rescue. They would be launched into the same orbit, their departures timed with scientific care to enable them to overtake the disabled vehicle. All the vehicles and their crews would be weightless in the uneven orbit, so it would be a fairly simple matter to transfer the men from the stricken craft to a rescue ship. Space-suited rescue crews would remove the crew members of the damaged rocket vehicle, capsules and all, through escape hatches, and would then carry the cylinders to the safety of the pressure cabins in their own craft.

But what if rescue is impossible? A rocket crew which found itself in a lopsided orbit would stay in the ship as long as possible, even if it began breaking up as it swept through the atmosphere. They would have little choice. Rocket expert Willy Ley estimates that crew members who bailed out would stay in the uneven orbit for almost three days; after the first half hour, they would be dead inside their capsules for lack of oxygen.

At best, bailing out of a disabled space vehicle is far more difficult than parachuting from an airplane. A man who jumped from a rocket ship at thousands of miles an hour would almost certainly collide with part of the vehicle. That would mean instant death. Suppose he was thrown free of the ship. At an extremely high altitude, he would die anyhow, and almost as fast—his lungs gasping for air, his body fluids set aboil by low pressure. Would a pressurized space suit save him? Only for the moment. Plummeting earthward, he would plunge into the dense atmosphere at terrific speed; the friction would toast him, scorch him and finally set his clothing furiously ablaze.

Then how would he bail out?

In the same emergency capsule he uses inside the cabin. A powder charge hurls him away from the speeding ship. As he tumbles through space, artificial atmosphere guards him from the dangers of low pressure. A light steel parachute steadies the

U. S. NAVY PHOTO

Ejection seat, similar in principle to escape capsule, being tested by Navy. Military services use ejection for bail-out from fast jet planes

Will the escape cylinder work in the upper altitudes? A similar capsule already has

capsule and brakes his speed as he enters the earth's envelope of air. Insulation keeps him cool. Just before he strikes the earth, a self-starting rocket jet cushions the landing. If he lands at sea, the capsule floats easily on the swells, and a radio signal beckons rescuers.

Suppose an earthbound third stage runs into serious difficulty at an altitude of about 50 miles, and it's impossible to land. The captain immediately slams the bail-out bell. Within seconds, the crew members have clapped shut their capsules. Once encased, they can operate the ejection buttons—and at a hasty signal from the captain, they do so. The powder charge hurls each cylinder free of the disabled ship, through a hatch. The opening is promptly sealed tight by a lid which closes automatically behind the departing capsule.

At the moment of bail-out, the rocket ship has been following a course which almost parallels the earth's curvature. The cylinders take the same course for several hundred miles before they start down, their progress slowed by a four-foot steel-mesh parachute.

As the capsule plows through the dense atmosphere, it begins to glow, and soon it becomes red hot. Inside, the crew member is protected by glass-wool insulation, and by lumps of solidified air, which has been frozen at a temperature of 363 degrees below zero F.

Approaching the earth's surface, the capsule falls at a rate of 150 feet per second. That's too fast; a man striking ground at that speed probably would be killed. But 150 feet off the ground, a proximity fuse sets off a small rocket in the foot of the capsule; the blast of the rocket slows the rate of fall, and the landing is fairly gentle. It's especially gentle if it occurs in the ocean, and rocket-ship captains who have the choice will attempt to bail their crews out over water.

Equipment in the bottom of the capsule serves as ballast and gives the cylinder stability in high seas. An automatic radio system guides rescue boats to the floating tube. A release catch opens the capsule's portholes, to let air in.

The emergency capsule will be used only rarely for escape. When they can, the crews will attempt to bring damaged ships back to land, and usually it will be perfectly practical to do so. Not only will emergency landings save many millions of dollars' worth of machinery and equipment—they will also protect the crew members from certain hazards of capsule bail-out.

For example, a man who ejects his capsule from a rocket ship which is speeding earthward at too steep an angle might be killed by the jarring impact of his collision with the atmosphere, or by the tremendous friction heat. Wherever possible, the captain will pull up his injured ship, so the crew members will be cast out at an angle which will permit them to enter the atmosphere gradually.

Then suppose the capsule, instead of landing in water, strikes down on solid ground. The touchdown will be gentle, but the man inside could be badly shaken up as the big tube flops over on its side. Or suppose it lands on a mountain, or on the roof of a house, and goes tumbling down the side?

Those landing risks will be extremely slight, statistically. Yet they'll worry the crew members. So will the possibility of equipment failure within the capsule. So will almost everything else about the cylinder.

The mental hazard will be one of the most important deterrents to the use of the capsules for bail-out. They will be psychologically offensive: coffinlike, cramped, stuffy and uncomfortable. The men inside them, once ejected from the ship, will be completely helpless. It will be a horrible feeling.

RALPH ROYLE

Monkeys Pat and Mike (shown with Lt. Johnie Reeves and A/1c Marshal Ross) went to 35-mile altitude in rocket like one in photo, were safely ejected in capsule

Two mice traveled with monkeys in rocket, were photographed while experiencing weightlessness (below, left) and again as their weight returned on the way down

U. S. AIR FORCE PHOTOS

Saga of Two Monkeys—Pat and Mike

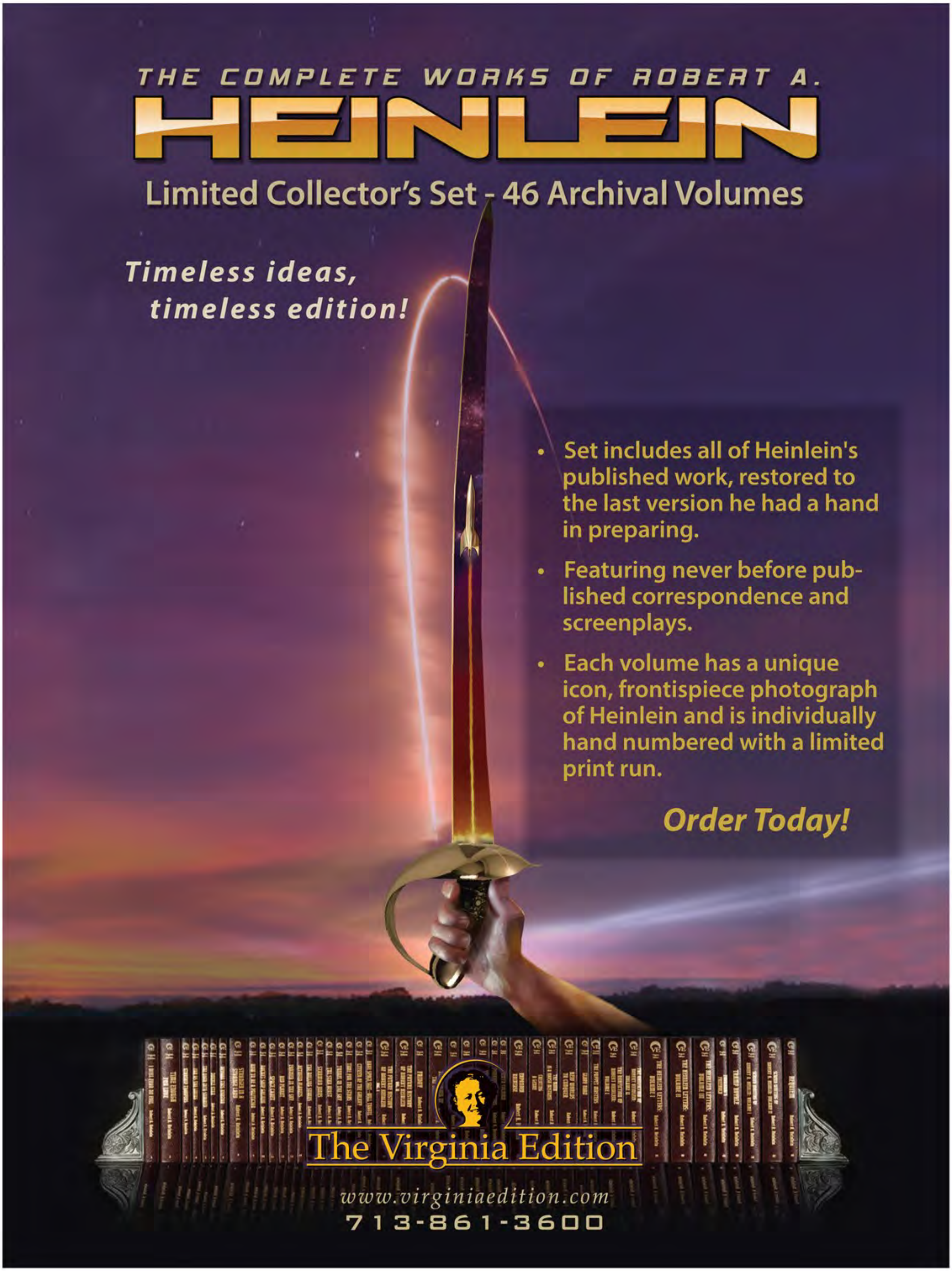
But the capsule *will* work when nothing else does. In fact, it has worked—at least, a capsule very much like it has.

Last May, two monkeys were sent to an altitude of 35 miles aboard an Air Force Aerobee rocket, at a speed of 2,000 miles an hour. The animals, named Pat and Mike, were seated in the projectile's nose, which was triggered to break away shortly after the rocket started back to earth. The nose capsule, with the monkeys slightly anesthetized to keep them from becoming excited, broke loose on schedule. It hit a peak speed of 1,000 miles an hour before a parachute (serving the same purpose as the steel-mesh umbrella on the man-sized capsule) broke the fall. The breaking impact was equal to about five times the monkeys' normal weight, but they were unharmed. They drifted safely back to earth, and are still alive and healthy (so healthy that they're too big to get into the capsule now).

The test, conducted by a team of biologists and engineers headed by Dr. James P. Henry, Air Force physiologist, proved the practicality of escape by capsule, and gave scientists other information about space travel as well. Both the monkeys and a couple of mice, who also were passengers in the capsule, experienced weightlessness for about two minutes, with no ill effects. They also endured an acceleration shock at launching far greater than that man will experience: they were flattened by a force 13 times their own weight, compared with the ninefold weight increase man can expect on his journeys spaceward, and the tenfold pressure he might feel as a capsule smashed into the atmosphere.

Pat and Mike were among the first living visitors to the extreme altitudes. The two creatures briefly experienced all the major difficulties of space travel—acceleration pressure, weightlessness, life in an artificial atmosphere. Nothing bothered them. Many more animals are sure to be rocketed into the earth's newest frontier.

After them will go the men.



THE COMPLETE WORKS OF ROBERT A.
HEINLEIN
Limited Collector's Set - 46 Archival Volumes
Timeless ideas,
timeless edition!
• Set includes all of Heinlein's published work, restored to the last version he had a hand in preparing.
• Featuring never before published correspondence and screenplays.
• Each volume has a unique icon, frontispiece photograph of Heinlein and is individually hand numbered with a limited print run.
Order Today!
The Virginia Edition
www.virginiaedition.com
713-861-3600

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.

To read more visit www.virginiaedtion.com

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.

The Virginia Edition

The Virginia Edition represents authoritative texts for all of Robert Heinlein's published fiction and nonfiction, newly typeset, whenever possible from the editions put in final form by Heinlein's own hand. In other cases, the definitive texts are represented by editions restored to their intended state, in publications overseen directly by Virginia Heinlein after her husband's passing. Mrs. Heinlein's role in perpetuating her husband's work and legacy was at all times crucial, both during and after the writing. It is truly fitting that her name be remembered in close connection with his.

Robert Heinlein and Virginia Gerstenfeld late fall 1947. Permission by Robert A. and Virginia Heinlein Prize Trust.

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."

To read more visit www.virginiaedtion.com

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

The American Institute of Aeronautics and Astronautics

Above: The late James C. McLane, Jr., is shown at left in this photograph of February 16, 1965. This is the Space Simulation Working Group. This was the second gathering of this organization whose annual technical convention continues to this day. The group now includes representatives from eight countries. Image credit: James C. McLane, III. James C. McLane, Jr. was our 1971-1972 AIAA Houston Section Chair.

AIAA Mission & Vision Statement

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

The World's Forum for Aerospace Leadership

Become a member of AIAA!

You can join or renew online at the AIAA national web site: www.aiaa.org.