Horizons

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Issue 2

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

September / October 2012
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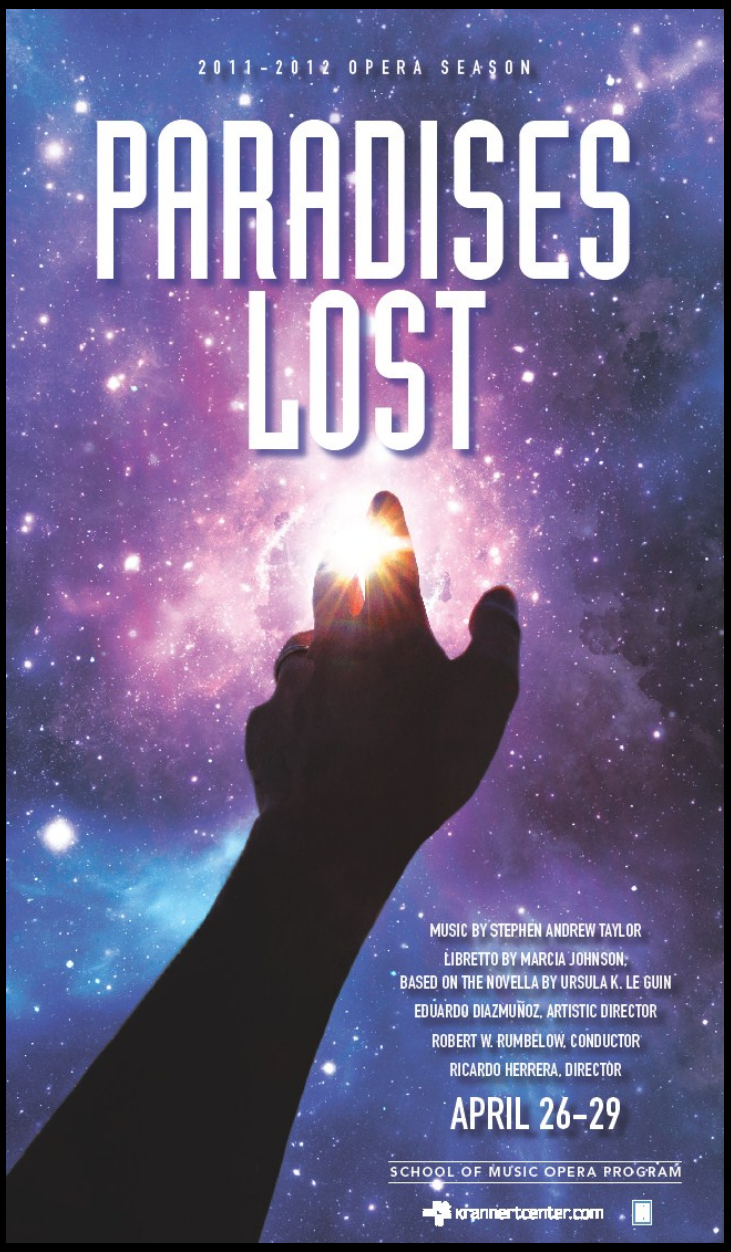
100 Year Starship
The 2012 Public Symposium



Left: An opera based on Ursula K. Le Guin's generation starship novella

Also, Continuing in this Issue! Part 2 of 8:
***Man Will Conquer Space Soon!* (Collier's 1952-54)**

September / October 2012
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Horizons is a bimonthly publication of the Houston Section of The American Institute of Aeronautics and Astronautics.

Douglas Yazell, *Editor*
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Cover: Poster for the Paradises Lost opera. Image credit: Jan McCracken, Senior Graphic Designer at Krannert Center. The 100YSS logo and mark: Image credit: Douglas Yazell. This page uses part of Vincent van Gogh's 1889 painting The Starry Night (Wikipedia).

A Great Year for Our Section Continues

From the Chair

DANIEL NOBLES, CHAIR

The NASA values consist of Safety, Teamwork and Integrity in support of mission success. We commit without compromise to embodying our core values in all that we do. To realize these values, we have defined a set of supporting behaviors for the contractors and civil servants that comprise the JSC community. Everyone in the JSC community is expected to demonstrate these behaviors every day.

Be respectful - demonstrate consideration or appreciation. We respect ourselves and each other.

We appreciate the creativity and broader perspective of a diverse team. This diversity is vital to our success. Ask yourself:

1. Do I actively solicit contributions from the people I work with, regardless of their badges or roles?
2. Do I use the term "team" more than the term "I?"
3. Do I treat others as I wish to be treated?
4. Do I share accolades in public and constructive criticism in private?
5. Do I accord others the benefit of the doubt and understand a situation before responding?
6. Do I value all constructive input and use this to make a decision?
7. Do I credit others for their work?
8. Am I aware of non-verbal cues, whether my own or others?

Be trustworthy - act with integrity and honor. Our success is built on an environment of trust and ethical behavior. We exhibit sincerity and truthfulness in all actions. Ask yourself:

1. Do I keep the people I work with apprised of my progress?
2. Am I honest in my assessments?
3. Do I communicate fully and openly?
4. Am I true to my word and do I honor my promises?
5. Do I present a calm presence even if the news is bad?

Be accountable. Be answerable and responsible for your actions. We are personally answerable for fulfilling our individual and team commitments. Ask yourself:

1. Do I consistently deliver my work as I have promised?
2. Do I willingly and gracefully accept well-meaning feedback?
3. When resolving a problem, do I consider how my actions contributed to it?
4. Do I emphasize face-to-face communication over email?
5. Do I confirm that my message has been received as intended?
6. Do I purposefully plan what information to communicate and how best to do that?

Be open-minded - be receptive. We seek knowledge that will strengthen our team and ourselves. Ask yourself:

1. Do I look for innovative ways to address challenges?
2. Do I look inward for areas of improvement?
3. Do I actively seek honest discussion and feedback, particularly if a situation is unfolding?
4. Do I help others to learn and improve?
5. Am I constantly striving towards my team's success?
6. Do I seek opportunities to celebrate team success?
7. Do I offer constructive alternatives, observations and dissention?

Effective communication is a crucial ingredient to practicing these behaviors daily. Communication is a two-way process that requires us to listen and understand at least as much as we speak. We openly share information and knowledge, focusing on quality, not quantity.

Brought to you by the JSC Joint Leadership Team: http://jlt.jsc.nasa.gov/

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(Daniel A. Nobles)
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https://people.nasa.gov

The JSC Expected Behaviors are taken from JSC Today, the daily e-mail note addressed to JSC civil servants. Sometimes, as in this case, the notes are addressed to the entire JSC family. Though AIAA Houston Section reaches out to airlines, Texas A&M University, Rice University, UH (and UHCL), the 1940 Air Terminal Museum at Hobby Airport and more, we would not exist without NASA/JSC. These September 2012 NASA/JSC expected behaviors are guidelines for our Section, too.

We had two very successful happy hours so far this year, the first at Cabo and the second at Cullen's. Attendance at the first one was a bit more than 25 people. Keep up the good work!

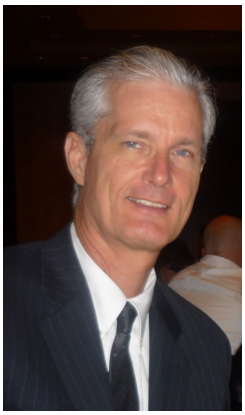
Daniel A. Nobles

Above: The space shuttle Endeavour, atop the Shuttle Carrier Aircraft, flies over the Johnson Space Center, Houston, prior to its landing and stopover at nearby Ellington Field on Sept. 19, 2012. Image credit: NASA

From the Editor

The 100 Year Starship & AIAA Section Awards

DOUGLAS YAZELL, EDITOR



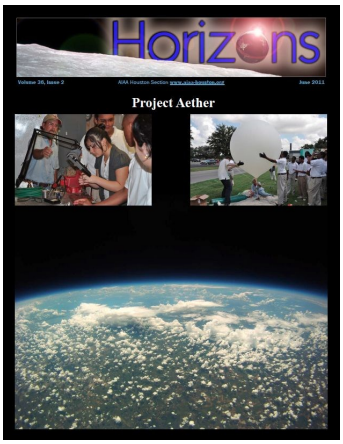
Shen Ge and I were fortunate to have press credentials (free registration) for all 100 Year Starship public symposium events in Houston, September 13-16, 2012, except for the two evening events, and I received a last-minute discount for those two events, using my own money.

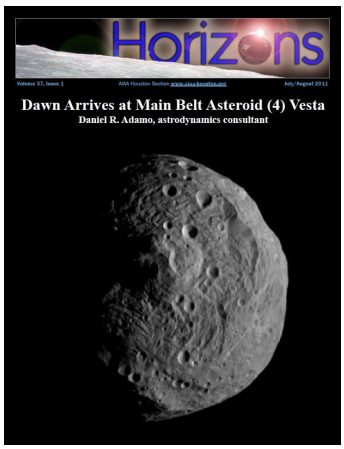
In September 2012 AIAA announced the winners of Section awards in about seven categories, such as Communications (newsletters, web sites and more). Congratulations to all of the winners, especially to the winners of the Communications award! Thanks to our Horizons team and contributors for our great year with six bimonthly issues for the year ending May 31, 2011.

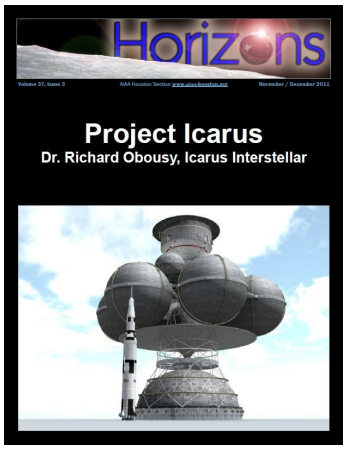
In response to the request from our Section Chair, I e-mailed a report to him prior to May 31, 2011, nominating our Horizons team for the Communications award. Once the winners were announced in September 2012, I learned that our Section Chair submitted the required annual report for our Section but no nominations for any Section Awards!

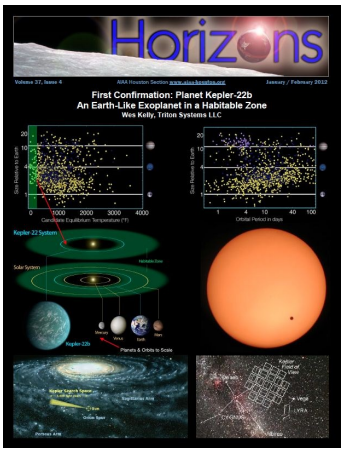
Only the Section Chair can submit those nominations, but a mistake of this magnitude requires a team! For example, I could have done more to help him with this.

Below are the six cover images for the issues not nominated. Let's start a tradition of reviewing them in this manner every year at this time, no matter what the results of the Section awards.









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For a Horizons archive on a national AIAA web site click here.

Submissions deadline: October 10, 2012, for the September / October 2012 issue, to be published by October 31, 2012.

Links:

Horizons archive:
https://info.aiaa.org/Regions/SC/Houston/Newsletters/Forms/AllItems.aspx

Advertising

Please contact the editor about rates for quarter-page, half-page and full-page ads.
E-mail: editor2012[at]aiaahouston.org
This issue contains quite a few examples of advertising (complimentary ads for team members).

Right: Astronauts for Hire (www.astronauts4hire.org) published their third quarterly newsletter.

100 Year Starship Public Symposium

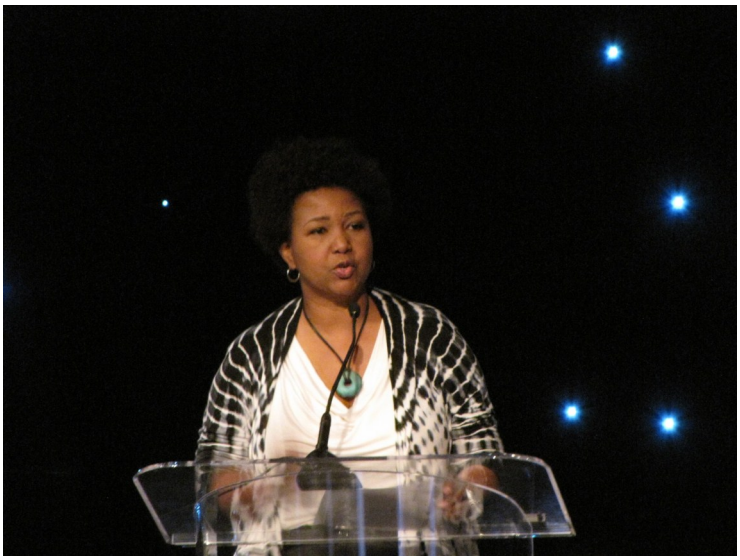
Cover Story

DOUGLAS YAZELL

The 100 Year Starship (100YSS) came to Houston (The Hyatt Regency Hotel in downtown) September 13-16, 2012, for its public symposium. The first 100YSS public symposium took place September 30 – October 2, 2011, in Orlando, Florida. After that first event, a team led by Mae Jemison, MD (a former astronaut who flew on the space shuttle, had a cameo appearance on Star Trek: The Next Generation, and was the first woman of color to fly in space) won the $500,000 to make this capability appear within 100 years without additional money from the Department of Defense (DoD) Advanced Research Projects Agency (DARPA) and NASA/Ames. The mission is usually stated as sending people to another star system within 100 years, by 2112. Sometimes it is stated as ensuring those capabilities exist to support any team that takes the initiative. They plan to send people, not virtual reality, not people in frozen sleep, and not people in Petri dishes who can be reconstituted once they reach their exoplanet destination. A one-way trip seems to be the default, so a generation ship might be used. Imagine a crew spending 40 or 50 years on a starship.

The first scheduled public symposium was required of the winning team for late 2013, but DARPA requested a public symposium in late 2012, so other 100YSS activities experienced schedule delays as this 2012 event was prepared. The 2013 public symposium is penciled in for the same hotel a week earlier in 2013.

Left: Houston Mayor Annise Parker, Texas Honorary Chair for this 100YSS event. Image credit: Douglas Yazell.



Left: Mae Jemison, MD, Chair for this 100YSS event. Image credit: Douglas Yazell.

A new logo was unveiled. It features the star Canopus, the second brightest star in the night sky, a star used for navigation along with the Sun by deep space probes. Speaking of space probes, Star Trek was mentioned often during this event, with good reason, given the popularity of Star Trek. Nichelle Nichols and LeVar Burton were featured guests, and they did not disappoint! Nichols played the role of Communications Officer Uhura in the original TV series (1966-1970) and occasional sequels, and LeVar Burton starred in the TV series Star Trek: The Next Generation (1987-1994), playing the role of Geordi La Forge, Chief Engineer. As a video of the launch of STS-1 was shown during the Friday plenary session, Nichelle Nichols started vocalized the wordless tune from the original TV show's theme music. The program document has a long paragraph about her actor/singer/dancer/activist career.

The song Starships by Nicki Minaj was played often during our event introductions, but

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100YSS

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only short clips.

During a presentation about space law by Dona Dulo of Icarus Interstellar, Jill Tarter (www.SETI.org, The Search for Extra-Terrestrial Intelligence) asked about rights of alien species.

Megan Kane stated, "The real value (what matters to people) is what they get out of it that is not money." Her presentation was titled, "Profit-Money or Knowledge," with co-authors Brian Kane and Gary Gilbert. She cited four reasons for such a mission, survival, survival, science and an orbital (a space) economy.

During this presentation, Jill Tarter mentioned that the NASA Kepler mission team might announce the existence of a "new Earth" within a year. That would be a exoplanet about the size of the Earth, not four times that size, like Neptune, in a habitable zone, as defined by temperature. That presentation track was called Becoming an Interstellar Civilization.

Dr. Joe Ritter of the University of Hawaii chaired the track called Destinations and Habitats, and he generated a lot of excitement. Joe mentioned the Open Source Starship Alliance (OSSA), and he later introduced Jerry Istell of Space GAMBIT, a man working with the hardware side of open source, the maker movement. Jerry's team did not win the $500,000 for their 100YSS proposal, but he won $500,000 from DARPA to continue his hardware work. He mentioned a magazine available on the internet and in print called Make (http://makezine.com).

Jason Batt and Alvin Carpenter made presentations regarding religion in a track chaired by Ian O'Neil, Becoming an Interstellar Civilization. Jason spoke very well with surprising skills in various professional areas. Hannah from SpaceUP Houston asked, "My background is psychology. How do we react in the presence of those who lose their faith on the starship? It is a profound loss. Assume they are in space and concluding, 'My faith is wrong.' " Jason Batt answered by speaking about religious pluralism and crises such as those experienced by police who become atheist after seeing the results of horrible crimes.

Alvin Carpenter was very surprising. His comments included something to this effect, "I speak as an evangelical. Our job is coercion. We drove many to suicides with our policies about gays and lesbians. Religion barely functions on Earth. Earth is big enough to absorb it. Scientists are naïve about us. Religion thinks you will burn for not accepting Jesus. No chance of repentance. There is no friendly relationship. Scientists are the worst enemy of the Church. They contradicted the Church about the age of the Earth. And then they had the gall to prove it! No historian was ever inspired by history to join Christianity. We from our church will want to come. Will have money. We are killing the planet with our religions. Religion must not be allowed on the starship."

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Right: Actor/producer LeVar Burton (Roots, Star Trek: The Next Generation, Reading Rainbow) is a member of the 100YSS advisory council. Image credit: Douglas Yazell.

Right: At left: Master of ceremonies Linda Lorelle. At right, special guest Miles O'Brien, veteran freelance broadcast and web journalist (space, aviation, science & technology). The space shuttle model was a surprise gift for Mr. O'Brien. Image credit: Douglas Yazell.

(Continued from page 6)

On Sunday morning, Dr. Mae Jemison reminded us of the tagline, "Look up!", and the tagline, "We believe that pursuing an extraordinary tomorrow will create a better today."

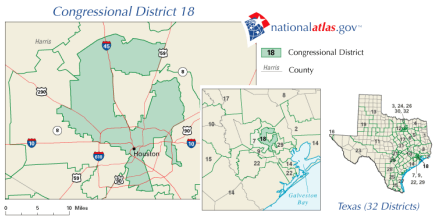
In summarizing the tracks, Dr. Eric Davis mentioned that Dr. Gerald Cleaver (Waco, Texas) talked about collecting a lot of antimatter from the vacuum of space. Track chair Dr. Joe Ritter stated that in two years we will be analyzing the atmospheres of exoplanets. He also spoke of the NASA Sunjammer mission, and Houston resident Louise Riofrio's great presentation that included capturing a black hole. A woman commented about the track hosted by Amy Millman and Dan Hanson, "Sometimes when a (starship) person is suffering from isolation, a second person is paired with that person in order to relieve the isolation, but both people end up suffering from the incapacitating feeling of isolation."

Dr. Mae Jemison mentioned Q in Star Trek: The Next Generation. They battle the Borg. Captain Picard finally asks Q for help. Q returns them to a safe space. Picard is angry because some of the crew died. Q replies, "You must take your bloody nose. There are temptations here to satiate your desires, both sublime and gross. Space is not for the timid!"

Papers and presentations are planned for the new web site once it is up and running in six to eight weeks.

It was an impressive event with emcee duties often provided by Houstonian Linda Lorelle and CNN science reporter Miles O'Brien. An excellent winning team is off and running, incorporating quite a few people who proposed but did not win the 100YSS competition of 2011. Aim high!

Left: Left to right, Congresswoman Sheila Jackson Lee, US Representative for the 18th Congressional district of Texas, and Mae Jemison, MD, Chair of this 100YSS event. Image credit: Douglas Yazell. District map: Wikipedia.



Left: Mae Jemison, MD, Chair of this 100YSS event. Image credit: Douglas Yazell.

100YSS

The 100 Year Starship in Houston: Editorial

SHEN GE, CONTRIBUTOR

The 100 Year Starship (100YSS). What a grand name and correspondingly, what a great expectation! I was looking for a concrete 100YSS plan and answers to the question of how to raise capital. In this case, the concept was to create an organization and to develop the capability to go to a star in a century. An ambitious goal! DARPA made a one-time award of $500,000 to the winning team. That will not go far, and the winning 100YSS team is required to find its required income elsewhere. Unfortunately, at the conclusion of the two and a half days, I was slightly disappointed with unanswered technical and financial questions.

Don't get me wrong. Aside from the overly played Nicki Minaj song, Starships, the conference was stellar (pun intended). There was an interview with the Star Trek actress Nichelle Nichols, another interview with Star Trek actor and Reading Rainbow narrator LeVar Burton, a talk by SETI co-founder Dr. Jill Tarter, and presentations of paintings by a Chinese calligraphy artist from Beijing, just to name a few. The emcee duties were often provided by award-winning journalists Linda Lorelle and Miles O'Brien in addition to Dr. Mae Jemison, who heads the winning 100 Year Starship team.

On opening night, a young enthusiastic Ecuadorian named Juan R. Robalino, who currently goes to University of Vienna studying physics and mathematics, handed me a flyer detailing the Institute for Interstellar Studies, a recently founded organization started by interstellar physicist Kelvin Long. Juan also happens to be one of the few student researchers of Icarus Interstellar. There were also many Icarus Interstellar scientists and engineers at the conference who have been working in collaboration with the 100 Year Starship.

On the first full day of the symposium, I attended a few talks on warp drives and propulsion. I found the opening talk by Dr. Richard Obousy, CEO of Icarus Interstellar, and the warp drive experiment talk by Dr. Harold "Sonny" White, NASA JSC Eagleworks Laboratories head, to be quite interesting and technically understandable. For lunch, I attended the invitation-only DARPA 100YSS proposal teams lunch. With about ten teams

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Right: From left to right: Dr. Mae Jemison, Saturday evening panel moderator (Accelerating Creativity... A Celebration), Dr. Johnnetta B. Cole (Anthropologist and Director, Smithsonian National Museum of African Art), LeVar Burton (actor/producer, Roots, Star Trek: The Next Generation, Reading Rainbow), Benjamin Palmer (co-founder and CEO, The Barbarian Group) and Dr. Linda Wetzel (philosopher and Professor at Georgetown University). Image credit: Douglas Yazell.

(Continued from page 8)

present, lunch was cozy. A representative from each team was given a few minutes to speak about their vision for 100YSS. There was Jeffrey Nosanov, a 2012 NASA Institute for Advanced Concepts (NIAC) Fellow from NASA JPL. There was Alex Wong of Global Space Commons. There was Marc Cohen, a space architect and recent NIAC proposal recipient for his company Astrotecture.

At the plenary session, Dr. Karl Aspelund presented an interesting talk on doing laundry and storing clothes in space. At Icarus Interstellar's Project Bifrost following, I learned that the current largest obstacle in nuclear space propulsion is political and that the plan for the 100YSS project will require less nuclear material than Curiosity or Cassini. I then listened to a talk on space law and how it is inadequate for an interstellar mission.

I attended a talk by Jim Cavera, a Senior System Engineer at AIM-USA, who presented a talk on the advantage of fusion over other devices. He was not joking when he recommended that people looking to do fusion research can work on it in their own garage. Anyone can build a nuclear fusion device in the garage for less than $10,000. He also cautioned that anyone with decent mechanical skills can build the dense plasma focus engine in a garage but you need to be careful with X-rays that can kill you.

The first full day's evening was concluded by the NASA JSC 50 Year Anniversary where a number of NASA JSC employees attended and several NASA JSC administrators and astronauts were interviewed by Miles O'Brien.

The next day I attended the life support track. Librarian Heath Rezabek presented a Vessel Archive concept as a self-enclosed habitat here on Earth. Political philosopher Gabe Terasem presented on the Seasteading Institute, which wishes to establish colonies in the ocean. The Seasteading Institute recently received a donated ship from which they can do some initial work. I was intrigued by the amazing pictures that Heath Rezabek presented. I ate lunch with him to learn more about how he plans to make this happen. He started the concept a month ago, so it is a long road ahead, but he's determined to make it happen.

The plenary talk after lunch was memorable. Dr. Jill Tarter, the co-founder of SETI, presented on the institute famously represented in the movie Contact. She gave us some memorable quotes:

- "SETI is the archaeology of the future."
- "In physics, if you find one you don't know whether it's unique. If you find two, you know it's many."
- "I think our imagination is very limited."

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Left: Zhang Wenxiang, one of the most famous living calligraphy artists in China (PRC). He is explaining what he painted during the Saturday night dinner. At left is the master of ceremonies, Linda Lorelle, and at right is the lady serving as translator. The scroll he is pointing to has lobsters at the bottom, which in Chinese literally means "dragon shrimp", with "dragon" being the symbol of auspiciousness and power in Chinese culture. The other scroll has the giant character "dragon" at the bottom reaching out to the stars. Image credit: Douglas Yazell.

100YSS

(Continued from page 9)

SETI has undergone a turbulent history over the years with funding cuts and legal blockades. Yet Dr. Tarter and SETI researchers remain optimistic and have succeeded in securing funding for the Allen Telescope Array (ATA-42), as well as getting public involvement through the recently introduced SETILive (http://setilive.org).

In the afternoon, I attended several interesting talks on new technology, including a presentation about a superconductor magnet device by Dr. Philippe Masson of the University of Houston. It can deflect space radiation. Another proposal was for a beamed power device by presenter Richard Dickinson of Off Earth-WPT (Wireless Power Transmission). SPEC Innovations CEO Steven H. Dam (SPEC: Systems and Proposal Engineering Company) talked about the need to use stepping stones to ensure that space businesses will be profitable. He said, "The government doesn't make money. The government takes money. When the government prints more money, that's called inflation." He suggested taking stepping stones with different levels of investment for each. This is not to say that progress along multiple stepping stones cannot happen at the same time; rather, the returns versus risks to investors are much easier to justify for the beginning stepping stones. The stepping stones are:

1. High-altitude tourism
2. High-altitude tourism and debris collection
3. LEO Habitats
4. LEO Hub and Moon Base
5. Permanent Lunar Habitation

I next listened to some education talks. Lee Woolridge of TrailBlazer Technologies, LLC presented some interesting statistics. For instance, the majority of Americans (60%) does not think our space program is a waste of taxpayer money, but they are not convinced that more funding is needed. Jason Matt, a social media guru, talked about how to create good social dynamics and communities on an interstellar world ship. Crew size and social facilitators and hindrances should be considered. The idea of sociomapping to identify areas where social interactions happen like a heat map was one interesting technique.

At the special dinner that night, I was disappointed by the panel discussion. There was not one engineer or scientist with the exception of Dr. Mae Jemison, the moderator. Though diversity of backgrounds is definitely good, it is not good when the three panelists have almost no knowledge of space. But one panelist (Dr. Cole) said something memorable, something the 100YSS needs to place at the top of its priority list, "Most of all, we better go find ourselves some money!"

Right: Zhang Wenxiang, one of the most famous living calligraphy artists in China (PRC). At left is master of ceremonies Linda Lorelle. At right is the lady serving as translator. The work of art on the left expresses Chinese-American friendship. The work in the center held by the artist expresses a common Chinese proverb, "10,000 things as you wish." Image credit: Douglas Yazell.

Below: President Bill Clinton, Honorary Chair for this 100YSS event. Image credit: Douglas Yazell.

Paradises Lost, the Opera

100YSS

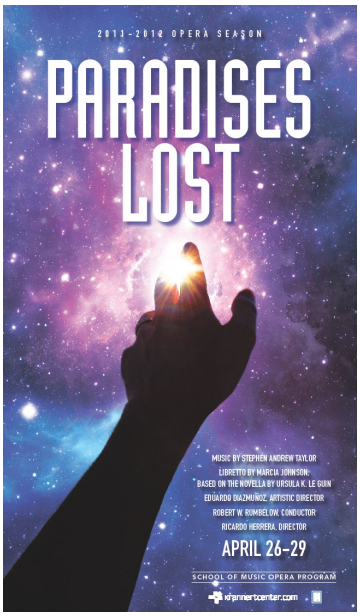
DOUGLAS YAZELL, EDITOR

One of the presentations at this 100YSS 2012 public symposium was Paradises Lost, the Opera, by Stephen Andrew Taylor. Here we present additional information from his web site. The full premiere took place at the Krannert Center for the Performing Arts, Urbana, Illinois from April 26-29, 2012.

Paradises Lost
opera in two acts

based on the novella by Ursula K. Le Guin
from the story collection The Birthday of the World
commissioned by the University of Illinois

music by Stephen Andrew Taylor
libretto by Marcia Johnson



Above: Image credit: Jan McCracken, Senior Graphic Designer, Krannert Center.

Plot Synopsis

What happens when you spend your whole life—entire generations—traveling toward a goal until the endpoint becomes otherworldly and unattainable? As voyagers on the starship Discovery are born and live their lives on a trip to colonize a distant planet, their metal-encased world becomes more tangible to them than Earth, which they have never seen. Hsing and Luis know that the ship's ultimate destination lies in the hands of future generations, but the followers of Bliss—a religion emerging from their cocoon in space—believe that they should remain inside that spaceship heaven for eternity. In this world premiere, a star-faring adventure transforms into an inward journey of conflict and turmoil.

Paradises Lost, a 2002 science fiction novella by Ursula K. Le Guin, tells the story of the Discovery, on a 200-year voyage to explore and colonize a planet known as New Earth, or Shindychew. The ship is almost perfectly self-contained and self-sustaining, and life aboard is lively and comfortable. Hsing and Luis, members of the fifth generation, born during the voyage, know no other life, no other world. They see their purpose as keeping things going till the ship lands, many years from now. They confront the followers of Bliss, and plots arise on both sides: those who want to land on the planet and those who want to travel through heaven forever, in Bliss. When the voyage is unexpectedly shortened, conflict becomes crisis.

Two video clips from the production at Krannert Center for the Performing Arts, April 28, 2012. Robert W. Rumbelow, conductor; Ricardo Herrera, director; Regina Garcia and David Warfel, stage and lighting design. In this performance, Luis is played by Joe Arko; Hsing, JooYoung Bang; Rosa, Yaritza Zayas; Tirza, Samantha Resser.

Above: The opening of the opera depicts life aboard the Discovery, which left Earth a century and a half ago. For the 4000 travelers, Earth is history. But even in a completely foreign environment, life for them in some ways is the same as it is for us.

Links: http://youtu.be/BuWr5RUyCQc,
http://youtu.be/sXypOzyMphM

Above: Hsing and Luis say goodbye to Rosa, who has decided to remain on the ship with the angels. They land on Shindychew. Part of what I wanted to depict in the opera was this: how you would feel seeing the sun, feeling the wind, for the first time in your entire life? It's a shock for which the travelers are profoundly unprepared; but, as Luis sings in an aria, they find beauty as well as terror.

Lunar EVA

Lunar Surface EVA Route Selection Optimization

YVONNE VIGUE-RODI, ADELANTE SCIENCES CORPORATION

Figure 1: Astronaut John Young Collecting Lunar Samples During an Apollo 16 EVA at Plum Crater. Image credit: NASA.

Although America's manned missions to the moon ceased in 1972, scientific researchers around the world continue to be moonstruck. An international resurgence continues in the desire to return humans to the moon, to gain further understanding of the moon's natural resources, and conduct geophysical research. During the last three Apollo missions, NASA astronauts spent a total of 213 hours on the Lunar surface, exploring and navigating lunar rovers a total of 41 miles – reminding us that there is still so much more to explore and understand. New technologies and advanced innovations have been developed over the last 40 years since the last time humans walked on the moon, and these can enable the next generation of exploration vehicles to be lighter, stronger, more efficient, and hopefully safer for all explorers.

Future manned missions will require extensive risk analysis, planning, and optimization which must consider many factors regarding crew safety and limited resources such as power, fuel, and communications. Upon reaching the lunar surface, astronauts face the challenge of executing a productive mission safely and efficiently within time and resource limitations. To pursue these goals, optimized route selection of lunar surface astronaut and rover paths has been performed using a Genetic Algorithm-based approach. Several examples of optimized exploration paths have been generated using cost functions containing distance traveled, surface slope, and terrain keep-out zones. Other constraints could include maximum path length, travel time limitations, maximum surface slope, power consumption, keep-out zones such as steep-sloped craters, daylight / darkness, or other time-varying conditions such as line-of-sight for direct communications with the Earth, a base camp, or a passing satellite. The slope of some lunar terrain can be an exploration hazard to the astronauts conducting EVAs in protective spacesuits with limited visibility and mobility. An excellent illustrative example of lunar surface terrain hazards are visible in the NASA photo in Figure 1 showing astronaut John Young during the Apollo 16 mission on a Lunar EVA (Extra-Vehicular Activity) exploring and collecting lunar samples near Plum Crater.

To address the surface exploration risk challenges, optimized route selection of lunar surface astronaut and rover paths has been performed by Adelante Sciences Corporation (ASC) using a Genetic Algorithm-based approach. Genetic Algorithms (GA) are a class of highly-adaptable optimization approaches used by ASC in a number of applications. A GA is a computer program that finds a near optimal solution by mimicking the evolutionary concepts of Charles Darwin. A given problem solution is characterized by a chromosome and is compared against rival solutions within a solution population. The best performing solutions are permitted to survive to the next generation, and to breed and yield offspring that are also compared. A near optimal solution is quickly reached by application of the "survival of the fittest" filter over a number of generations. (Hence the method's name *Genetic Algorithms*.)

Experience has shown that GAs are very adaptable and can quickly find a near optimal solution. A broad range of constraints and cost functions can be incorporated. GAs can be employed both strategically (e.g. mission planning) and tactically (e.g. real time routing) and have proven to be far more flexible than other optimization approaches. The answer to the optimization problem is decoded from the best chromosome. Each chromosome is a series of bits and represents one member of a solution population. For EVA routing problems the chromosome could include details such as the safest route an astronaut takes in a hazardous terrain environment. For this problem, constraints are included by not permitting certain chromosomes from existing in the population. Also solutions that include locations that exceed permissible limits would not be permitted. Each solution is evaluated via a cost function, which can include a wide variety of economic (e.g. equipment/ personnel resources, critical schedules, lighting/daylight/ darkness, etc.) and non-economic (e.g. personnel skill

(Continued on page 13)

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level, risk) factors.

Many are familiar with the classic Traveling Salesman Problem. Examples of other related unit-problems include: (1) Individual/Closed Traveling Salesman Problem where constraints include starting/ending at the same city while visiting each city once with a cost function of minimizing total distance traveled and (2) Group/Open Traveling Salesmen Problem where the constraints include everyone starting/ending at the same city while visiting each city only once with a cost function of minimizing total distance traveled. Many examples exist in industry and the military including: computer network job leveling, airline/truck/railroad dispatching, military route/tactical planning, and autoracing pit-stop refueling strategy. Adelante Sciences Corporation's approach is to create a GA-based solution optimization methodology that leverages advances in route planning optimization techniques from the airline/trucking/railroad industries to generate optimized route selection plans for the astronauts on EVA.

The process of applying the GA-based route optimization approach to the Lunar EVA route planning problem begins with defining the operational area of interest. In this example problem, we have one lunar rover ground vehicle attempting to reach a destination. We assume that the available territory includes open terrain, steep craters, boulders, sand obstructions, and elevation changes. All of these features can be modeled as part of the cost function.

As a first example, the cost function to be optimized can begin by looking at the topology of the area to be explored. Figure 2 shows a sample lunar surface terrain with craters of varied depths/slopes, and a rover vehicle trying to return to base camp (Figure 2(a)). The color contour plot on the right (Figure 2(b)) shows craters of varied diameters, depths, and slopes, with the darkest blues representing the deepest craters with the steepest slopes, which can be serious terrain hazards for astronauts on EVA. The higher terrain is colored in the yellow-orange-red. In this example, steep terrain is to be avoided so both the altitude of a given location and the slope of the local terrain can be included in the cost function.

For illustrative purposes, the first case for consideration is shown in Figure 3. This case minimizes the cost function "distance" to optimize the route which minimizes distance traveled between base camp and the destination with 10 intermediate way points. In this figure, the waypoints are visible by the small black circles, while the starting and ending points are marked by small black "x's". This example does not include the risk of craters of any size, depth, or slope steepness, thus yielding a direct route as expected, showing the shortest distance between the start and end points. This simplified example shows that the optimization process is functioning properly.

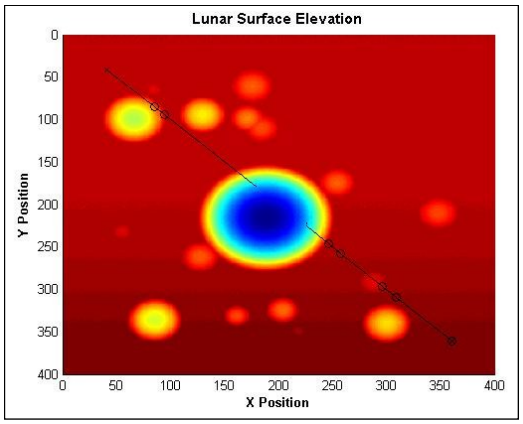

Figure 3: Case #1 - Lunar Surface EVA Showing Direct Route

The second case employs the same lunar landscape terrain as presented in Case 1, but minimizes the cost function

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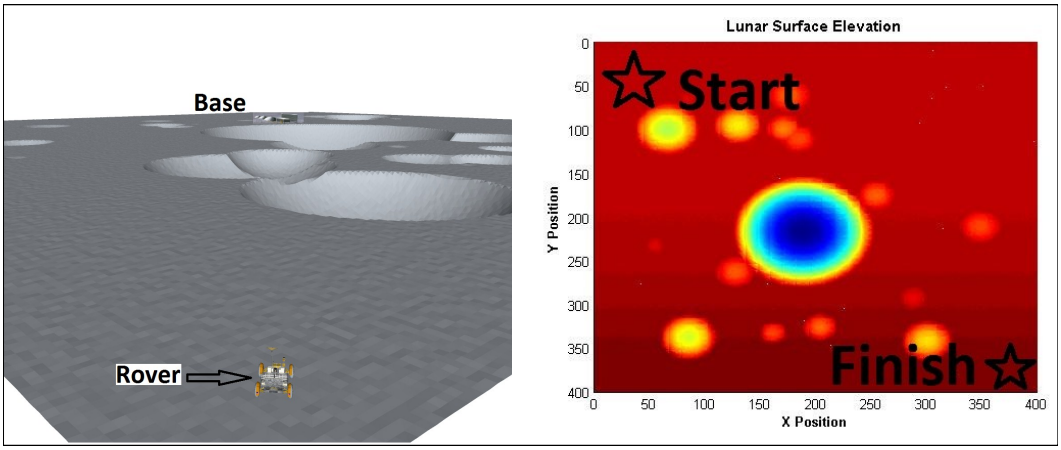

(2a) **(2b)**

Figure 2: Lunar Surface Terrain with Lunar Rover at Exploration Starting Point or Base

Lunar EVA

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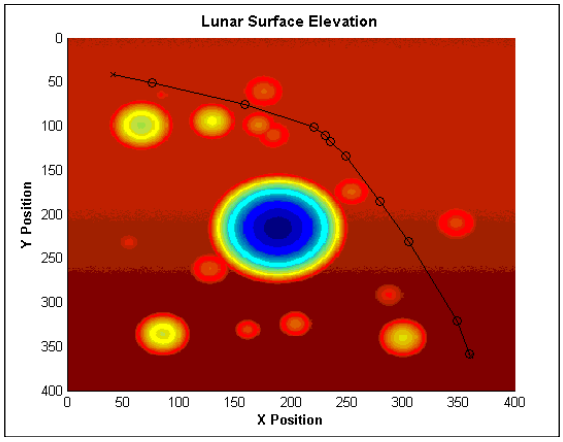


Figure 4: Case #2 - Lunar Surface EVA Showing Shortest Route Which Avoids Craters

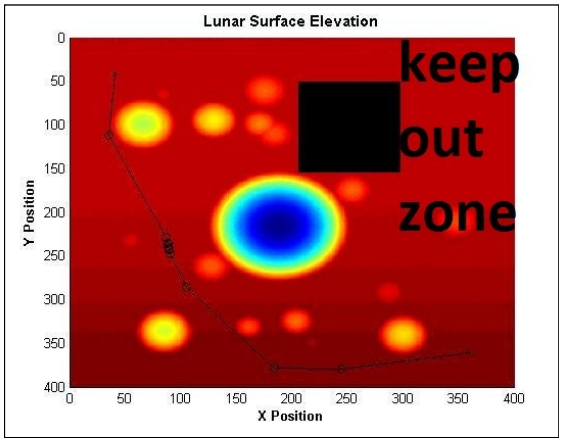


Figure 5: Case #3 - Lunar Surface EVA Showing Shortest Route Which Avoids Keep-Out Zones

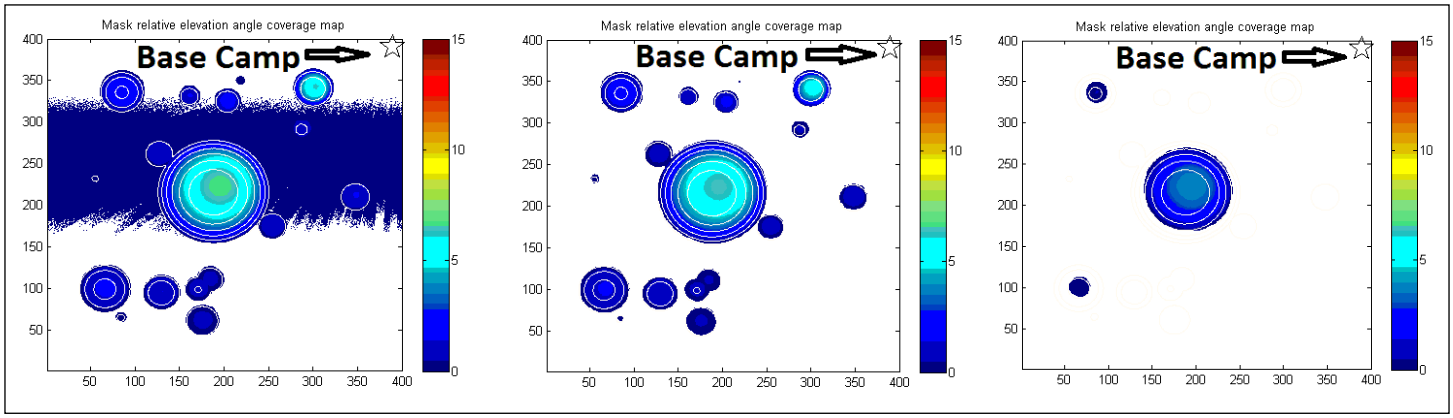
"distance + slope". The point of this example is to optimize the route which minimizes distance traveled between base camp and the destination with the same number of 10 exploration way points as shown in Case 1, with one additional factor of surface slope/ steepness since the risk of steep craters can be a hazard to crewmembers during EVA. The optimized route for this case is shown in Figure 4, showing a longer route than Case 1, but avoiding the steepest crater shown in dark blue, and selecting an optimal (safer) path through the crater field.

The third case takes the same lunar landscape terrain as presented in Cases 1 & 2, but minimizes the cost function "distance + slope" with an additional constraint that contains a specified "keep-out" zone. The goal of this example is to optimize the route by minimizing distance traveled to the destination with the same number of 10 exploration way points as Cases 1 & 2, with the additional constraints of avoiding steep surface slopes and predefined keep-out zones. These keep-out zones can be caused by communications black-out areas, bolder fields, sand pits, or other known hazard zones. In this example the keep-out zone was purposefully located in the way of the optimized path found in the previous case. The optimized route for this case is shown in Figure 5, showing a longer route than Cases 1 & 2, but avoiding the steepest crater shown in dark blue and avoiding the keep-out zone (defined by the black box) that is shown in Figure 5.

Antenna masking issues can be another constraint when exploring or travelling through certain terrain features and when designing antenna heights for base camp communications equipment. For crew safety reasons, visual line-of-sight between crew and base camp can be another constraint when optimizing route selection during EVA mission planning activities. Line-of-sight communications/ visibility limitations between lunar rover and base camp are shown in Figure 6, using antenna heights of 20 meters (Figure 6a), 10 meters (Figure 6b), and 5 meters (Figure 6c). In this figure, the location of the base camp near the upper right corner (400,400). The areas colored in white ARE visible to the base camp from the lunar rover, while the areas colored in blue ARE NOT.

The fourth case presented is a rover exploration of a Martian valley with steeply sloped walls. The additional constraint for consideration is time-varying lighting (daylight/darkness) since shadows can degrade efficiency of optics instrumentation/cameras or interfere with the sunlight needed for solar panels. Figure 7 shows the sample Martian landscape terrain, with black dots indicate the starting/ending point and the desired stopping point at the far end of the canyon. The time-varying shadows during a Martian day are shown on eight samples in Figure 8. The eight images in Figure 8, from left to right, illustrate shadows (in

(Continued on page 15)



(6a) **(6b)** **(6c)**

Figure 6: Lunar Surface Terrain Map Showing Antenna Masking Zones

(Continued from page 14)

green & blue) as the sunlight moves across the sky. The shadows in the first panel in Figure 8 are due to the sun's position low on the right horizon, whereas the fifth panel has the sun directly overhead (no shadows), and the shadows shown in the eighth panel of Figure 8 are due to the sun's location low on the left horizon. These shadows are treated as time-varying keep-out zones in the route optimization for a Martian rover (manned or unmanned) going from a base camp to a geological sampling destination and returning to base camp. Minimizing the cost function "distance + slope" while remaining in the sunshine, the optimized route is shown in Figure 9. This image shows the rover starting point near the bottom of the image, traveling along the left side of the valley capitalizing on the lighting and terrain, reaching the exploration destination, and returning along the right side of the valley which also avoids the shadows and steepest slopes on the return to base camp.

In conclusion, Genetic Algorithms is a class in Evolutionary Computing techniques, that have been used for a number of scheduling & routing problems across numerous industries and have been employed here to optimize surface EVA route selection for human exploration under various conditions. Potential cost-functions and constraints could include: distance, slope, line-of-sight/ communications, keep-out/ hazard zones, and daylight/ darkness/shadows. Adelante Sciences Corporation's GA tool is versatile and easily adaptable to many different types of problems. Someday, it may even be used by astronauts to explore and possibly colonize the Moon or Mars to establish permanent scientific research stations. Eventually, this software tool can be run by crews on EVA using rugged military-grade laptops for real-time mission planning in the field, on the lunar surface, installed with the most up-to-date surface/ terrain maps with cost functions, where astronauts can change or update the exploration points of interest and hazard avoidance areas.

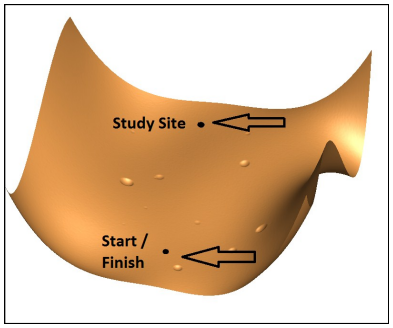


Figure 7: Martian Surface Terrain With Curved Landscape, Steep Slopes, and Shadow Keep -Out Zones

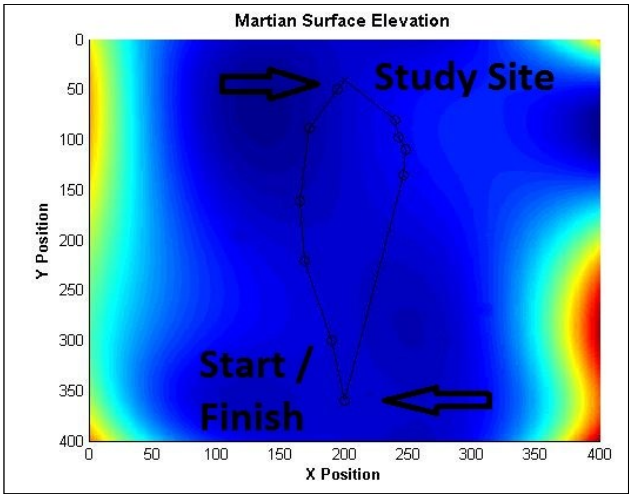


Figure 9: Martian Surface Terrain Route Optimized With Daylight/Darkness Constraint,

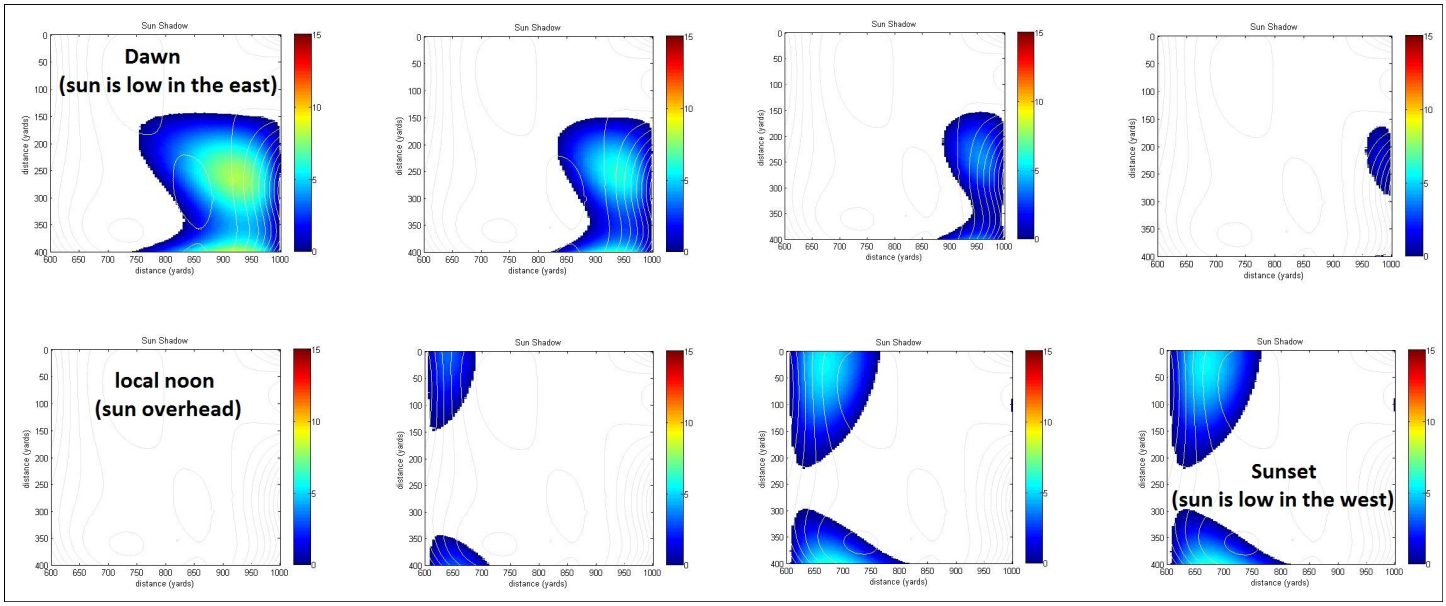


Figure 8: Martian Surface Terrain Maps Showing Shadow Keep-Out Zones During a Martian Day

Comet ISON

Comet ISON (C/2012 S1) in 2013-2014

DANIEL R. ADAMO, ASTRODYNAMICS CONSULTANT

Observing with the 0.4-m f/3 Santel reflector of the International Scientific Optical Network (ISON) near Kislovodsk, Russia, Vitali Nevski of Belarus and Artyom Novichonok discovered a faint object of magnitude 18.8 from images obtained 2012 September 21.06 UT. The object was later determined to be a long-period comet making its way toward perihelion in late November 2013. It was named Comet ISON (C/2012 S1).

Because Comet ISON has a perihelion distance of 0.0125 AU (only 1.2 million km

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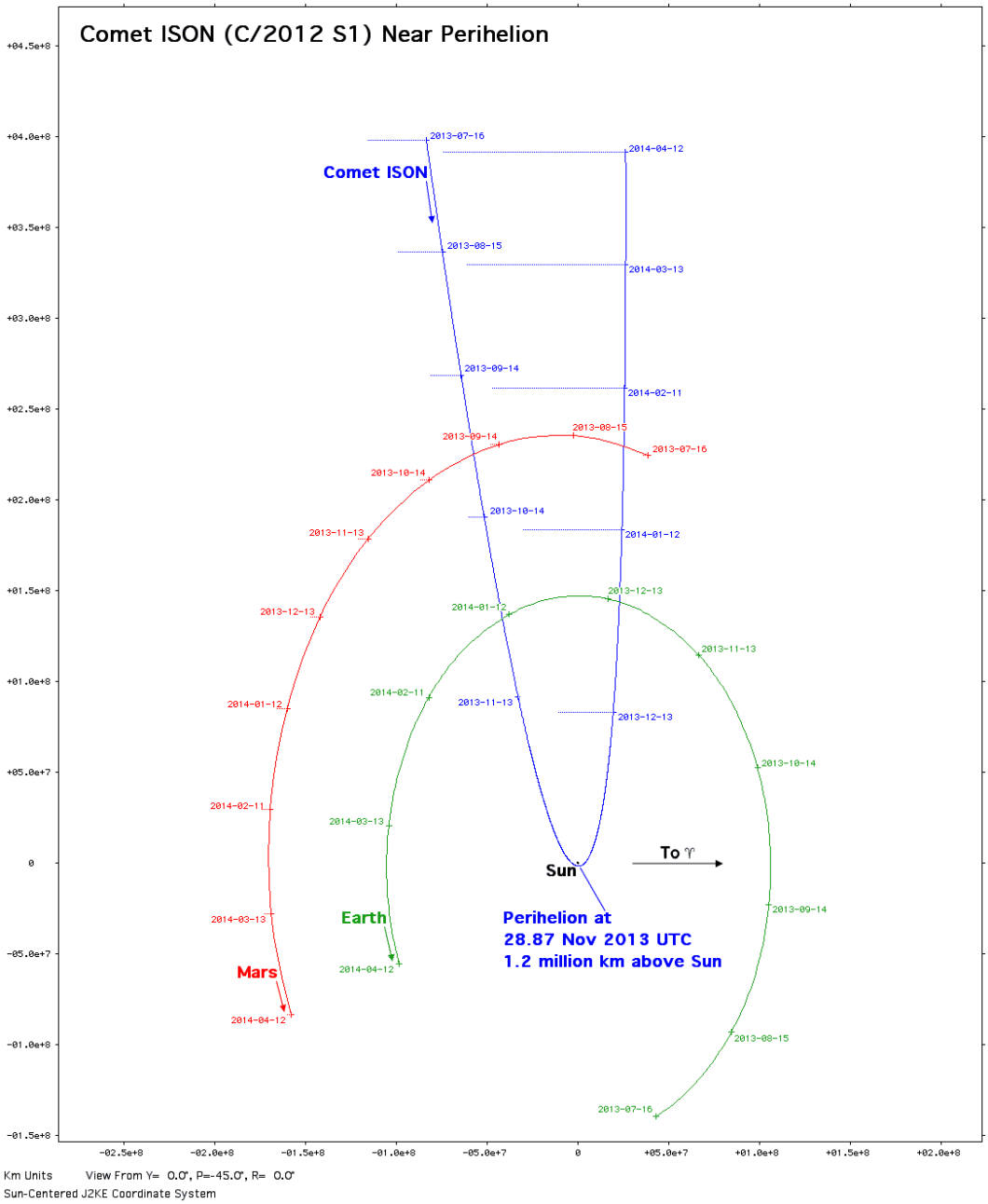

Figure 1. This heliocentric plot is viewed from a perspective 45° north of Earth's orbit plane (the ecliptic) with Comet ISON's orbit plane nearly face-on and inclined 61.8° to the ecliptic. Dotted lines are projections from ISON's orbit onto the ecliptic, indicating both the comet's nodes are inside Earth's orbit. Except for a brief period in late November 2013, ISON will remain well north of the ecliptic plane. This geometry will favor viewing from Earth's northern hemisphere.

(Continued from page 16)

above the Sun's photosphere), its fate is highly uncertain. Although comets have survived closer approaches to the Sun (see the report on Comet Lovejoy's Sun graze in the January/February 2012 issue of *Horizons*, pp. 47-49), some evaporate or break up into a debris cloud before leaving the Sun's vicinity.

There's an even greater uncertainty about Comet ISON's maximum brightness when observed from Earth. Depending on composition and structure of its nucleus, Comet ISON's tail could stretch for tens of degrees across Earth's skies and be visible in daylight near perihelion, or it could fail to develop much of a visible tail at all. The best advice for Earthbound observers is to stay tuned over the next year and see what develops in late 2013.

What we currently *do* know about Comet ISON is its orbit. This article is based on "JPL#1" orbit elements using 54 observations, some of them obtained pre-discovery, spanning the 270-day interval from 2011 December 28 to 2012 September 23. The JPL#1 eccentricity is effectively 1, indicating this object is on a parabolic trajectory originating in the Oort Cloud at the fringes of our solar system and likely about to undergo its first perihelion passage. Figures 1 and 2 provide additional insights obtained from JPL#1 elements.

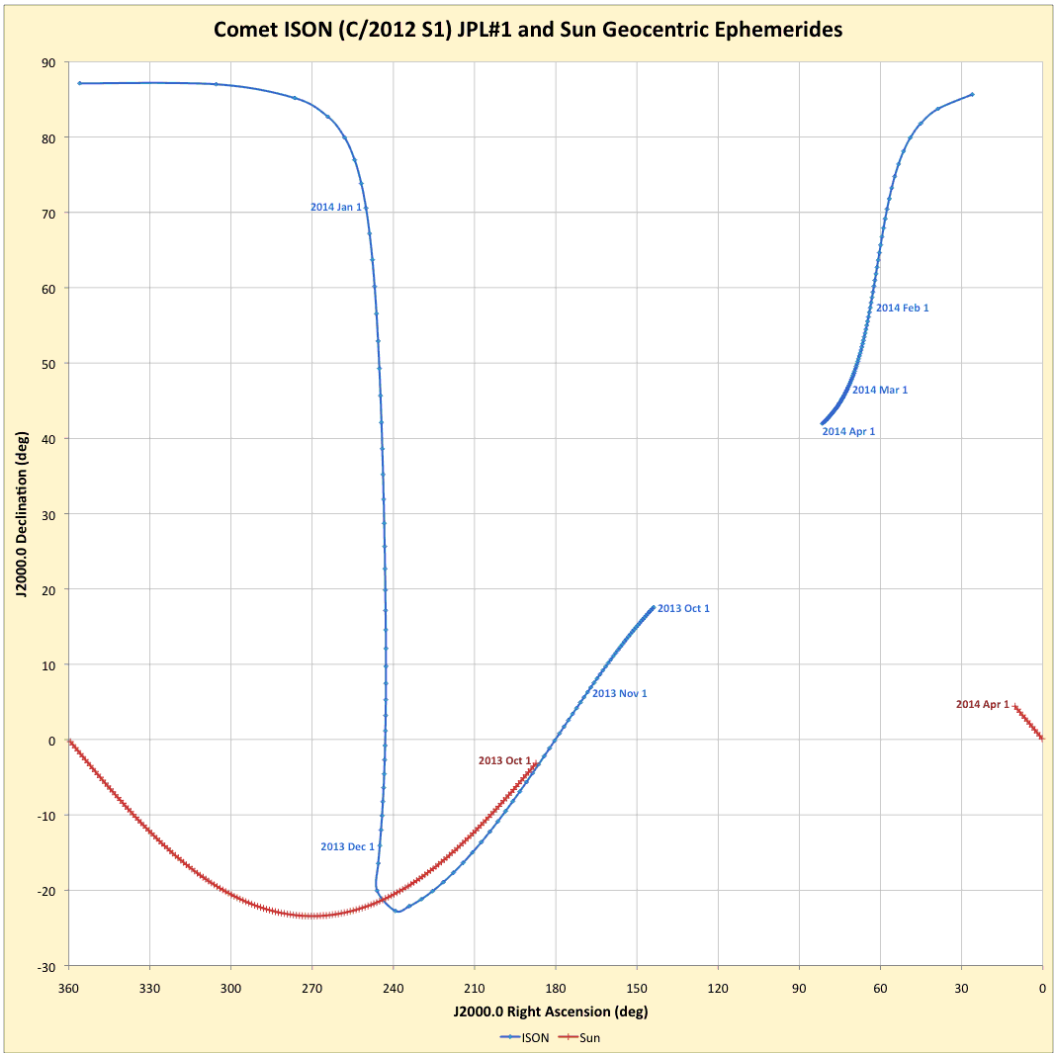

Figure 2. The apparent paths of ISON (blue) and the Sun (russet) are plotted from 2013 October 1 to 2014 April 1 on the geocentric celestial sphere's interior (east is left and north is up). Note the Sun's path coincides with a sector of the ecliptic plane projected onto this sphere. Prior to perihelion in late November, ISON will be visible to earthbound observers above the eastern horizon before sunrise. After perihelion, ISON rapidly moves north to become circumpolar at U.S. latitudes by late December 2013. As ISON moves south in early 2014, it enters the evening sky to become visible above the western horizon after sunset.

3AF MP

The Third Annual Aerospace Festival of Art and Literature: Stars and Wings

PHILIPPE MAIRET, 3AF MP, DOUGLAS YAZELL, EDITOR

Our French sister section is 3AF MP, l'Association Aéronautique et Astronautique de France, Midi-Pyrénées chapter, www.3af-mp.fr. See the Section News pages of our last issue for the 3AF MP organization chart. More information is soon to be placed on our web site at www.aiaahouston.org, but that has not yet been transferred from our former web site, www.aiaa-houston.org. The relevant committee is in the technical branch of AIAA Houston Section, the International Space Activities Committee (ISAC). The ISAC is chaired by Ludmila Dmitriev-Odier.

The third edition of the Aerospace Festival of Art and Literature, "Stars and Wings," will be held at the Cité de l'Espace in Toulouse, France, November 15 to November 18, 2012. 3AF is a partner. For this third edition, the honorary patron is Jacques Perrin, actor, director, documentary director and French film producer. The festival patrons are astronauts Jean-Loup Chrétien and Patrick Baudry.

Friday, November 16 is scheduled for a 4:30 PM lecture entitled "Curiosity Triumphs on Mars," in the Altair room, featuring presenter Olivier Sanguy (www.enjoyspace.com, formerly Editor-in-Chief of Espace Magazine).

Saturday, November 17, will feature, at 4:00 PM in the room Imax Astralia, the round table "What Future for the Conquest of Space?" The facilitator will be Michel Polacco, journalist and author of numerous books about aviation and space. This round table will be placed under the auspices of the Academy of Air and Space. The attendance of certain notables has been announced, including Philippe Coué, a specialist in Chinese astronautics, Jean-Loup Chrétien, the first French astronaut in space, Patrick Baudry, second French astronaut in space and French astronauts Jean-François Clervoy and Michel Tognini. According to Michel Polacco, today we ask the

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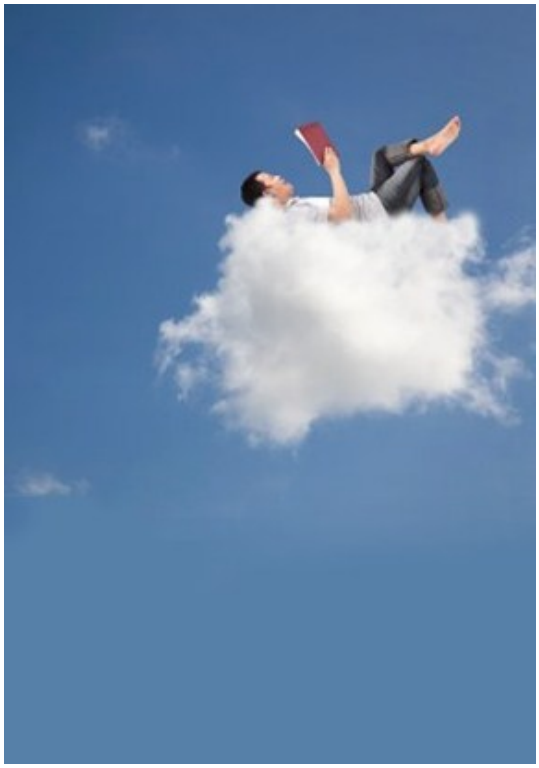
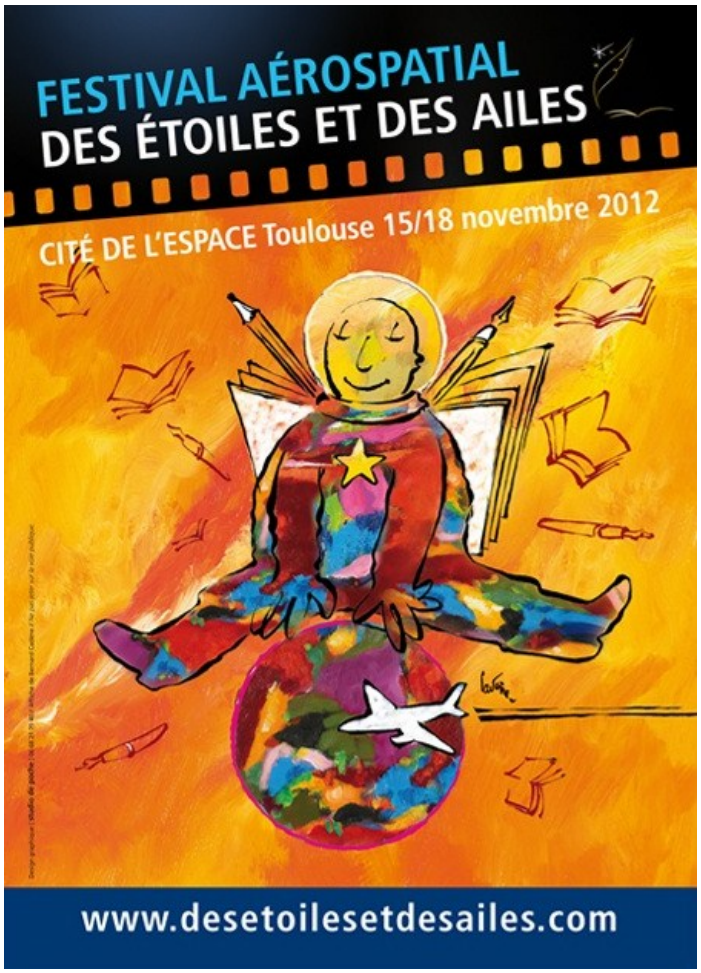
Image credits: Stars and Wings. Poster: Bernard Cadène.





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question about the future of space exploration. More precisely:

- Will we continue to orbit the Earth, then for lack of funds, remain on Earth and leave space exploration for vehicles without crew?
- Will we create permanently inhabited space stations?
- Will humans leave the vicinity of Earth and fly to the Moon, Earth-Moon L2 Lagrangian point, Mars, the asteroid belt or farther ?

On Sunday, November 18, at 10:30 AM in room Altaïr, a conference entitled, "The Hazards of the Conquest of Space," will be held. The speaker will be Robert Galan, former fighter pilot and former test pilot and author of numerous books on aviation. In the afternoon at 4:00 PM in room Altaïr another conference will take place, "Space Tourism Soon?" The featured speaker is Garrett Smith, founder and President of Cosmica Spacelines. (See www.cosmicaspacelines.com.)

3AF MP

During the festival's round table of November 17, 2012, each featured speaker will share their analysis and their vision. Is it possible that in 2013, a similar festival will be born in Houston, where we can benefit from the analysis and vision of our American counterparts?

PROGRAMME

Programme en cours d'élaboration, susceptible de modifications.

Jeudi 15 novembre
10h : Ouverture du Festival
10h - 18h : Animations : simulateurs, ateliers, etc
18h : Clôture du Festival

Vendredi 16 novembre
10h : Ouverture du Festival
10h - 18h : Animations : simulateurs, ateliers, etc
16h30 : Conférence - *Curiosity Triomphe sur Mars* - Salle Altaïr
18h : Clôture du Festival

Samedi 17 novembre
10h : Ouverture du Festival
10h - 18h : Salon du livre - Salle Vega / Animations
10h30 : Conférence - *Un paradoxe : pourquoi tant d'avions vendus alors que le transport aérien est en crise ?* - Salle Altaïr
14h : Conférence - *Comment volerons-nous en 2050 ?* - Salle Altaïr
16h : Table Ronde - *Quel avenir pour la conquête spatiale ?* - Salle IMAX
18h : Clôture du Festival

Dimanche 18 novembre
10h : Ouverture du Festival
10h - 18h : Salon du livre - Salle Vega / Animations
10h30 : Conférence - *Les aléas de la conquête spatiale* - Salle Altaïr
14h30 : Conférence - *Le jour où nous avons fait décoller Concorde...* - Salle Altaïr
16h : Conférence - *Bientôt le tourisme spatial ?* - Salle Altaïr
18h : Clôture du Festival

Left: The festival schedule without translation. Image credit: Stars and Wings.

Left: Festival patrons Jean-Loup Chrétien and Patrick Baudry. Image credit: Stars and Wings.

Above: Catherine Gay, President of the Association, "Stars and Wings." Pierre Cohen, President of Toulouse Metropolitan Area and President of La Cité de l'Espace, the space-themed visitor center in Toulouse, France. Image credits: Stars and Wings.

Above: Jacques Perrin, honorary patron of this festival. Image credit: Stars and Wings.

Aviation

The Fog of War Obscures a Great Aerial Dogfight (Speculation)

JAMES C. MCLANE III

Recently KUHF radio in Houston featured Dr. John Lienhard's "Engines of our Ingenuity" episode #1995 about the P-40 aircraft.

http://www.uh.edu/engines/epi1995.htm

The radio program reminded me of a story I'd heard from my father, longtime AIAA member and former AIAA Section Chair James C. McLane Jr.

During WW2 my dad (now 89 years old) was a fighter pilot. He trained in the Curtiss P-40 Warhawk, and spent much of 1944 serving as an instructor for those single seat aircraft. He transitioned to the much more advanced P-51 Mustang after joining the 357th Fighter Group in England.

In July 1945 his Group moved into a former German air base at Neubiberg near Munich. There was speculation about whether they might eventually have to tangle with the Russians in disputes over the post-war division of Europe. To help prepare for this possibility, the US Army sent a couple of recently surrendered German aviators to discuss combat tactics with the pilots of the 357th. The two German aces were almost legendary, each having each shot down more than 200 enemy aircraft.

Right: James C. McLane Jr. (center–right) and P-40 with other pilots of "A" Flight, Squadron "T", Punta Gorda Army Air Field, Florida, Feb 7, 1945. Image credit: James C. McLane III.

An American pilot asked one of the visitors to describe his toughest aerial combat. The German, with luck and great skill had survived countless dogfights, perhaps more than any living aviator. The listening audience included pilots who had wanted to shoot this man and his Luftwaffe brothers down, so they were very interested in his response. Maybe he would describe an encounter with one of the notable American aces in that very room, a group that included Kit Carson, one of the US's top scoring fighter pilots. The German's answer would surprise his audience.

The Luftwaffe ace said his most memorable combat occurred early in the war. He was flying a Messerschmitt Bf-109 on a patrol over North Africa. Flying high up in the empty blue sky over the desert, the war seemed a remote abstraction. The air was crystal clear and visibility was excellent. It was cool up here, unlike the stifling hot conditions that prevailed on the ground. This was a fine day to be in the Luftwaffe instead of Rommel's Afrika Korps, choking on dust, crawling around somewhere down below on the blistering Sahara desert.

Habitually scanning the sky, he saw a tiny speck in the far

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distance and instantly veered over in that direction for a better look. The speck was a lone Curtiss P-40 Warhawk painted brown in British camouflage colors. The war had once again become a personal matter. The German knew he was there to make just such a discovery. Nevertheless, for an instant before deciding on a course of action he resented how much the impending encounter would interfere with his enjoyment of the beautiful day. Barring a mechanical failure on his trusty Messerschmitt, the outcome of this chance meeting with the enemy was inevitable. He was an expert, flying the world's fastest front-line fighter plane. He would score another easy victory by downing the plodding, semi-obsolete P-40. Experience had taught him that any pilot in a P-40 with the bad luck to meet his fully armed Bf-109 would soon be another casualty of war. Such an encounter held little of the danger and excitement of strafing targets on the ground, or the personal satisfaction of escorting the slow, vulnerable troop transports that carried dozens of fellow German soldiers. He wasn't nervous as he methodically cinched his shoulder harness tighter, advanced the throttle, glanced one last time at the instrument panel and banked the lethal little Messerschmitt into a curving path designed to intercept the track of the P-40 and put him in a firing position behind his opponent.

(Continued on page 22)

Left: Instructor pilot McLane in P-40. Image credit: James C. McLane III.

Aviation

(Continued from page 21)

But the Warhawk pilot was alert and he would not be taken unaware.

A P-40 could accelerate very rapidly in a dive, so to escape the situation the British pilot headed toward the ground as steeply as possible. But, the air was clear and there were no clouds below to dive into and hide. Perhaps down near the desert the mottled tan camouflage on the Warhawk would make him hard to see. At least that was one remote possibility.

The fast Bf-109 headed down too, following in the distance behind the P-40. The resulting pursuit continued as both aircraft spiraled closer and closer to earth. The German was tenacious, but couldn't close the distance separating him and his now fast flying enemy. Pulling high G's both planes flattened out near the ground without shedding necessary parts, like wings or tails, or rendering their pilots unconscious. The cockpits began to take in the hot air that one associates with the desert. In a short while flying outfits, designed for the cold of 20,000 feet became uncomfortable and the pilots began to sweat. Behind tight fitting goggles, sweat could sting the eye and obscure vision. Now the German sought a rapid end to this contest. It had already proven more inconvenient than he expected. This had become a classic match of two planes and their pilots, knights of the sky engaged in a close-in fight that almost certainly would end in a death.

After pulling out of its steep dive, by chance the P-40 found itself flying at rooftop level above a North African city. The Messerschmitt was not far behind. The subsequent dog fight happened inside the town. The planes chased each other down streets and between buildings and houses, their wing tips and propellers barely clearing obstacles. Panic-stricken people, animals and livestock scattered. The planes were so low that their propeller tips may have touched the dirt as they roared down the roads. Clouds of dust hung in the air in their wake.

Right: James McLane Jr. and a P-40 Warhawk. Image credit: James C. McLane III.

The very low altitude meant there could be no chance to bail out with a parachute if your plane was fatally shot. The extreme high-G maneuvers, the banking and the constant, hard over, knife edge turns did not offer any chance for the Bf-109 to use its ability to go fast. Close proximity to the ground made it impossible to dive. A climb would slow you down and make you an easy target, so the normal three dimensional environment of flight was reduced to moving in only two dimensions, a condition that greatly handicapped the faster Messerschmitt.

It must have been frightening for the two pilots. Horrifying would be a better term. This was the stuff of a nightmare. The experience was so scary that three years later the German could still remember every detail. Following close behind the P-40 pebbles and dirt struck his windshield as he occasionally lost sight of his enemy in the dust. On the ragged edge of a high speed stall the tight turning P-40 would try to cut inside the German's circle. For an instant each pilot might find himself in an advantageous

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position and perhaps get off a few shots, but neither could stay in a favorable orientation long enough for a kill.

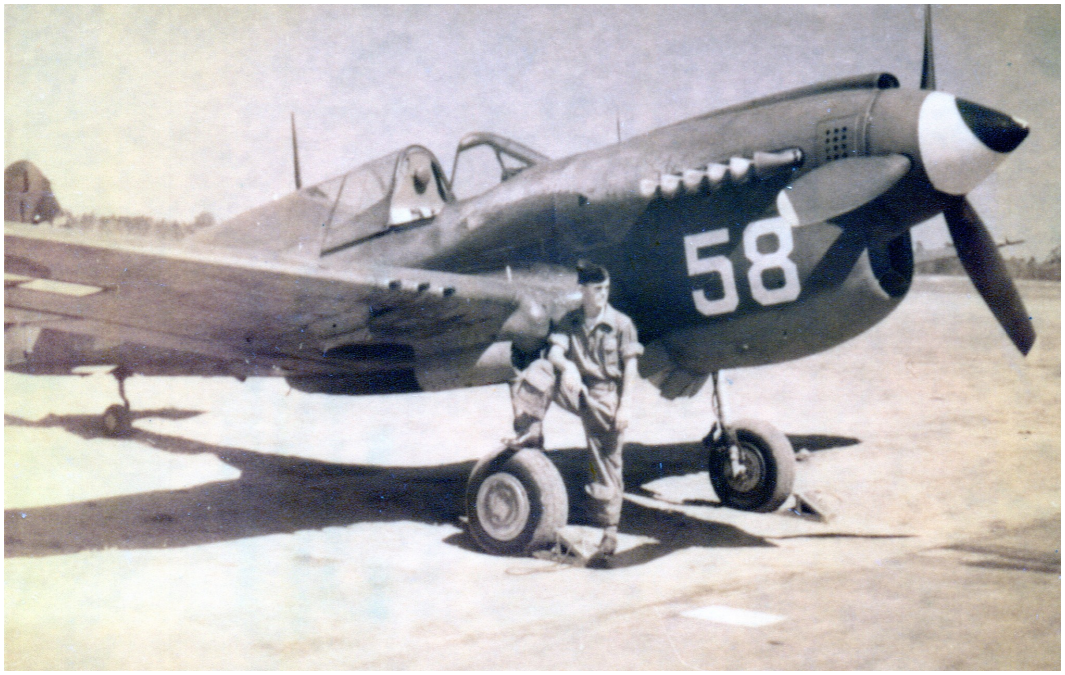
After an agonizing time engaged in this risky low level flying, it was plain that the match was going nowhere. Neither aviator could gain sufficient advantage over the other to prevail. Flying crazy like this, low in an unfamiliar city, would ultimately end in disaster. For the pilots, the tension, like the heat in the cockpit, was almost unbearable. Throwing the aircraft into one extreme maneuver after another at the very limit of controllability was physically exhausting.

As suddenly as this desperate life or death struggle began, the combatants broke it off, each frightened by the flying ability and tenacity of the other. They had both met their match and knowing so, with mutual relief they departed the city in separate directions.

In the spring of 2012, news reports began to filter out of Egypt announcing the discovery of a crashed P-40 aircraft. An oil exploration crew had found a well preserved wreck in the desert. There were bullet holes in the airplane and indications that the pilot had survived the emergency landing. Identification tags made it possible to trace the wreck. Official military records showed that on June 28, 1942 this aircraft and its pilot, 24-year-old British Flight Sergeant Dennis Copping, had completely vanished.

On that fateful day, did Flight Sergeant Copping, flying alone without escort, encounter a German ace and fight a desperate aerial dance of death? We'll probably never know, but it's indeed a fascinating possibility. If this is true, then Copping's dogfight might rank among the great examples of aerial combat. Could he, against all odds, while piloting an obsolete aircraft, have successfully battled a noted German ace to a draw, only to later die alone of thirst and exposure in the desert? If so, he never got to tell his remarkable story or be recognized for his skill and bravery.

Those who might discount the P-40 as a fighter aircraft should take note. In the hands of the right pilot it could be formidable.



Left: P-40 training in Florida – 1944. Image credit: James C. McLane III.

Links about lost 1942 P-40 found in 2012 (Since we plan to print Horizons on paper on occasion, we present the entire links):
Daily Mail: http://www.dailymail.co.uk/news/article-2142300/Crashed-plane-Second-World-War-pilot-Dennis-Copping-discovered-Sahara-desert.html
National Geographic:
http://news.nationalgeographic.com/news/2012/05/pictures/120524-world-war-ii-plane-egypt-desert-science-p-40-lost/
Video 1 of 2 (1\2): http://www.youtube.com/watch?v=CFe8CsOdoG8
Video 2 of 2 (2\2): http://www.youtube.com/watch?v=KmTNXcGB3Fo
British Forces News: http://www.youtube.com/watch?v=G6m7vkqGS5g

Museum

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

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

DOUGLAS YAZELL, EDITOR

I stopped by the museum recently to buy some logo shirts and took the picture with the American flag below. At $30 each, the shirts are expensive souvenirs but affordable and fashionable clothing. (Please see the back cover.)

The museum web site does a great job of summarizing Wings & Wheels for August and September 2012. These lunch hour events usually take place on the third Saturday of the month. Admission is $7 for adults, and lunch meals are available from a gourmet truck. I asked two volunteers when the museum stairway would be open so that visitors can stand on the roof of the first floor to take photos of the nearby airplanes. Not soon, I was told, since fundraising progress has been slow lately. Once visitors can go up there, it will greatly enhance the already excellent visits to this unique museum. Meanwhile, anyone will enjoy their visits almost any day of the year.

Above: A picture of the T-6 Texan from the September 2012 Wings & Wheels event. Image credit: Museum web site.

Above: Museum atrium on the ground floor just after Labor Day, just before they took down the flag. It's a great and affordable place for AIAA events. Image credit: Douglas Yazell.

Right: A picture from the August 2012 Wings & Wheels event. The Lockheed Lodestar (C-60A) on the left is from the Commemorative Air Force, Houston Wing. The Lodestar on the right belongs to the museum. Image credit: Museum web site.

Links:

www.1940airterminal.org

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!

Ideas for a meeting? Contact Richard at rtsessions[at]earthlink.net, Chapter 12 web site: www.eaa12.org. Another email contact: eaachapt12[at]gmail.com. As of April 13, 2012, EAA Chapter 12 is meeting on the first Tuesday of month, based on the calendar on the web site.

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

Scheduled/Preliminary Chapter 12 Event/Meeting Ideas and Recurring Events:

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

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

Below: Lance Borden and his Inland Sport airplane in about May of 2011 in the hangar at Ellington Field in Houston, Texas USA. It is possible that this airplane is now flightworthy. See the note above for the FULL story back in May 2011. Getting caught up with Lance in 2012, he mentioned Andy's Army, a fundraising effort for his grandson who has cancer. (http://www.gofundme.com/AndysArmy). Image credits: Douglas Yazell.

Calendar

Section events & other events related to aeronautics & astronautics. This September / October 2012 issue of Horizons is scheduled to be online by October 31, 2012. All 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 of most months except for holidays.
Location: NASA/JSC Gilruth Center is often used. The room varies.

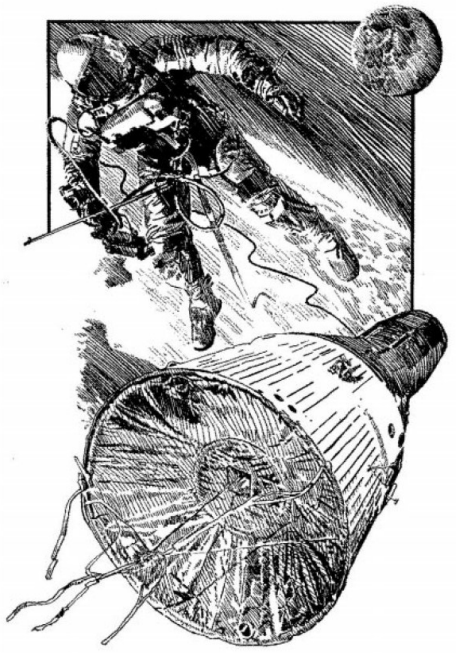
Recent Section events:
Monthly happy hours, the first at Club Cabo, and the second at Cullen's.

Upcoming Section events:
Audiobook in work by Ted Kenny, Suddenly Tomorrow Came, A History of JSC

AIAA National & International Conferences

2013:

7 - 10 January 2013 Grapevine (Dallas/Ft. Worth Region), Texas
51st AIAA Aerospace Sciences Meeting
25 - 28 March 2013 Daytona Beach, Florida
22nd AIAA Aerodynamic Decelerator Systems Technology Conference and Co-located Conferences
8 - 11 April 2013 Boston, Massachusetts
54th Structures, Structural Dynamics, and Materials and Co-located Conferences



Above: Chapter 5: Gemini: On Managing Spaceflight. Image credit: Suddenly Tomorrow Came… A History of the Johnson

Above: Chapter 6: The NASA Family. Image credit: Suddenly Tomorrow Came… A History of the Johnson Space Center.

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

Cranium Cruncher

DR. STEVEN E. EVERETT

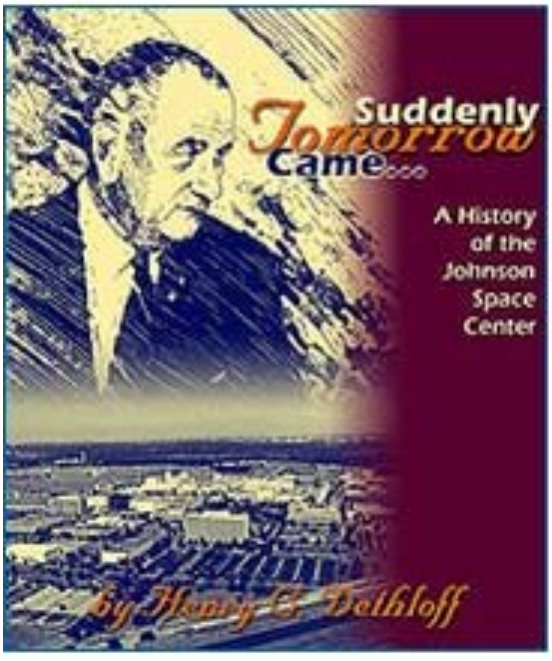
Challenge

Last month, the reader was asked to determine for whom the sales of a set of launch contracts by CosmoCorp for the companies AstroLoft and BlueSky was detrimental and by how much.

The total set of contracts were sold at the rate of five launches for 200 million, so there must have been a multiple of five launch slots available in the schedule. Likewise, Astroloft must have had a multiple of 2 launches to offer, and BlueSky must have had a multiple of 3 to offer. Since each company was offering the same number of launches, the minimum number of combined slots would be 60 (30 launches for Astroloft, which would have brought them 1500 million, and 30 launches for BlueSky, which would have brought them 1000 million). When sold separately, these launches would have earned a total of 2500 million dollars. But when sold together, the total earned would be 60*(200 million)/5 = 2400 million, at a loss of 100 million for the group. Since it was stated there was a 700 million dollar loss, there must have been 60*7 = 420 launch slots available from the pair of companies over the next 30 years. These sales resulted in 420*(200 million)/5 = 16800 million dollars, so that each company made 8400 million dollars. However, AstroLoft could have sold its 210 slots for 10500 million, while BlueSky could have sold its 210 slots for 7000 million. Thus, Astroloft essentially lost 2100 million dollars in this deal, while BlueSky made 1400 million more than it would have otherwise. It appears that AstroLoft should hire some new financial advisors!

In this month's puzzle, a new three-man spacecraft is being launched in which the passengers are all facing forward, sitting in a single line. It is known that on board, there are a total of five launch helmets available, three of which have a red stripe and two of which have a black stripe. Just before launch, the crew chose from among the helmets at random and put them on. Once they are strapped into their seats, they can see the men ahead of them, but not those behind. While waiting for launch, the flight controller asks the man in the rear which helmet he is wearing, to which he replies, "I do not know." The middle man is asked which helmet he is wearing, to which he replies, "I do not know." Finally, the man in the front is asked which helmet he is wearing, to which he replies, "I am wearing the helmet with the red stripe." How did he know?

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



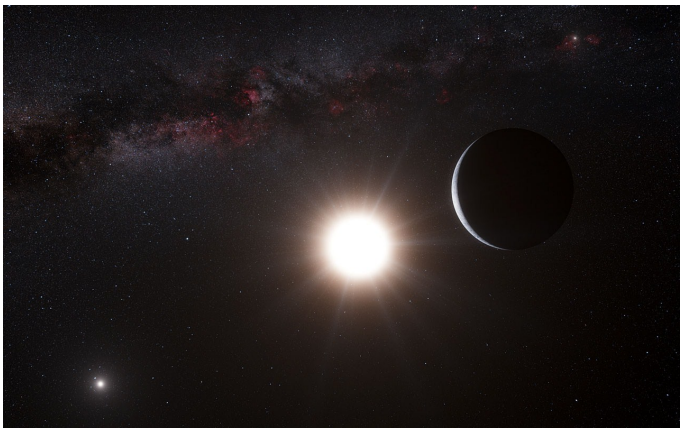
Suddenly Tomorrow Came… A History of the Johnson Space Center… the Audiobook! See page 22 of our last issue! That 76-page PDF file is available in low (23 MB) or high (87 MB) resolution. The original 1993 book is free (PDF with great art!) via NASA.

Section News

European Southern Observatory (ESO):
Planet Found in Nearest Star System to Earth.

16 October 2012. ESO's HARPS instrument finds Earth-mass planet orbiting around Alpha Centauri B.

European astronomers have discovered a planet with about the mass of the Earth orbiting a star in the Alpha Centauri system — the nearest to Earth. It is also the lightest exoplanet ever discovered around a star like the Sun. The planet was detected using the HARPS instrument on the 3.6-metre telescope at ESO's La Silla Observatory in Chile. The results will appear online in the journal Nature on 17 October 2012.



Association Aéronautique et Astronautique de France (3AF)

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

3AF Association Aéronautique Astronautique de France
Midi-Pyrénées

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- **Trésorier** G. Destarac (F. Renard,comptable)
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- Jeunes : M. Biason (*C. Romboletti*)
- Programmation : O. Marty/ Y.Roncin
- Relations Ecoles & Université:
  - ENAC: B. Lamiscarre
  - ISAE: Y. Gourinat; J.Huet
  - IPSA: A. Torgue (*C. Romboletti*)
  - UPS: (*S. Boyer*)
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- Relations CDE: J.J Runavot; J.M. Faure
- Relations PME/ PMI: S.Haug; G. Ladier ; K. Dijkstra
- Relations TMMA : (F. Renard)
- Site Internet: J.C. Torgue

- Patrimoine *(Com. Histoire):* G. Destarac
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- Systèmes Embarqués Critiques : G. Ladier
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- Aviation Civile & Commerciale : F. Guimera
- Aviation Légère & Machines Dérivées : J.L. Chanel
- Environnement : TBD
- Exploration et Observation spatiales: M. Rieugnié

Section News

Left: Who's on ISS Now? October 23, 2012. Expedition 33. September - November 2012. Suni Williams (Commander), Yuri Malenchenko, Akihiko Hoshide. Image credit: NASA.

The American Institute of Aeronautics and Astronautics (AIAA)

AIAA Houston Section
Since 1962

P.O. Box 57524
Webster, TX 77598

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July 01, 2012 - June 30, 2013

www.aiaahouston.org

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- Larry Friesen / UHCL — 281-334-5268
- Shirley Brandt — 713-542-9085
- Sarah Shull / NASA — 281-244-6441

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- Space Operations — BeBe Kelly-Serrato / A-SCC — 281-798-9060
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- Propulsion and Power Systems — Sheikh Ahsan / NASA — 281-244-6826
- Safety and Mission Assurance — Roger Kleinhammer / SAIC — 281-335-2303
- Systems Engineering — Gary Brown / Booz Allen Hamilton — 713-933-6814
- Space Commercialization (Open)
- International Space Activities Committee — Ludmila Dmitriev-Odier / USA — 832-524-6307

Updated July 31, 2012, Executive Council Voting Members (20) are identified by:

Student Section News

New!

We are adding a "Student Section News" to our regular features starting with this issue. We will inform our readers about events happening in our student sections. 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

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.

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

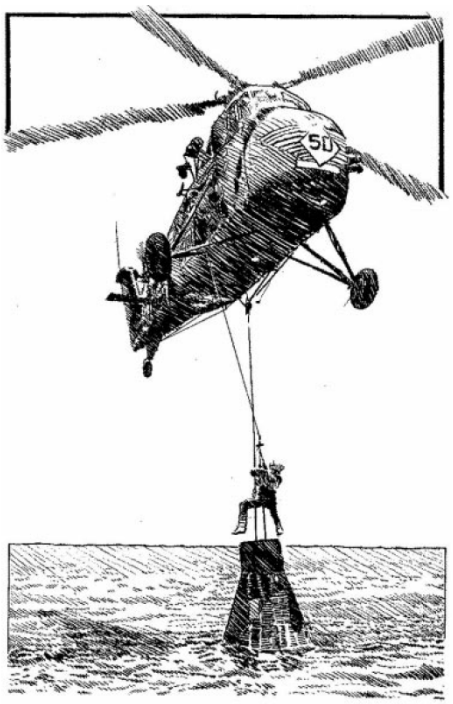
Update

The design-build-fly team at Rice University is looking for someone with aircraft and project management experience who would be willing to meet with the team periodically and mentor them through their design and build process. The mentor's role is restricted to supporting and advising the students; the final product must be student-designed and student-fabricated.

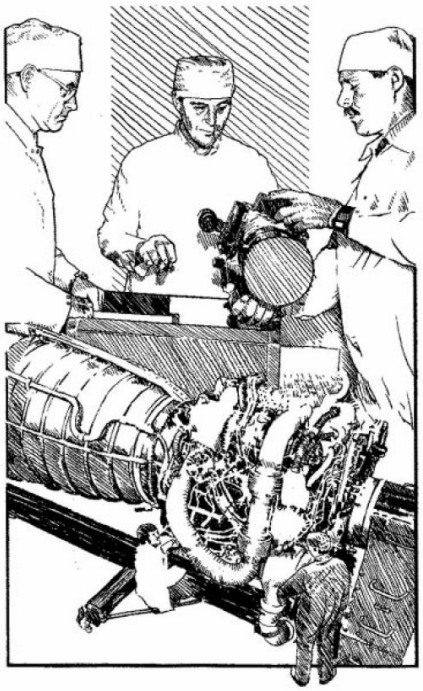
If anyone is interested in assisting, please contact either:

- Dr. Gary Turner, College and Co-Op Chair (collegecoop2012[at]aiaahouston.org)
- Professor Andrew Meade, Chair of Mechanical Engineering and Materials Science Department, Rice University (meade[at]rice.edu)

Professor Meade found the two required volunteers for mentoring at Rice University. One is Clay Stangle, our AIAA Houston Section treasurer. The other is Justin Figueroa, an engineer in the Everett Facility (about 36 miles from Seattle, Washington) for Boeing Commercial Airplanes.



Above: Chapter 7: Precious Human Cargo. Image credit: Suddenly Tomorrow Came… A History of the Johnson Space Center.



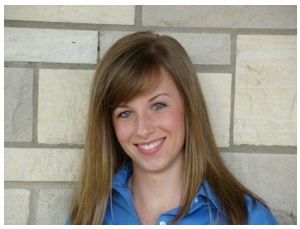
Above: Chapter 8: A Contractual Relationship. Image credit: Suddenly Tomorrow Came… A History of the Johnson Space Center.

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/

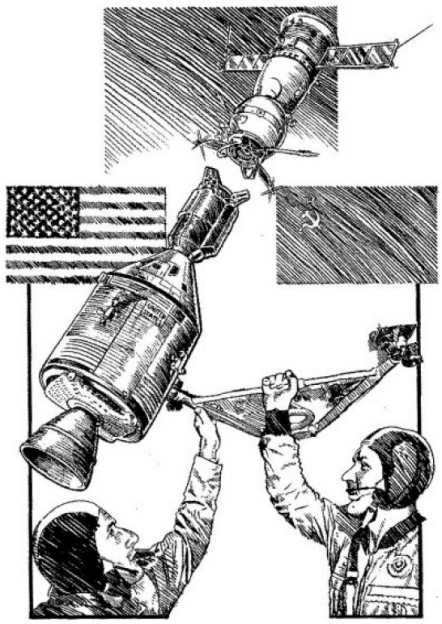
Faculty advisor: Professor John E. Hurtado, *jehurtado[at]tamu.edu*, 979-845-1659.

Brian Freno ‘08 Chair	Bob Cline ‘13 Speaker Chair	Grant Atkinson ‘11 Graduate Representative
Rahul Venkatraman ‘13 Vice Chair	Nhan Phan ‘14 SEC Chair	Nick Ortiz '13 Senior Class Representative
John Guthery '11 Secretary	Travis Dawsey Activity Chair	Alejandro Orozco '14 Junior Class Representative
Erica Lovig ‘13 Treasurer	Lauryn Hoch '15 Publicity Chair/ Webmaster	Logan Hodge '15 Sophomore Class Representative



Above: Erica Lovig. Career Interests: I am interested in aerodynamics and testing (both flight and wind-tunnel). Something you should know about Erica: I attended the last shuttle launch - Atlantis, STS-135 - and got to stand on the wing of Discovery!

Above: Alejandro Orozco. From: Maracaibo, Venezuala and Houston, Texas. Career Interests:NASA Astronaut. Something you should know about Alejandro: I'm a pilot, come fly with me!



Above: Chapter 9: The Flight of Apollo. Image credit: Suddenly Tomorrow Came… A History of the Johnson Space Center.

Above: Chapter 10: “After Apollo, What Next?” Image credit: Suddenly Tomorrow Came… A History of the Johnson Space Center.

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!

We start this article with these summaries from last issue, making this a crowded page. The next page contains those images from last issue of the covers of these Collier's magazines from 1952 to 1954.

We are the first to reprint this Collier's series page by page in high resolution.

In this issue of Horizons, we present a core set of 11 pages from the October 18, 1952 issue of the weekly magazine Collier's, along with some additional material.

In our last issue Dr. Albert A. Jackson IV supplied a one-page article about a von Braun novel that was written in about 1948 and never published until about 2006. In the Dreams of Space blog written by John Sisson, some blog entries appeared recently presenting a von Braun work of fiction from about 1960. It is probably a short version of that same novel. It appeared

(Continued on page 33)

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

This issue

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

(Continued from page 32)

as part of a Sunday supplement in quite a few American newspapers. Artist Fred Freeman provided several excellent illustrations.

Special thanks from Horizons go to Arthur M. Dula and Shirazi Jaleel-Khan in his law office. Others on our Horizons team worked to gather those original issues so that they could be scanned and cleaned up for our publication, but before we started publishing, we needed an opinion from a copyright lawyer, and Mr. Dula volunteered in that role.

Please note that Collier's editor Cornelius Ryan assembled the material for this superlative and famous Collier's series. From a Wikipedia entry, *"Cornelius Ryan (5 June 1920—23 November 1974) was an Irish journalist and author mainly known for his writings on popular military history, especially for this World War II books, The Longest Day: June 6, 1944 D-Day (1959), The Last Battle (1966) and A Bridge Too Far (1974)."*

From page 4 of the October 18, 1952 issue of Collier's, here is a paragraph labeled, "The Cover."

Collier's 1952-54

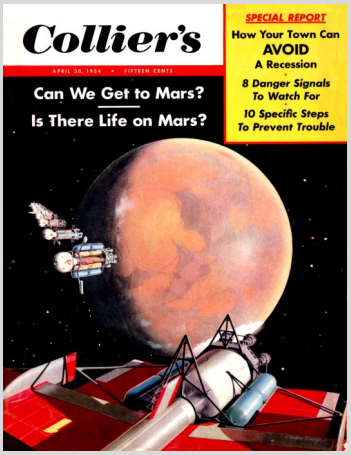
The Cover

A historic moment: man's first landing on the moon. The lunar rocket ship is about to touch down; its motors are being turned off, and the shock-absorbing central landing leg, visible inside the rocket flames, is just above the moon's surface. This view, with the distant earth in the background, was painted by artist Chesley Bonestell from the perspective of a man standing on the lunar north pole. Full a full description of the ship and the trip, turn to page 51.

Below: Image credits: Scott Lowther, with help from other team members.

Issue 3 of 8:
The cover image
is not related to
Man Will Conquer
Space Soon!

Issue 5 of 8:
The cover image
is not related to
Man Will Conquer
Space Soon!

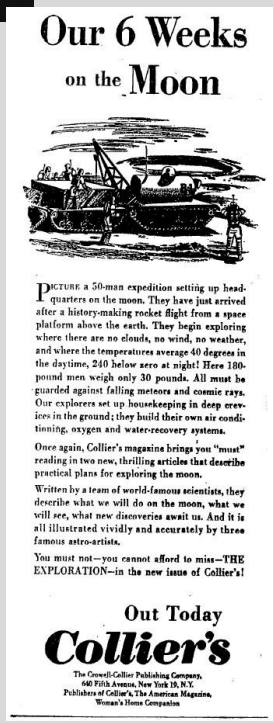


Dreams of Space

Books & Ephemera

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

http://dreamsofspace.blogspot.fr



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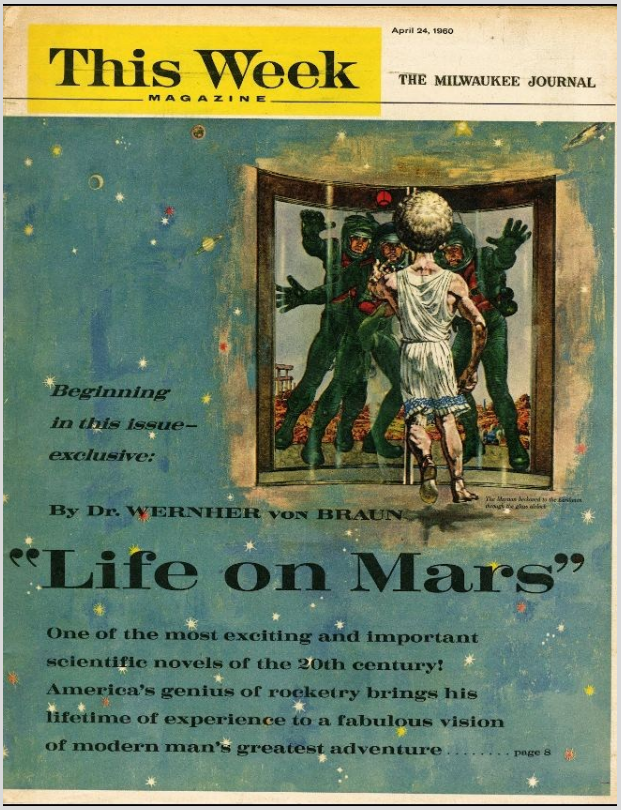
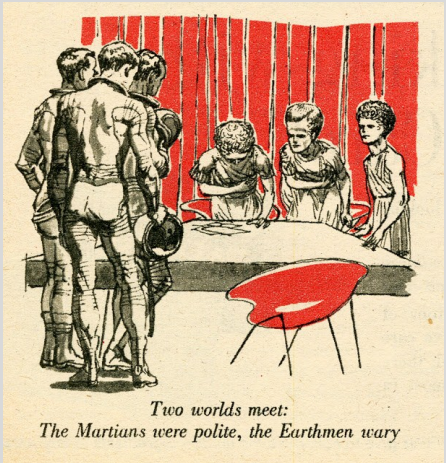
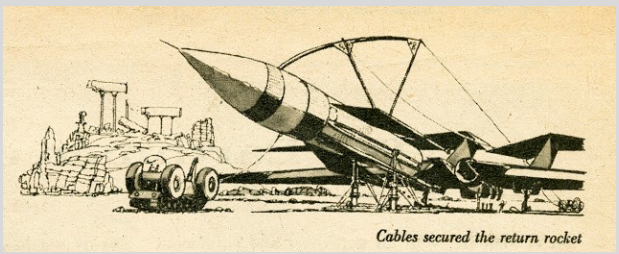
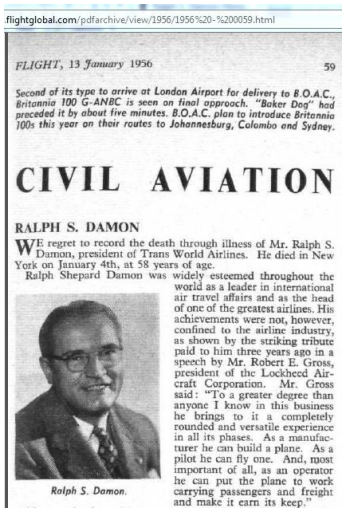



Two worlds meet:
The Martians were polite, the Earthmen wary


Cables secured the return rocket



flightglobal.com/pdfarchive/view/1956/1956%20-%200059.html

FLIGHT, 13 January 1956 59

Second of its type to arrive at London Airport for delivery to B.O.A.C., Britannia 100 G-ANBC is seen on final approach. "Baker Dog" had preceded it by about five minutes. B.O.A.C. plan to introduce Britannia 100s this year on their routes to Johannesburg, Colombo and Sydney.

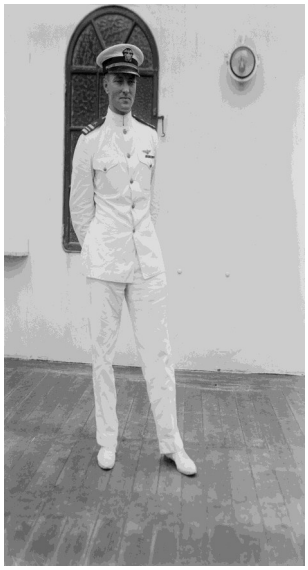
CIVIL AVIATION

RALPH S. DAMON

WE regret to record the death through illness of Mr. Ralph S. Damon, president of Trans World Airlines. He died in New York on January 4th, at 58 years of age.

Ralph Shepard Damon was widely esteemed throughout the world as a leader in international air travel affairs and as the head of one of the greatest airlines. His achievements were not, however, confined to the airline industry, as shown by the striking tribute paid to him three years ago in a speech by Mr. Robert E. Gross, president of the Lockheed Aircraft Corporation. Mr. Gross said: "To a greater degree than anyone I know in this business he brings to it a completely rounded and versatile experience in all its phases. As a manufacturer he can build a plane. As a pilot he can fly one. And, most important of all, as an operator he can put the plane to work carrying passengers and freight and make it earn its keep."

Ralph S. Damon.



Above: U.S. Navy Lt. Com. Richard E. Byrd, 1888 - 1957. Image source: Wikipedia. Image author: Carl Grantham Bain. Rear Admiral Byrd specialized in feats of exploration such as being first to reach the South Pole by air. [Wikipedia]

Above: Robert Moses (December 18 1888–July 29 1981) was the "master builder" of mid-20th century New York City, Long Island, and other suburbs. As the shaper of a modern city, he is sometimes compared to Baron Haussmann of Second Empire Paris, and he was easily the most polarizing figure in the history of urban planning in the United States. Although he never held elected office, Moses was arguably the most powerful person in New York City government from the 1930s to the 1950s. He literally changed shorelines, built roadways in the sky, and transformed vibrant neighborhoods forever. His decisions favoring highways over public transport formed the modern suburbs of Long Island and influenced a generation of engineers, architects, and urban planners who spread his philosophies across the nation. Image source: Wikipedia. Author: C. M. Stieglitz, World Telegram staff photographer.

Above: Artist Chesley Bonestell from page 22 of Collier's, March 22, 1952. His likeness is apparently used in his own artwork at right.

Right: Week's Mail from Collier's of May 10, 1952, discussing Collier's of March 22, 1952. Thanks to http://UNZ.org, we can read these letters as they were first presented in the magazine and recreate the letters as shown above and on the next page.

Isadore "Dore" Schary (August 31, 1905, Newark, New Jersey - July 7, 1980, New York City) was an American motion picture director, writer, and producer, and playwright who became head of production at Metro-Goldwyn Mayer and eventually president of the studio. Source: Wikipedia.

Week's Mail

Man Will Conquer Space Soon

EDITOR: YOUR MARCH 22D ISSUE OF COLLIER'S AND ITS FINE SERIES OF ARTICLES ON HOW MAN WILL CONQUER SPACE IS AN OUTSTANDING ACCOMPLISHMENT. CONGRATULATIONS.

Ralph S. Damon, New York, N.Y.

...Of course, being an explorer… (the issue)… fascinated me. I congratulate you for the effort, time and great detail that you must have put into this… I have never seen anything like it before in a magazine. For the past two years I have been working on defense matters… and that, of course, gives me an added interest in your articles. Congratulations. RICHARD E. BYRD, Department of the Navy, Washington, D.C.

...You must have H. G. Wells lashed to the mast!

ROBERT MOSES, New York, N.Y.

...I read the March 22d issue and it's a smash. The material is absolutely fascinating. I found myself chilled and thrilled and scared– and I think it's a helluva job of editing. My congratulations.

DORÉ SCHARY, Culver City, Cal.

...The extensive work you have put into the preparation of these articles is very apparent. Certainly it is the most comprehensive thing that has been done by any publication to date.

LAWRENCE D. BELL, Buffalo, N.Y.

...Who's the goldbrick in the water recovery plant room reading the space edition of Collier's? The artist who drew the diagram?

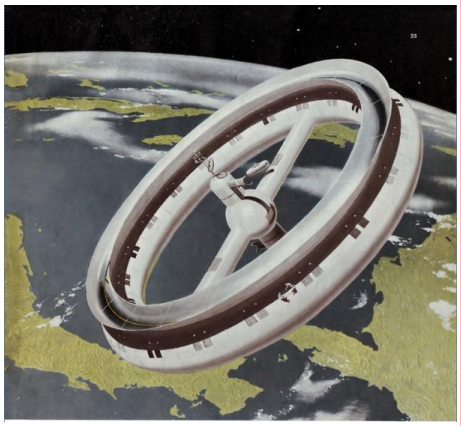
M/SGT. EDWARD M. BERQUIST, Lockbourne Air Force Base, Columbus, Ohio

That's Kilroy– he was there too.

...Considering the many unbelievable things that have happened during my sixty-three years on earth, I am almost ready to buy anything, although at times I feel like the mountaineer who had just seen the first railroad train. He said: "I seed it and I heared it, but I'll be gosh durned if I'll believe it."

So I'll make a deal with you. You can have all the cash that remains unstolen in the U.S. Treasury to build what you send, on the condition that your scientists build a gadget which, at one fell swoop, will wipe out all the public debt in the U.S. I fear that the publication of those articles during Operation Income Tax was untimely?

ARTHUR H. HASCHE, Watertown, S.D.



...From military considerations alone, it would seem criminal negligence for our government to refuse to embark on a (space superiority) program once confronted with the facts. If the Russians become the first to have an earth satellite, our whole program of national defense would be in serious jeopardy, if not made entirely useless.

H. C. TREMAIN, Stockton, Cal.

...I wish I could tell you that I am enjoying the March 22d issue, so far all I have seen is the cover and a quick glance inside– over the shoulder of my sixteen-year-old David.

Please can't you produce a separate publication of Man Will Conquer Space *Soon* for those budding young scientists?

MRS. CARL G. JOHNSON, Fredonia, N.Y.

Arrangements are now being made with Viking Press to produce the issue as a book for publication in October.

...Delusions of "progress" via trips to outer space are now the occupational disease of our best scientists. That's my conclusion on scanning the stop-the-presses feature about moon trips and space platforms and related hooey as printed in Collier's. I believe that the scientists responsible for all this moonshine "science" ought to take off and stay away from the earth until the rest of us can work out the solution of our own miseries.

I. H. SCHWARTZ, Cincinnati, Ohio

...My youngest son, aged thirteen, took Collier's to school and this led to his class having a complete afternoon of relaxation– the teacher became spellbound with the text…My sincere thanks for a most splendid night of reading. I have not been so thrilled since reading Jules Verne, 30 years ago. FRED H. PEMBERTON, Cornwall, Ont., Can.

...I commend your magazine for the vision, bold imagination and adventurous spirit exemplified in the editorial comment, articles and illustrations...By a happy

(Continued on page 10)

Week's Mail

CONTINUED FROM PAGE 6

union of authoritative writers and gifted artists, the imagination was stirred and a desire aroused...to burst through this most challenging frontier in mankind's struggle for a larger and clearer picture of God's universe and our place in it.

J. W. LITTLE, Pelham, Ga.

...I predict that it will be impossible to produce men willing to let themselves be disembarked a thousand miles above the earth. To put it bluntly; no one is going to be that crazy.

VAN CORT, New Paltz, N.Y.

...Could a crew really be found who would be competent and courageous enough to man a space rocket? Wouldn't each man have to have the genius of an Einstein, the physical stamina of an Olympic champion, the...fearlessness of Admiral Byrd, Lindbergh or Columbus?

LOUISE F. WHITE, Charleston, W.Va.

...I am a boy of only thirteen years of age, but I am seriously interested. My ambition is to become a lawyer, but if I had the opportunity to go into space I would jump at the chance. If, and when, I enter the armed forces of the U.S., I will join the Air Force because I am thrilled at the speed of jets...piston engines are so old-fashioned.

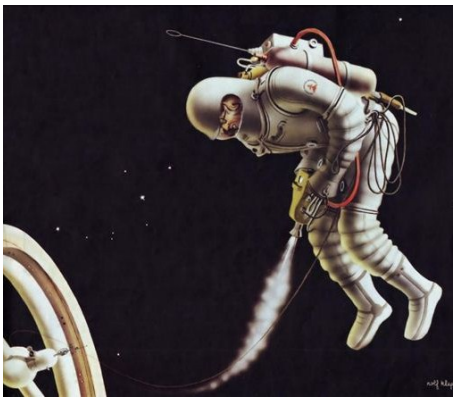
WALTER CUTLER, Jr., Leicester, Mass.

...Why not an organization for boys like me (eighteen years old) who want to go in for that form of future flying? All the necessary subjects could be taught them and eventually we would have an unbeatable "fleet" of boys ready to go out and "conquer space."

KEN DURBIN, Chicago, Ill.

...After reading the articles I remembered the hazard of meteors striking the wheel. Then I remembered Silly Putty. It is a plastic material which stretches...I thought to prevent a leakage of air you could take one layer of stell and then put a one-inch layer of Silly Putty and then another layer of steel thus making something like a sandwich. The Silly Putty would seal any leaks and plug up any holes. I am twelve years old.

DICK HEINE, Jr., Fort Wayne, Ind.



...We have been reading your March 22d issue with interest. The verdict is that we are short of lunatic asylums for the scientists who are cooking all this up. They have reached beyond the harmless stage of cutting up paper dolls and should be put away in some safe place...It would be hard to find a more idiotic "15 Startling Pages" than those I've just read.

PELHAM BARRETT, Southern Pines, N.C.

...It is by all odds the most fascinating issue of a magazine that I have ever read in my life…I'm insisting that everyone in my family read it. Congratulations.

JACK H. SAWYER, Chicago, Ill.

...I am a boy thirteen years old...and I would like to make a correction in Mr. Bonestell's drawing (page 25). If I am correct, in space there is no light– then how could the figures cast shadows?

JAMES ROGERS, Detroit, Mich.

One of those space stations always faces the sun. The two men shown in the drawing are working on the sunny side of the platform. They are actually floating in space between the sun and the station, thus the shadows are correct.

Collier's for May 10, 1952

Above: Week's Mail from Collier's of May 10, 1952, discussing Collier's of March 22, 1952. Thanks to http://UNZ.org, we can read these letters as they were first presented in the magazine and recreate the letters as shown above.

Above: Lawrence Dale Bell, founder of Bell Aircraft Corporation. Image source: Wikipedia. Permission: Hill Aerospace Museum.

Lawrence Dale "Larry" Bell (April 5, 1894 – October 20, 1956) was an American industrialist and founder of Bell Aircraft Corporation.

Bell was born in Mentone, Indiana and lived there until 1907, when his family moved to Santa Monica, California. He joined his older brother Grover and stunt pilot Lincoln Beachey as a mechanic in 1912. Grover Bell was killed in a plane crash the following year, and Lawrence vowed to quit aviation for good; however, he went to work for the Glenn L. Martin Company after friends convinced him to return to the industry. He became Martin's shop foreman at age 20, and later the company's general manager.

He left Martin in 1928 to join Consolidated Aircraft in Buffalo, New York, eventually becoming vice president and general manager. When Consolidated relocated to San Diego, Bell stayed in Buffalo and founded his own company, Bell Aircraft Corporation, on July 10, 1935. Bell Aircraft built the P-39 "Airacobra" and P-63 "Kingcobra" fighter aircraft during World War II. Their P-59 "Airacomet" fighter was America's first jet-powered aircraft. Postwar, the company produced the Bell X-1, the first aircraft to break the sound barrier in level flight. The company began developing helicopters in 1941, with the Bell 30 taking its maiden flight in 1943. This early model evolved into the Bell 47, one of the most recognizable aircraft in history.

For his role in the X-1's first supersonic flight, he shared the 1947 Collier Trophy with pilot Chuck Yeager and John Stack, a research scientist with the National Advisory Committee for Aeronautics (now NASA). He was awarded the Society of Automotive Engineers' Daniel Guggenheim Medal in 1944, and was posthumously inducted into the National Aviation Hall of Fame (1977), the Army Aviation Hall of Fame (1986), and the International Aerospace Hall of Fame (2004). [Wikipedia]

Collier's

OCTOBER 18, 1952 • FIFTEEN CENTS

MAN ON THE MOON

Scientists Tell How We Can Land There In Our Lifetime

MAN on the MOON

Scientists have dreamed for centuries of a lunar voyage. Now we know it can be done within the next 25 years—if we get started right away. In this symposium, a distinguished panel tells how

WE WILL go to the moon in the next 25 years. We have the knowledge and the tools to do it now, but years of preparation and detailed planning are needed first. What we *can* do now is get the project started.

The first step has been taken: our scientists have developed rockets which have shot through the earth's atmosphere into airless space beyond. All we need now are better rockets—and we know how to build them.

Our trip to the moon will not be a simple nonstop flight from the earth. We'd need too large and expensive a rocket ship for that. Instead, we'll make a stopover in space. We'll change vehicles, shifting from one especially designed to break away from the earth's atmosphere into one specifically designed for a moon voyage. There will be other advantages to a two-step trip, too, among them a 15,840-mile-an-hour running start on the second leg of the journey. Here's how it's done:

Within the next 10 or 15 years, we can expect to see a permanent station erected in space, 1,075 miles high, in an orbit which will carry it around the earth once every two hours. The details of this project were given in Collier's issue of March 22, 1952.

The station will be built of materials carried to the two-hour orbit by great rocket ships—called three-stage rockets because they will have three separate batteries of motors to be used one at a time, then dropped off. At a speed of 15,840 miles an hour, 1,075 miles up, these rockets become satellites of the earth, unaffected by gravity. Without power, they will cruise around the globe as long as we let them. Their cargo will do the same, since it travels at the same speed. So we merely unload our building supplies in space and let them drift there until needed.

From these prefabricated parts, we'll build a wheel-shaped structure 250 feet in diameter, with pressurized compartments and a crew of 80. The space station's ability to scan all parts of the earth will make it one of the most powerful forces for peace ever developed—or, in the wrong hands, a terrible weapon of war. Collier's still believes that the station must be built by free men; that means the United States, the only nation which can afford the satellite's $4,000,000,000 cost. In 1948, the late Secretary of Defense James V. Forrestal indicated that work on an earth satellite program had already begun. It should not be allowed to lag.

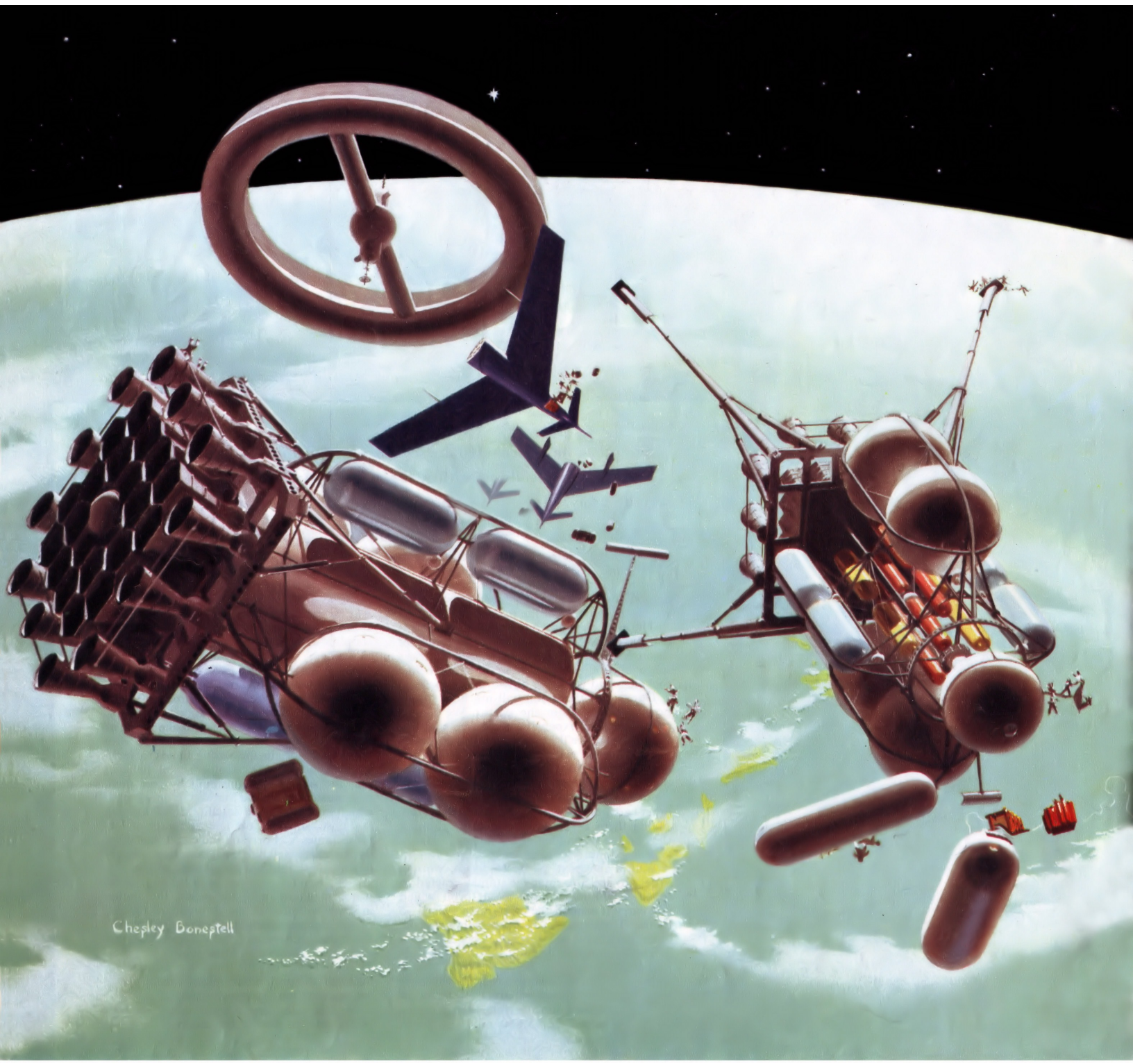
For, besides serving as a roving, ever-watchful guardian of the peace, the station in space will provide the springboard for one of the greatest scientific advances in history: the lunar journey men have dreamed of for centuries. The space station should be a reality by 1967. By the time it's completed, many of the preliminary plans will be ready for the next long step into space.

By 1977, the first scientists may set foot on the ancient dust of the moon.

HANS KNOPF

Contributors to symposium: Willy Ley, left, writer on scientific subjects; Dr. Fred L. Whipple, chairman of Harvard University astronomy department; Dr. Wernher von Braun, world's top rocket expert; artists Chesley Bonestell, Rolf Klep, Fred Freeman; associate editor Cornelius Ryan, who assembled material

MOON PHOTO COURTESY LICK OBSERVATORY



Weightless in orbit 1,075 miles above earth, workers in space suits assemble three moon ships. Hawaiian Islands lie below. Winged transports unload

Man on the Moon

THE JOURNEY

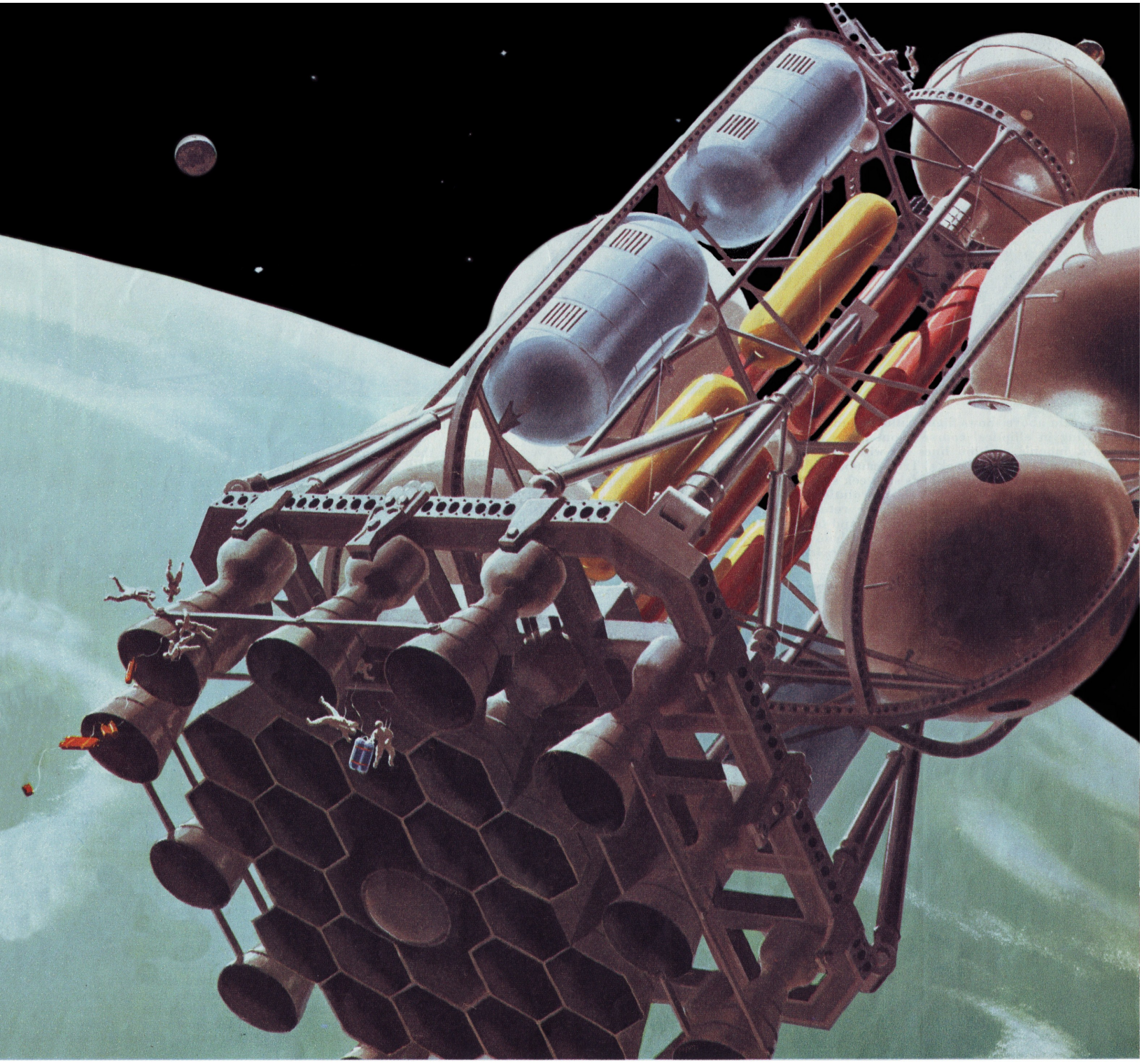
By Dr. WERNHER von BRAUN

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

For five days, the expedition speeds through space on its historic voyage —50 men on three ungainly craft, bound for the great unknown

HERE is how we shall go to the moon. The pioneer expedition, 50 scientists and technicians, will take off from the space station's orbit in three clumsy-looking but highly efficient rocket ships. They won't be streamlined: all travel will be in space, where there is no air to impede motion. Two will be loaded with propellant for the five-day, 239,000-mile trip and the return journey. The third, which will not return, will carry only enough propellant for a one-way trip; the extra room will be filled with supplies and equipment for the scientists' six-week stay.

On the outward voyage, the rocket ships will hit a top speed of 19,500 miles per hour about 33 minutes after departure. Then the motors will be stopped, and the ships will fall the rest of the way to the moon.



supplies near wheel-shaped space station top left. Engineers and equipment cluster around cargo ship lower left, passenger ships center and right

Such a trip takes a great deal of planning. For a beginning, we must decide what flight path to follow, how to construct the ships and where to land. But the project could be completed within the next 25 years. There are no problems involved to which we don't have the answers—or the ability to find them—right now.

First, where shall we land? We may have a wide choice, once we have had a close look at the moon. We'll get that look on a preliminary survey flight. A small rocket ship taking off from the space station will take us to within 50 miles of the moon to get pictures of its meteor-pitted surface—including the "back" part, never visible from the earth.

We'll study the photographs for a suitable site. Several considerations limit our selection. Because the moon's surface has 14,600,000 square miles—about one thirteenth that of the earth—we won't be able to explore more than a small area in detail, perhaps part of a section 500 miles in diameter. Our scientists want to see as many kinds of lunar features as possible, so we'll pick a spot of particular interest to them. We want radio contact with the earth, too; that means we'll have to stick to the moon's "face," for radio waves won't reach across space to any point the eye won't reach.

We can't land at the moon's equator because its noonday temperatures reach an unbearable 220-degrees Fahrenheit, more than hot enough to boil water. We can't land where the surface is too rugged, because we need a flat place to set down. Yet the site can't be too flat, either—grain-sized meteors constantly bombard the moon at speeds of several miles a second; we'll have to set up camp in a crevice where we have protection from these bullets.

There's one section of the moon that meets all our requirements, and unless something better turns up on closer inspection, that's where we'll land. It's an area called *Sinus Roris*, or Dewy Bay, on the northern branch of a plain known as *Oceanus Procellarum*, or Stormy Ocean (so called by early astronomers who thought the moon's plains were great seas). Dr. Fred L. Whipple, chairman of Harvard University astronomy department, says *Sinus Roris* is ideal for our purpose —about 650 miles from the lunar north pole, where the daytime temperature averages a reasonably pleasant 40 degrees and the terrain is flat enough to land on, yet irregular enough to hide

PAINTING BY CHESLEY BONESTELL

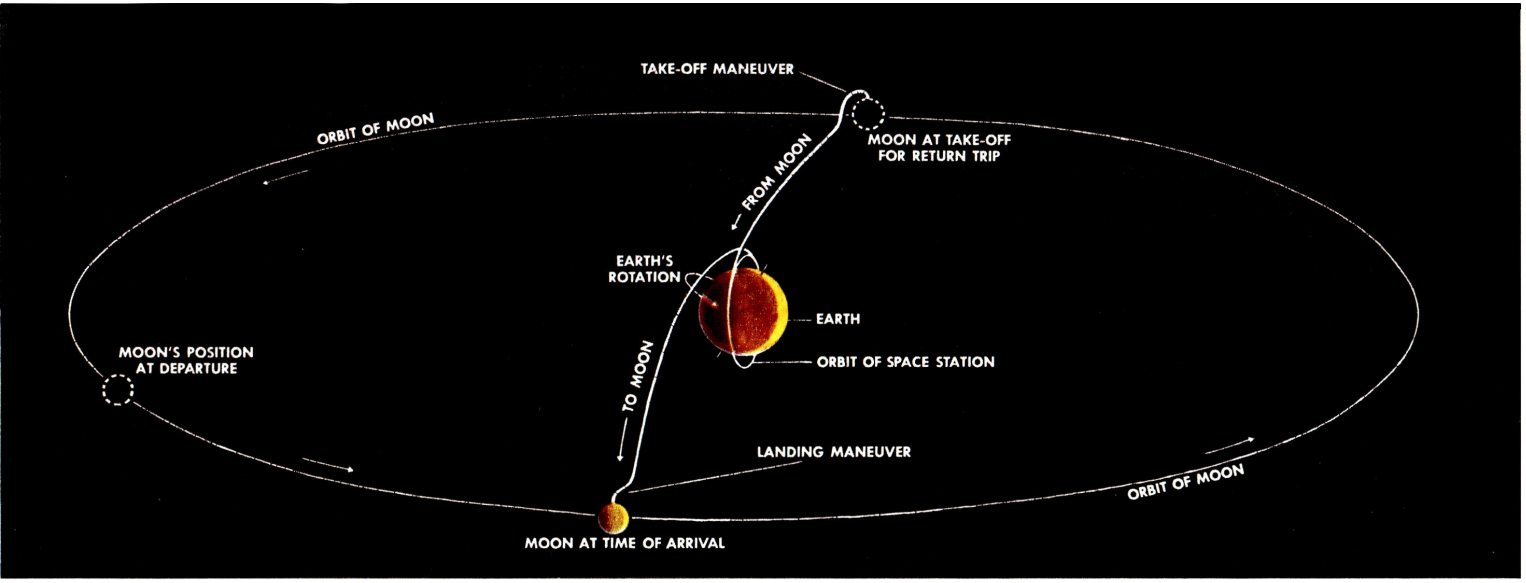
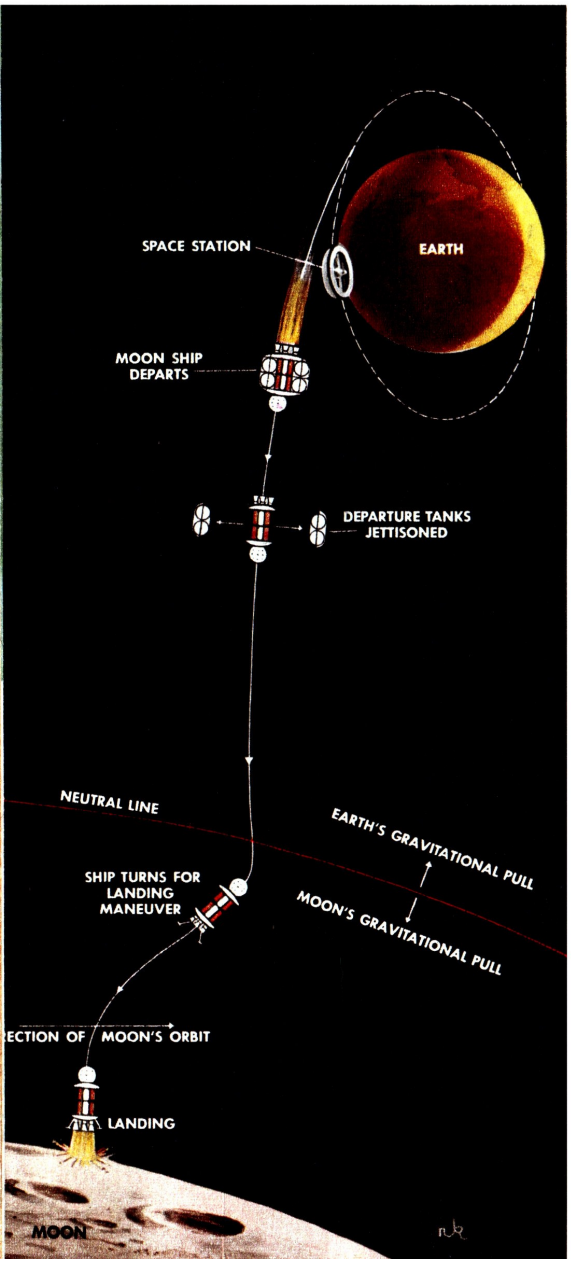


Diagram above shows flight paths to and from moon. Moving in elliptical course about globe every 27⅓ days, moon's position lines up with space station's orbit once every two weeks. Trips can be made only at this time. During expedition's six-week stay on lunar surface, moon will make 1½ revolutions around earth to reach correct position for return. Slight curves in flight track during landing and take-off are caused by moon's gravity. Drawing below, not in scale, shows moon-bound flight maneuvers in close-up



in. With a satisfactory site located, we start our detailed planning.

To save fuel and time, we want to take the shortest practical course. The moon moves around the earth in an elliptical path once every 27⅓ days. The space station, our point of departure, circles the earth once every two hours. Every two weeks, their paths are such that a rocket ship from the space station will intercept the moon in just five days. The best conditions for the return trip will occur two weeks later, and again two weeks after that. With their stay limited to multiples of two weeks, our scientists have set themselves a six-week limit for the first exploration of the moon—long enough to accomplish some constructive research, but not long enough to require a prohibitive supply of essentials like liquid oxygen, water and food.

Six months before our scheduled take-off, we begin piling up construction materials, supplies and equipment at the space station. This operation is a massive, impressive one, involving huge, shuttling cargo rocket ships, scores of hard-working handlers, and tremendous amounts of equipment. Twice a day, pairs of sleek rocket transports from the earth sweep into the satellite's orbit and swarms of workers unload the 36 tons of cargo each carries. With the arrival of the first shipment of material, work on the first of the three moon-going space craft gets under way, picking up intensity as more and more equipment arrives.

The supplies are not stacked inside the space station; they're just left floating in space. They don't have to be secured, and here's why: the satellite is traveling around the earth at 15,840 miles an hour; at that speed, it can't be affected by the earth's gravity, so it doesn't fall, and it never slows down because there's no air resistance. The same applies to any other object brought into the orbit at the same speed: to park beside the space station, a rocket ship merely adjusts its speed to 15,840 miles per hour; and it, too, becomes a satellite. Crates moved out of its hold are traveling at the same speed in relation to the earth, so they also are weightless satellites.

As the weeks pass and the unloading of cargo ships continues, the construction area covers several littered square miles. Tons of equipment lie about—aluminum girders, collapsed nylon-and-plastic fuel tanks, rocket motor units, turbopumps, bundles of thin aluminum plates, a great many nylon bags containing smaller parts. It's a bewildering scene, but not to the moon-ship builders. All construction parts are color-coded—with blue-tipped cross braces fitting into blue sockets, red joining members keyed to others of the same color, and so forth. Work proceeds swiftly.

In fact, the workers accomplish wonders, considering the obstacles confronting a man forced to struggle with unwieldy objects in space. The men move clumsily, hampered by bulky pressurized suits equipped with such necessities of space-life as air conditioning, oxygen tanks, walkie-talkie radios and tiny rocket motors for propulsion. The work is laborious, for although objects are weightless they still have inertia. A man who shoves a one-ton girder makes it move all right, but he makes himself move, too. As his inertia is less than the girder's, he shoots backward much farther than he pushes the big piece of metal forward.

The small personal rocket motors help the workers move some of the construction parts; the big stuff is hitched to space taxis, tiny pressurized rocket vehicles used for short trips outside the space station.

As the framework of the new rocket ships takes form, big, folded nylon-and-plastic bundles are brought over. They're the personnel cabins; pumped full of air, they become spherical, and plastic astrodomes are fitted to the top and sides of each. Other sacks are pumped full of propellant, and balloon into the shapes of globes and cylinders. Soon the three moon-going space ships begin to emerge in their final form. The two round-trip ships resemble an arrangement of hourglasses inside a metal framework; the one-way cargo carrier has much the same framework, but instead of hourglasses it has a central structure which looks like a great silo.

Dimensions of the Rocket Ships

Each ship is 160 feet long (nine feet more than the height of the Statue of Liberty) and about 110 feet wide. Each has at its base a battery of 30 rocket motors, and each is topped by the sphere which houses the crew members, scientists and technicians on five floors. Under the sphere are two long arms set on a circular track which enables them to rotate almost a full 360 degrees. These light booms, which fold against the vehicles during take-off and landing to avoid damage, carry two vital pieces of equipment: a radio antenna dish for short-wave communication and a solar mirror for generating power.

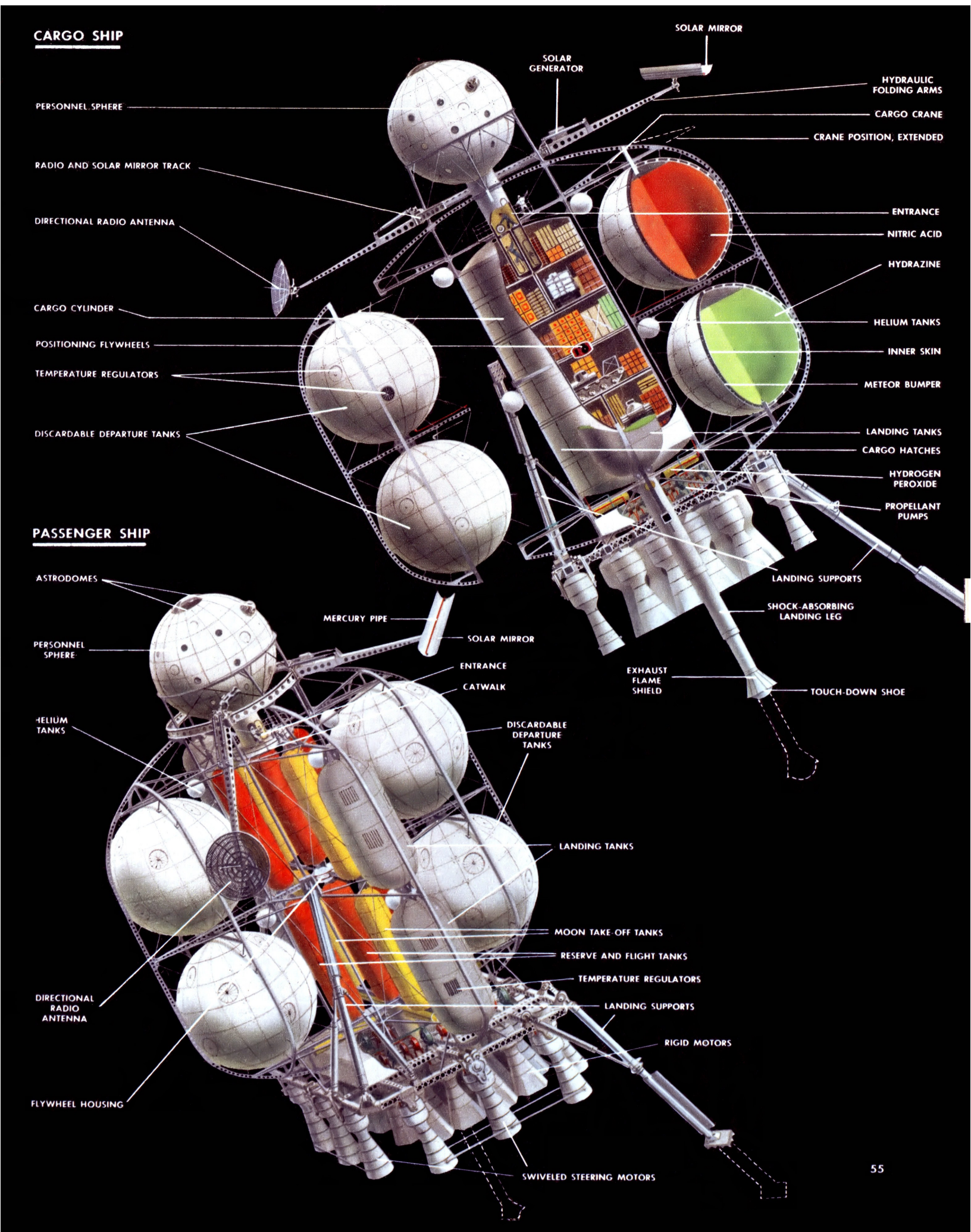
The solar mirror is a curved sheet of highly polished metal which concentrates the sun's rays on a mercury-filled pipe. The intense heat vaporizes the mercury, and the vapor drives a turbo-generator, producing 35 kilowatts of electric power —enough to run a small factory. Its work done, the vapor cools, returns to its liquid state and starts the cycle all over again.

Under the radio and mirror booms of the passenger ships hang 18 propellant tanks carrying nearly 800,000 gallons of ammonialike hydrazine (our fuel) and oxygen-rich nitric acid (the combustion agent). Four of the 18 tanks are outsized spheres, more than 33 feet in diameter. They are attached to light frames on the outside of the rocket ship's structure. More than half our propellant supply—580,000 gallons—is in these large balls; that's the amount needed for take-off. As soon as it's exhausted, the big tanks will be jettisoned. Four other large tanks carry propellant for the landing; they will be left on the moon.

We also carry a supply of hydrogen peroxide

Vehicles, right, have same dimensions: 160 ft. long, 110 ft. wide; weigh 4,370 tons. Cargo ship carries 10 men, passenger ships 20 each

DRAWINGS BY ROLF KLEP


CARGO SHIP
SOLAR MIRROR
SOLAR GENERATOR
HYDRAULIC FOLDING ARMS
PERSONNEL SPHERE
CARGO CRANE
CRANE POSITION, EXTENDED
RADIO AND SOLAR MIRROR TRACK
ENTRANCE
DIRECTIONAL RADIO ANTENNA
NITRIC ACID
HYDRAZINE
CARGO CYLINDER
HELIUM TANKS
POSITIONING FLYWHEELS
INNER SKIN
TEMPERATURE REGULATORS
METEOR BUMPER
DISCARDABLE DEPARTURE TANKS
LANDING TANKS
CARGO HATCHES
HYDROGEN PEROXIDE
PROPELLANT PUMPS
LANDING SUPPORTS
PASSENGER SHIP
ASTRODOMES
SHOCK-ABSORBING LANDING LEG
MERCURY PIPE
SOLAR MIRROR
PERSONNEL SPHERE
ENTRANCE
CATWALK
EXHAUST FLAME SHIELD
TOUCH-DOWN SHOE
HELIUM TANKS
DISCARDABLE DEPARTURE TANKS
LANDING TANKS
MOON TAKE-OFF TANKS
RESERVE AND FLIGHT TANKS
TEMPERATURE REGULATORS
DIRECTIONAL RADIO ANTENNA
LANDING SUPPORTS
RIGID MOTORS
FLYWHEEL HOUSING
SWIVELED STEERING MOTORS

to run the turbopumps which force the propellant into the rocket motors. Besides the 14 cylindrical propellant tanks and the four spherical ones, eight small helium containers are strung throughout the framework. The lighter-than-air helium will be pumped into partly emptied fuel tanks to help them keep their shape under acceleration and to create pressure for the turbopumps.

The cost of the propellant required for this first trip to the moon, the bulk of it used for the supply ships during the build-up period, is enormous—about $300,000,000, roughly 60 per cent of the half-billion-dollar cost of the entire operation. (That doesn't count the $4,000,000,000 cost of erecting the space station, whose main purpose is strategic rather than scientific.)

The cargo ship carries only enough fuel for a one-way trip, so it has fewer tanks: four discardable spheres like those on the passenger craft, and four cylindrical containers with 162,000 gallons of propellant for the moon landing.

In one respect, the cargo carrier is the most interesting of the three space vehicles. Its big silo-like storage cabin, 75 feet long and 36 feet wide, was built to serve a double purpose. Once we reach the moon and the big cranes folded against the framework have swung out and unloaded the 285 tons of supplies in the cylinder, the silo will be detached from the rest of the rocket ship. The winch-driven cables slung from the cranes will then raise *half* of the cylinder, in sections, which it will deposit on trailers drawn by tractors. The tractors will take them to a protective crevice on the moon's surface, at the place chosen for our camp. Then the other lengthwise half will be similarly moved—giving us two ready-to-use Quonset huts.

Now that we have our space ships built and have provided ourselves with living quarters for our stay on the moon, a couple of important items remain: we must protect ourselves against two of the principal hazards of space travel, flying meteors and extreme temperatures.

For Protection Against Meteors

To guard against meteors, all vital parts of the three craft—propellant tanks, personnel spheres, cargo cabin—are given a thin covering of sheet metal, set on studs which leave at least a one-inch space between this outer shield and the inside wall. The covering, called a meteor bumper, will take the full impact of the flying particles (we don't expect to be struck by any meteors much larger than a grain of sand) and will cause them to disintegrate before they can do damage.

For protection against excessive heat, all parts of the three rocket ships are painted white, because white absorbs little of the sun's radiation. Then, to guard against cold, small black patches are scattered over the tanks and personnel spheres. The patches are covered by white blinds, automatically controlled by thermostats. When the blinds on the sunny side are open, the spots absorb heat and warm the cabins and tanks; when the blinds are closed, an all-white surface is exposed to the sun, permitting little heat to enter. When the blinds on the shaded side are open, the black spots radiate heat and the temperature drops.

Now we're ready to take off from the space station's orbit to the moon.

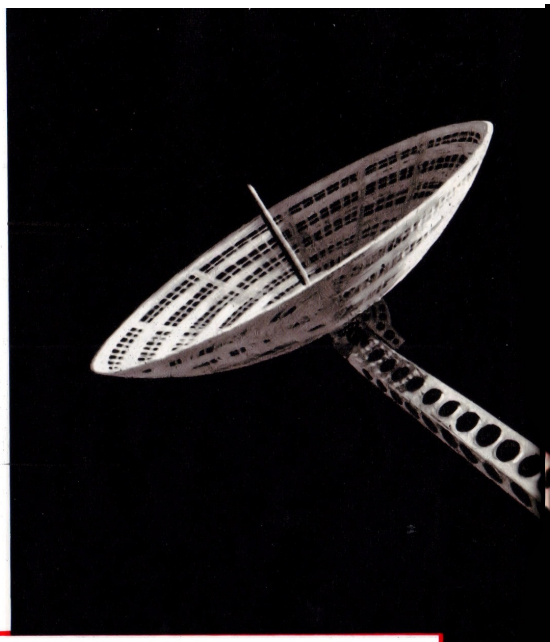
The bustle of our departure—hurrying space taxis, the nervous last-minute checks by engineers, the loading of late cargo and finally the take-off itself—will be watched by millions. Television cameras on the space station will transmit the scene to receivers all over the world. And people on the earth's dark side will be able to turn from their screens to catch a fleeting glimpse of light—high in the heavens—the combined flash of 90 rocket motors, looking from the earth like the sudden birth of a new, short-lived star.

Our departure is slow. The big rocket ships rise ponderously, one after the other, green flames streaming from their batteries of rockets, and then they pick up speed. Actually, we don't need to gain *much* speed. The velocity required to get us to our destination is 19,500 miles an hour, but we've had a running start; while "resting" in the space station's orbit, we were really streaking through space at 15,840 miles an hour. We need an additional 3,660 miles an hour.

Thirty-three minutes from take-off we have it. Now we cut off our motors; momentum and the moon's gravity will do the rest.

The moon itself is visible to us as we coast through space, but it's so far off to one side that it's hard to believe we won't miss it. In the five days of our journey, though, it will travel a great distance, and so will we; at the end of that time we shall reach the farthest point, or apogee, of our elliptical course, and the moon should be right in front of us.

The earth is visible, too—an enormous ball, most of it bulking pale black against the deeper black of space, but with a wide crescent of daylight where the sun strikes it. Within the crescent, the continents enjoying summer stand out as vast green terrain maps surrounded by the brilliant



Inside the Moon Ship

By WILLY LEY

ABOARD the moon ships, living is cramped, but not uncomfortable. Each of the two passenger vehicles holds 20 men en route to the moon, 25 on the return trip (the 10 men on the one-way cargo ship will split up coming back). For added safety, each passenger ship carries enough oxygen (three pounds per man per day), water (four pounds per man per day) and food for the *entire* expedition.

The top floor of the personnel sphere is the control deck. At the far left, an engineer keeps watch over fuel, temperature, pressure, oxygen and other gauges. Next to him, the radio operator maintains contact with the other two ships and the space station. At center, a member of the navigation staff, using a combination telescope-celestial camera, sights on a star. (When not in use, astrodomes are closed off by shutters to block the sun's blinding glare.)

To the right of his position is the rocket motor instrument panel and, underneath, the automatic pilot and the reels of tape which operate it during landing. The man at extreme right is the crew captain, strapped into a swivel seat which enables him to watch either the master controls, as he's doing now, or the motor instruments behind him (for comfort, all seats are contour seats; personnel must be strapped in so they won't float away in the weightless ship). A control board at the captain's position enables him to operate the rocket motors, and the intercom unit by his hand keeps him in communication with the rest of the ship.

The next floor down is primarily a navigation deck, although a sponge-bath stall (there are no showers, because the water won't fall properly) and extra bunks are also installed here. Next to the bathing stall, a navigator operates a mechanical computer. The chief navigator and two assistants are working at the dead-reckoning tracer, a device which automatically records the space ship's course. The clock on the wall shows elapsed time since departure, and the three screens at the right indicate the attitude of the ship, as determined by an artificial horizon mechanism in the astrodome at far right.

On the central, and largest, deck are the ship's living quarters. Bunks line the walls and hang from stanchions (the sleeping men are members of the off-duty watch), and a cooking-dining area occupies most of the floor space. At center is an automatic dining unit: table, short-wave food heater and dishwasher.

It works this way: the "cook" (background) has taken a packaged, precooked meal from the deep freeze and is placing it on a conveyer belt. It enters the short-wave heater and is deposited in a spring-lidded dish (so it won't float away). The dish is locked into one of the two outer conveyer tracks on the table (one for solids, the other for liquids) and the diner draws the food toward him along a slot. When he's finished, he slides his dish back to the third, or inner, track, which carries it to the dishwashing unit. Straps hold the diners in their seats, making their snap-equipped belts unnecessary. At far right is a snack dispenser for quick meals, particularly for crewmen standing watch.

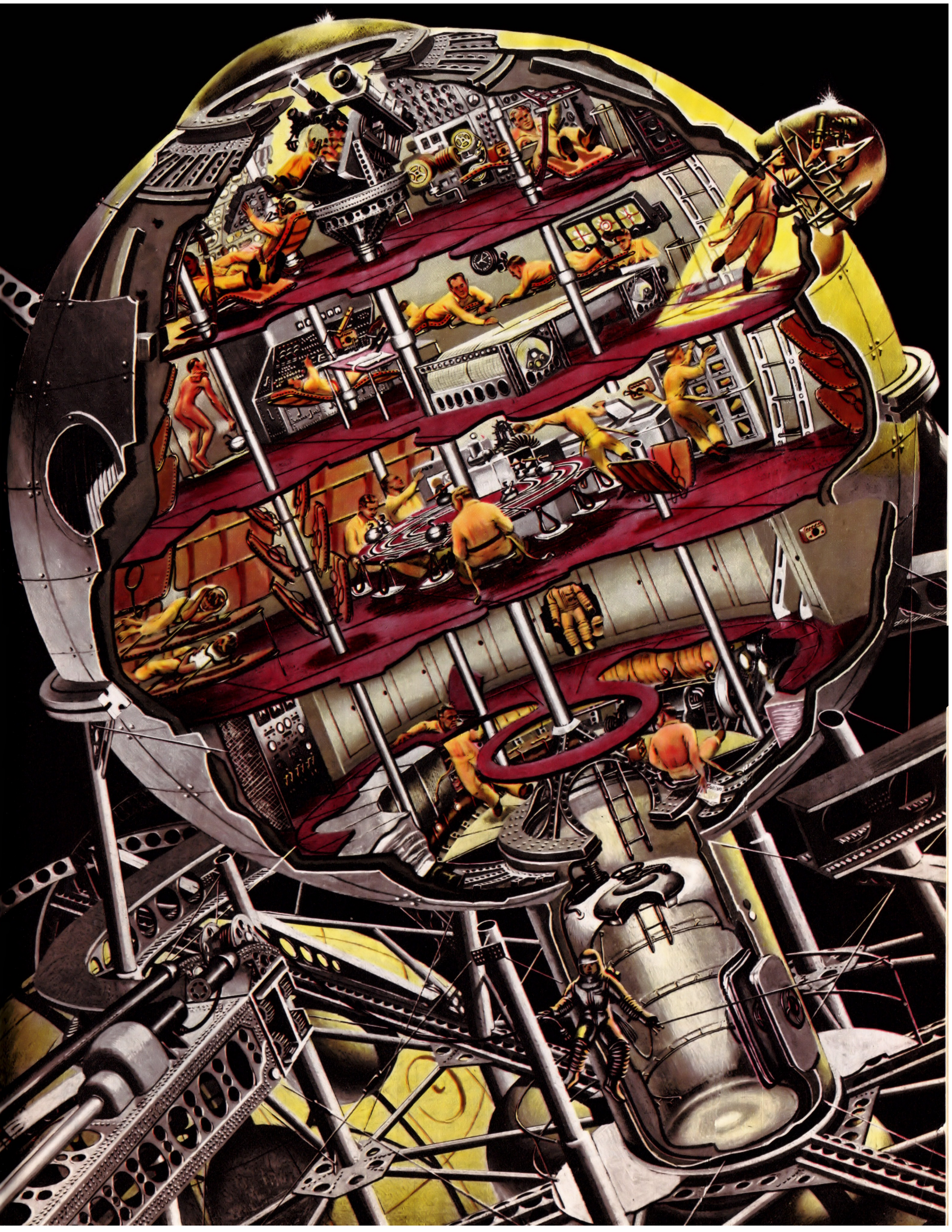
The fourth floor down, or stowage deck, houses the main electrical switchboard, storage cupboards and a washroom (next to the stairway).

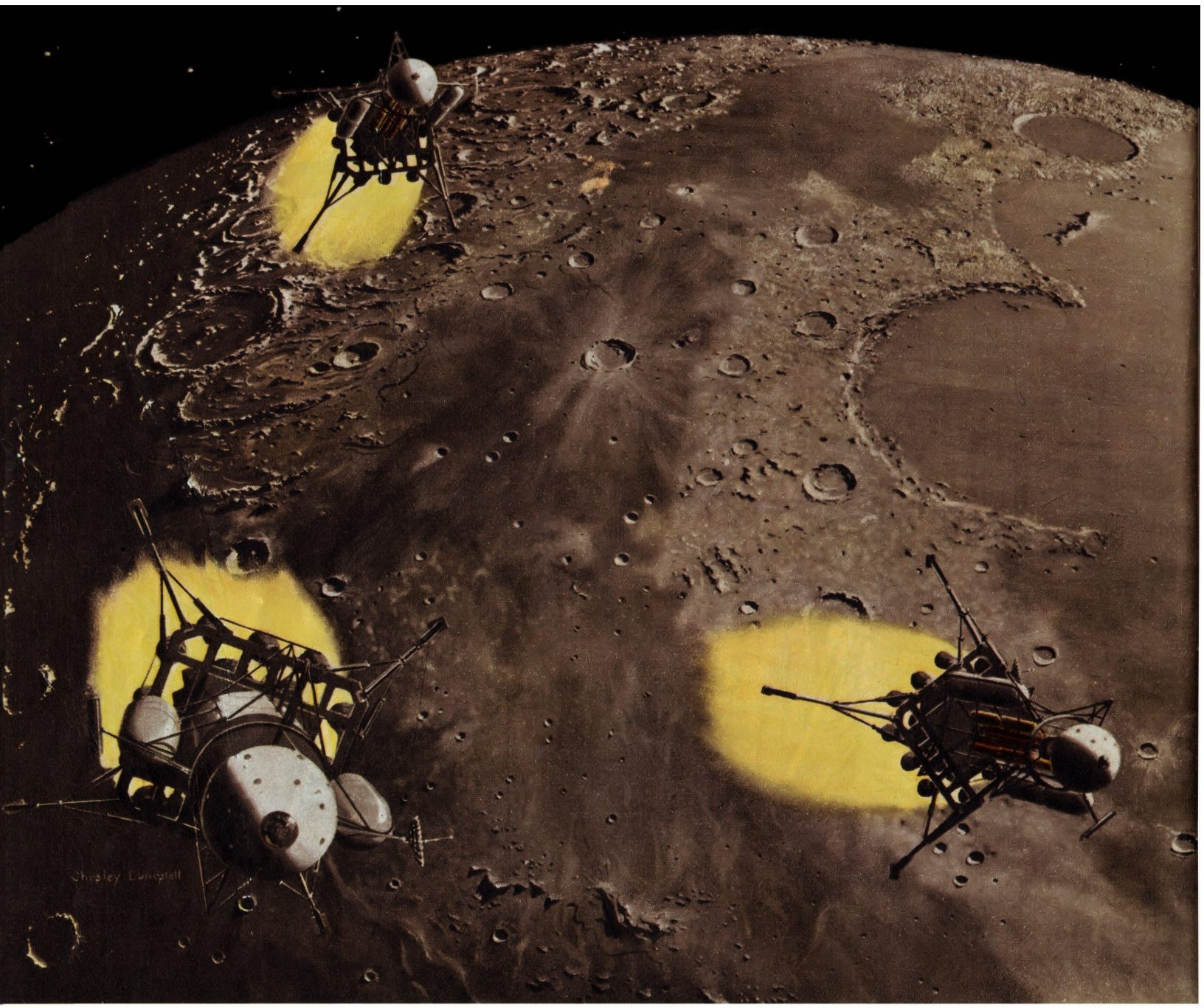
The engineering deck is at the bottom of the sphere. Lining the walls, directly below the ceiling, are water tanks (left), yellow oxygen tanks (center), air blower pump (behind the large gauges) and tanks for water recovered from the ship's atmosphere. Below this ring are the brown electric storage batteries and the ship's air-conditioning and water-cleansing systems. Sewage tanks are under the floor.

The space-suited engineer outside the ship's air lock holds the main power line, which connects with the power-producing solar mirror (off picture at lower left). He's about to plug the line into the black distributing box, shown on the catwalk between his feet, half hidden by the air-lock tower.

The sphere will be home to the voyagers not only for the five-day trip, but for several days after, while lunar quarters are being constructed. ▲▲▲

ILLUSTRATED BY FRED FREEMAN





Landing on the moon. Ten minutes before touchdown, rocket motors are switched on to slow down ships' high-speed fall caused by the moon's gravity. Vehicles are maneuvering 550 miles above landing area known as *Sinus Roris* (Dewy Bay), dark plain above cargo ship in lower left

blue of the oceans. Patches of white cloud obscure some of the detail; other white blobs are snow and ice on mountain ranges and polar areas.

Against the blackness of the earth's night side is a gleaming spot—the space station, reflecting the light of the sun.

Two hours and 54 minutes after departure, we are 17,750 miles from the earth's surface. Our speed has dropped sharply, to 10,500 miles an hour. Five hours and eight minutes en route, the earth is 32,950 miles away, and our speed is 8,000 miles an hour; after 20 hours, we're 132,000 miles from the earth, traveling at 4,300 miles an hour.

On this first day, we discard the empty departure tanks. Engineers in protective suits step outside the cabin, stand for a moment in space, then make their way down the girders to the big spheres. They pump any remaining propellant into reserve tanks, disconnect the useless containers, and give them a gentle shove. For a while the tanks drift along beside us; soon they float out of sight. Eventually they will crash on the moon.

There is no hazard for the engineers in this operation. As a precaution, they were secured to the ship by safety lines, but they could probably have done as well without them. There is no air in space to blow them away.

That's just one of the peculiarities of space to which we must adapt ourselves. Lacking a natural sequence of night and day, we live by an arbitrary time schedule. Because nothing has weight, cooking and eating are special problems. Kitchen utensils have magnetic strips or clamps so they won't float away. The heating of food is done on electronic ranges. They have many advantages: they're clean, easy to operate, and their short-wave rays don't burn up precious oxygen.

Difficulties of Dining in Space

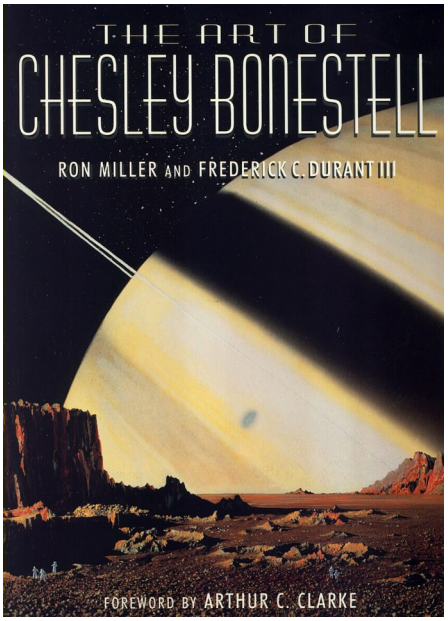
We have no knives, spoons or forks. All solid food is precut; all liquids are served in plastic bottles and forced directly into the mouth by squeezing. Our mess kits have spring-operated covers; our only eating utensils are tonglike devices; if we open the covers carefully, we can grab a mouthful of food without getting it all over the cabin.

From the start of the trip, the ship's crew has been maintaining a round-the-clock schedule, standing eight-hour watches. Captains, navigators and radiomen spend most of their time checking and rechecking our flight track, ready to start up the rockets for a change in course if an error turns up. Technicians back up this operation with reports from the complex and delicate "electronic brains"—computers, gyroscopes, switchboards and other instruments—on the control deck. Other specialists keep watch over the air-conditioning, temperature, pressure and oxygen systems.

But the busiest crew members are the maintenance engineers and their assistants, tireless men who have been bustling back and forth between ships since shortly after the voyage started, anxiously checking propellant tanks, tubing, rocket motors, turbopumps and all other vital equipment. Excessive heat could cause dangerous hairline cracks in the rocket motors; unexpectedly large meteors could smash through the thin bumpers surrounding the propellant tanks; fittings could come loose. The engineers have to be careful.

We are still slowing down. At the start of the fourth day, our speed has dropped to 800

PAINTING BY CHESLEY BONESTELL



Award winner Ron Miller & Black Cat Studios

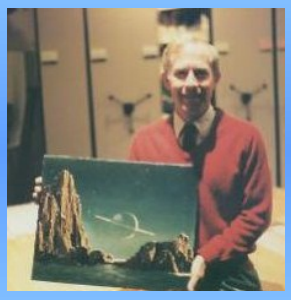
Ron Miller, winner of the 2002 Hugo Award (World Science Fiction Society) for Best Related Work: The Art of Chesley Bonestell

The Chesley Bonestell Archives of Melvin H. Schuetz

A Chesley Bonestell Space Art Chronology

Melvin H. Schuetz

www.bonestell.com



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

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

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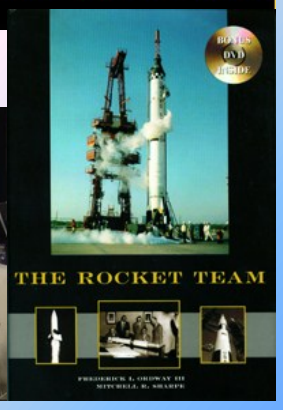


Frederick Ira Ordway III

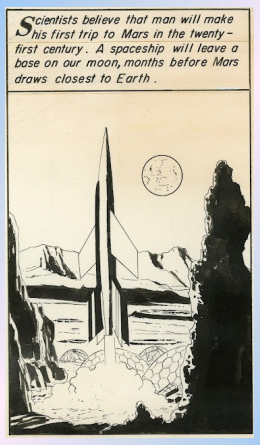
Co-Author with Mitchell R. Sharpe of The Rocket Team

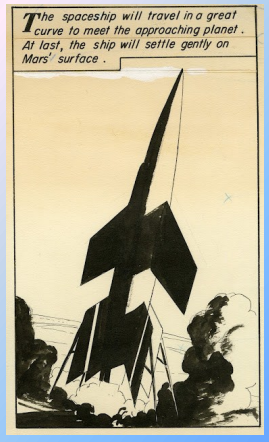
Dreams of Space, Books & Ephemera

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

http://dreamsofspace.blogspot.fr

Below: From John Sisson's Dreams of Space blog entry, this art is by Angelo Torres, from a 1961 non-fiction Classics Illustrated comic book, The World Around Us, Undersea Adventures #30.





APR Corner

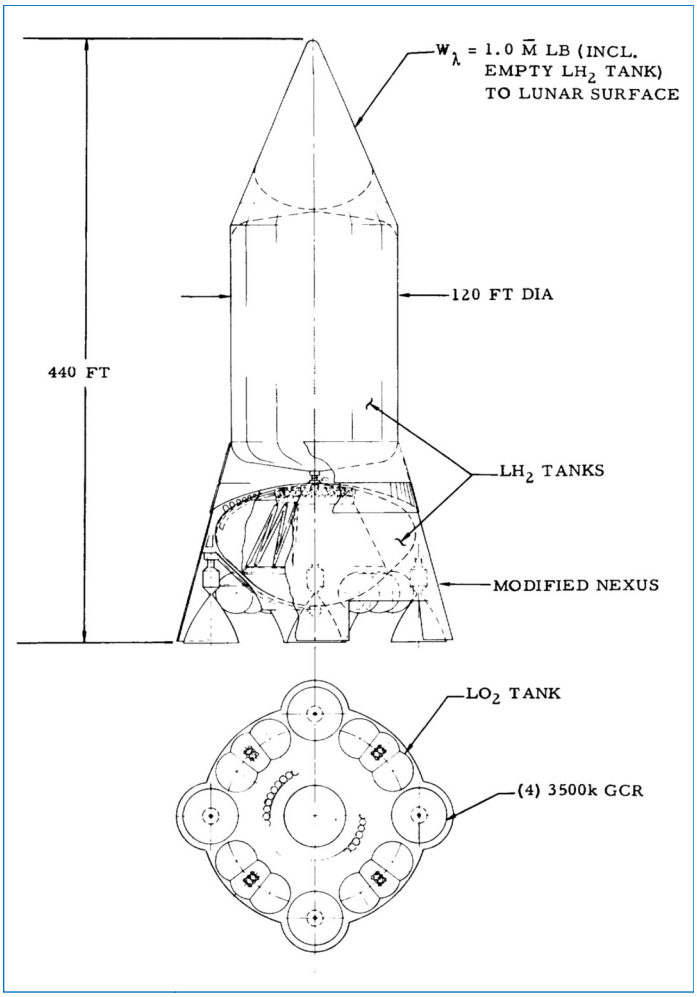
Aerospace Projects Review

Convair "Super-NEXUS"

SCOTT LOWTHER

The Convair "Super NEXUS" of 1963 was certainly one of the most ambitious and forward thinking launch vehicles ever contemplated by a serious aerospace corporation. Delivery of one million pounds of payload to the lunar surface would be possible with this vehicle, which was a modification of the NEXUS single-stage-to-orbit design. It would launch using conventional hydrogen-oxygen rocket engines on the NEXUS core; at a velocity of 8,000 feet per second four nuclear Gas Core Rockets (GCRs) would ignite and the chemical rockets burn out. The GCRs would put the vehicle into a circular Earth orbit for check-out, then ignite again for a 60-hour transfer orbit to the moon. Once there the vehicle would enter a circular orbit about the moon and then brake, completely cancelling out orbital velocity and dropping to a hover 1500 feet above the lunar surface. The payload, which would include the now-empty segmented

(Continued on page 49)



Above: Design P/S-E-LV 3.5, the "Super NEXUS." (Convair) Image credit: Scott Lowhter.

miles an hour, only slightly more than the speed of a conventional jet fighter. Ahead, the harsh surface features of the moon are clearly outlined. Behind, the blue-green ball of the earth appears to be barely a yard in diameter.

Our fleet of unpowered rocket ships is now passing the neutral point between the gravitational fields of the earth and the moon. Our momentum has dropped off to almost nothing—yet we're about to pick up speed. For now we begin falling toward the moon, about 23,600 miles away. With no atmosphere to slow us, we'll smash into the moon at 6,000 miles an hour unless we do something about it.

Rotating the Moon Ship

This is what we do: aboard each ship, near its center of gravity, is a positioning device consisting of three flywheels set at right angles to one another and operated by electric motors. One of the wheels heads in the same direction as our flight path—in other words, along the longitudinal axis of the vehicle, like the rear wheels of a car. Another parallels the latitudinal axis, like the steering wheel of an ocean vessel. The third lies along the horizontal axis, like the rear steering wheel of a hook-and-ladder truck. If we start any one of the wheels spinning, it causes our rocket ship to turn slowly in the other direction (pilots know this "torque" effect; as increased power causes a plane's propeller to spin more rapidly in one direction, the pilot has to fight his controls to keep the plane from rolling in the other direction).

The captain of our space ship orders the longitudinal flywheel set in motion. Slowly our craft begins to cartwheel; when it has turned half a revolution, it stops. We are going toward the moon tail-end-first, a position which will enable us to brake our fall with our rocket motors when the right time comes.

Tension increases aboard the three ships. The landing is tricky—so tricky that it will be done entirely by automatic pilot, to diminish the possibility of human error. Our scientists compute our rate of descent, the spot at which we expect to strike, the speed and direction of the moon (it's traveling at 2,280 miles an hour at right angles to our path). These and other essential statistics are fed into a tape. The tape, based on the same principle as the player-piano roll and the automatic business-machine card, will control the automatic pilot. (Actually, a number of tapes intended to provide for all eventualities will be fixed up long before the flight, but last-minute checks are necessary to see which tape to use—and to see whether a manual correction of our course is required before the autopilot takes over.)

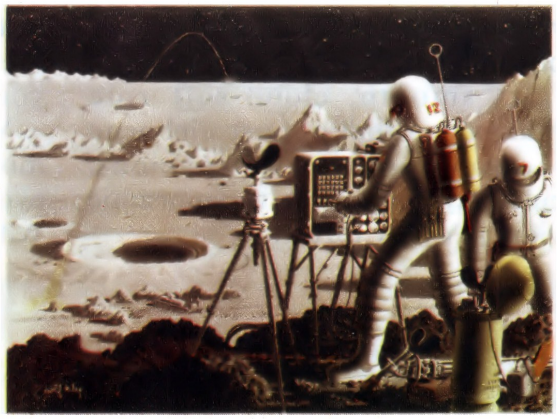
Now we lower part of our landing gear—four spiderlike legs, hinged to the square rocket assembly, which have been folded against the framework.

As we near the end of our trip, the gravity of the moon, which is still to one side of us, begins to pull us off our elliptical course, and we turn the ship to conform to this change of direction. At an altitude of 550 miles, the rocket motors begin firing; we feel the shock of their blasts inside the personnel sphere and suddenly our weight returns. Objects which have not been secured beforehand tumble to the floor. The force of the rocket motors is such that we have about one third our normal earth weight.

The final 10 minutes are especially tense. The tape-guided automatic pilots are now in full control. We fall more and more slowly, floating over the landing area like descending helicopters. As we approach, the fifth leg of our landing gear—a big telescopic shock absorber which has been housed in the center of the rocket assembly—is lowered through the fiery blast of the motors. The long green rocket flames begin to splash against the baked lunar surface. Swirling clouds of brown-gray dust are thrown out sideways; they settle immediately, instead of hanging in air, as they would on the earth.

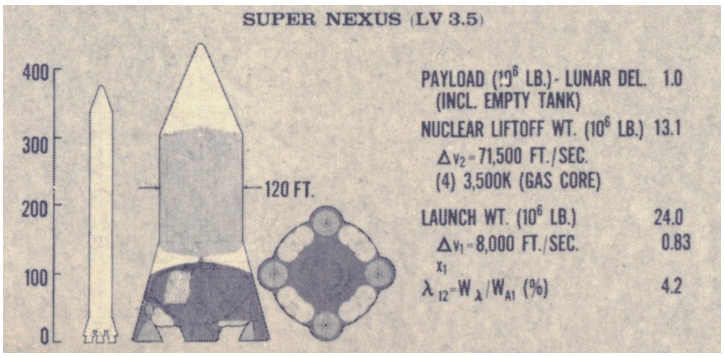
The broad round shoe of the telescopic landing leg digs into the soft volcanic ground. If it strikes too hard, an electronic mechanism inside it immediately calls on the rocket motors for more power to cushion the blow. For a few seconds, we balance on the single leg. Then the four outrigger legs slide out to help support the weight of the ship, and are locked into position. The whirring of machinery dies away. There is absolute silence. We have reached the moon.

Now we shall explore it. ▲▲▲



NEXT WEEK

The Exploration of the Moon



Left: While small, this illustration does give a good idea of the gigantic size of the Super NEXUS by showing it to scale with a Saturn V. While not greatly longer than a Saturn V, the diameter of the vehicle is vastly greater. (Convair) Image credit: Scott Lowther.

Mission: Lunar Delivery - Δv_T = 71,500 ft/sec (21.8 km/sec)

OVERALL:	
Payload (10^6 lb)(Lunar delivery-incl. empty tank)	1.0 (454 M. T.)
Launch weight (10^6 lb)	24.0 (10,900 M. T.)
Staging velocity (ft/sec)	8,000 (2.44 km/sec)
Paylcad fraction (W_λ / W_{A1})	0.042
Diameter (nominal) (ft)	120 (36.6m)
Height (ft)	440 (134m)
NUCLEAR STAGE (I_{sp} = 2000 sec)	
Liftoff weight (10^6 lb)	13.1 (5940 M. T.)
Nuclear system type	GCR
No. and engine sizes	(4) 3500K
Total thrust (10^6 lb)	14.0 (6350 M. T.)
Propellant weight (10^6 lb)	8.27 (3750 M. T.)
BOOSTER STAGE (I_{sp} = 382/439 sec)	
Booster type	Super Nexus
Propulsion system type	Plug
Total thrust (10^6 lb)	30.0 (13,600 M. T.)
Propellant (oxidizer/fuel)	LO_2/LH_2
Mixture ratio	5:1
Diameter (nominal)	150 (45.7m)
Diameter (maximum)	170 (51.8m)
Length (ft)	115 (35.0m)
Mass fraction (x_1)	0.83

Above: Data for P/S-E-LV 3.5 "Super-NEXUS." Image credit: Scott Lowther.

APR Corner

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

(Continued from page 48)
hydrogen tanks above the Super-NEXUS, would separate and land itself on the lunar surface; the Super-NEXUS itself would return to lunar orbit, transfer back to a circular Earth orbit, de-orbit and splash down. Total mission velocity was to be 71,450 feet per second. Not only would the Super-NEXUS deliver an impressive 454 metric tons of payload mass to the lunar surface, each mission would also deliver a gigantic 120-foot diameter pressure vessel to the lunar surface in the form of the empty hydrogen tank. Just the thing for kick-starting a giant lunar base.

More on the NEXUS series of launch vehicles can be found in issue V3N1 of Aerospace Projects Review at aerospaceprojectsreview.com

Contributors to symposium: Willy Ley, left, writer on scientific subjects; Dr. Fred L. Whipple, chairman of Harvard University astronomy department; Dr. Wernher von Braun, world's top rocket expert; artists Chesley Bonestell, Rolf Klep, Fred Freeman; associate editor Cornelius Ryan, who assembled material

Left: A map to images of these famous individuals in the Bonestell painting in the weekly magazine Collier's for October 18, 1952. This photograph is from the first page (after the cover) of these space articles in this issue of Collier's. Image credit: Scott Lowther, Aerospace Projects Review.

Above: A model capsule seen ahead of drop tests inside the Vehicle Assembly Building at NASA's Kennedy Space Center in Florida to test a rotor system landing design. Image credit: NASA/Kim Shiflett.

Above: NASA's Johnson Space Center Aerospace Engineer Jeff Hagen attaches a rotor to the top of a model capsule ahead of drop tests inside the Vehicle Assembly Building at NASA's Kennedy Space Center in Florida. Image credit: NASA/Kim Shiflett.

Engineers Test Rotor Landing for Capsule

10.3.12

Above: An artist concept shows a capsule flying back to Earth with a rotor blade system instead of parachutes. The rotors deploy from the side of the capsule once the fall has slowed to subsonic speeds. Image credit: NASA.

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The American Institute of Aeronautics and Astronautics

As noted elsewhere in this issue, the store in the 1940 Air Terminal Museum at Hobby Airport sells these logo shirts for about $30, a very affordable price. Eight different men's shirts are shown here. The black shirt is the only one with a pocket in these pictures. You will enjoy your visits to the museum, one of the AIAA Historic Aerospace Sites. For more information, please see the museum web site at www.1940airterminal.org.

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