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OMNI

JULY 1989

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THE DARK SIDE:
20 YEARS LATER THE ASTRONAUTS SPEAK OUT

NORMAN MAILER:
REFLECTIONS ON SPACE

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OMNI®

VOL 11 NO 10 JULY 1989

CONTENTS

Painted by veteran astronaut Alan Bean An American Success Story depicts fellow Apollo astronaut John Young's excitement and pride upon walking on the moon From the collection of Leonard E B Andrews Newtown Square Pennsylvania

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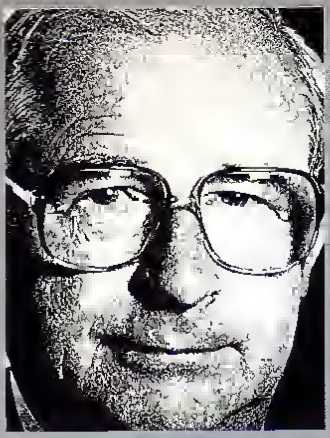

FIRST WORD

By Tom Paine

"Apollo had launched a limitless age of discovery. Humanity was destined to evolve from an earthbound to a spacefaring species. But where do we stand today, 20 years after that first lunar landing?"

As the lunar module *Eagle* dove toward the moon, I gripped my tabletop in Mission Control, applying body English to the plunging spaceship. At the same time the tense voices of Neil Armstrong and Buzz Aldrin exchanged flight information across 240,000 miles with Charlie Duke here at Houston Space Center. Moments later Armstrong transmitted the long-awaited message: "Houston, Tranquility Base here; the *Eagle* has landed!" Tumultuous applause broke out in Mission Control—and around the world.

I felt a surge of relief and exultation but reminded myself, *Okay, we've got 'em down, now we've got to get them back.* I grabbed the private telephone to the White House and asked for President Nixon. "Mr. President," I said as evenly as I could, "our astronauts have landed on the moon and initiated human exploration of other worlds." As I hung up I looked into the faces of the cheering band around me and felt admiration for the giants on whose shoulders Neil and Buzz stood to reach the moon.

Looking back at that electrifying moment two decades later, I wonder what is the lasting significance of America's Apollo program. The importance is clear. By setting NASA's sights on a lunar landing within only eight short years President John F. Kennedy indeed opened the new frontier he envisaged. Kennedy inspired the U.S. pioneers in space to overcome innumerable obstacles and accomplish what many saw as an impossible feat within a demanding timetable.

Sitting beside me on that July 20, 1969, Wernher von Braun—who with Eberhard Rees developed the Saturn 5, the launch vehicle that carried the astronauts to the moon—predicted that the next century would become known as the extraterrestrial century. We agreed that exponentially growing world economies and advancing space technologies would accelerate space exploration. I believed that scientific progress interacting with the vastness of the space frontier could now eliminate any barriers previously stopping man from fulfilling his greatest aspirations in space. Apollo had launched a limitless age of discovery, and humanity was destined to evolve from an earthbound to a spacefaring, multiplanet species.

And where do we stand today, 20 years after that first lunar landing? 1989 finds us marking time in Washington, awaiting a decision on our future direction in space. President Bush must act quickly and work with Congress to set new goals for NASA, including plans to probe beyond Earth's orbit.

In order to fulfill these goals the newly appointed administrator of NASA, Rear Admiral Richard Truly (who is also the first astronaut to hold this position), must invest in a new generation of technology for twenty-first century space exploration. The time is right for NASA to develop and build advanced space propulsion systems, orbital spaceports that can circle the earth, the moon, and Mars, deep-space cargo transports, economical human transports, and closed-ecology biospheres that can produce the daily nutritional needs of interspace travelers without depending on Earth's resources.

The next steps are clear. We need to build a bridge between worlds and establish lunar and Martian bases so we can utilize the indigenous resources of these terrestrial masses. We must learn to travel routinely to other worlds in order to successfully claim the entire solar system as our backyard. We should monitor from orbit the health of our beautiful blue planet Earth, accelerate robotic exploration of the solar system, and intensify the search for extraterrestrial intelligence.

Challenging? Certainly. But we understand these possibilities (and the problems that go along with them) far better today than we could grasp the concept of a lunar landing when President Kennedy launched Apollo. Such a program will create myriad opportunities for peaceful international cooperation and inspire young people to work toward exciting careers in space sciences and extraterrestrial operations.

All of the peoples of our home planet should participate in this upward and outward evolution of terrestrial life. It is time for man to spread out beyond the earth's gravitational limits and to encourage the evolution of new societies. Those who wish to experiment with different forms of government, who seek religious freedom, or who are being smothered by the physical boundaries of Earth should be allowed to pursue their aspiration in the untamed frontier of space. Neil Armstrong was right. The lunar landing of Apollo 11 was indeed "a giant leap for mankind." For America it enhanced our commanding lead in aerospace technology that still represents our most competitive arena. Continuing United States leadership into the twenty-first century, however, requires a vigorous national response to the challenge of the space frontier.

To forge ahead we must set bold goals for NASA: create a new advanced technology base, develop next-generation spacefaring capabilities, and sail beyond Earth's orbit to explore and develop the solar system's vast untapped potential. With these steps, plus unforeseeable scientific breakthroughs, we will gain a new understanding of the role of intelligence in the cosmos. And in another century our descendants will literally reach out and touch the stars. ∞

Tom Paine was administrator of NASA when the United States landed the first man on the moon, July 20, 1969.

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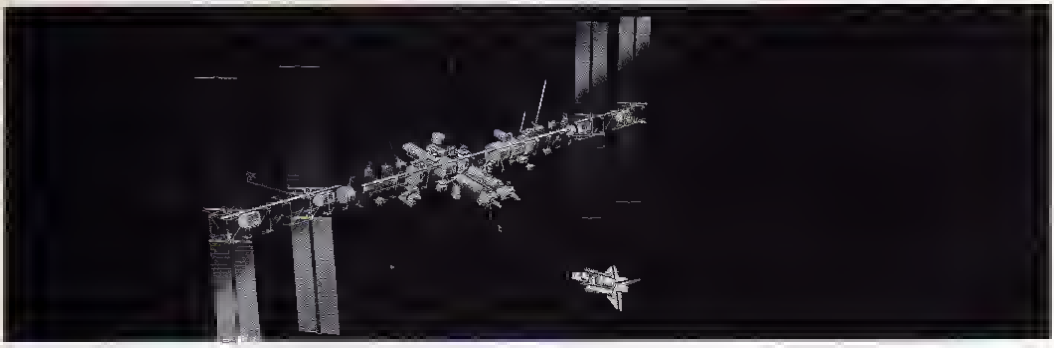

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SELLING SPACE


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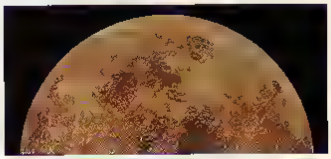
LUNAR REFLECTIONS


LUNAR TIMEKEEPER


UNIDENTIFIED OBJECTS

On July 20, 1969, Neil Armstrong took a giant leap for mankind and announced to planet Earth that the United States had initiated human exploration of other worlds. The crew of Apollo 11—Armstrong, Buzz Aldrin, and Michael Collins—couldn't have reached the moon without the many people who worked long and hard to make space travel possible. But the real heroes, of course, were the astronauts, who risked their lives to go where no man had gone before.

Not long ago, while attending a Palm Springs, California, space conference, associate editor Tom Dworetzky met up with Alan Shepard. What impressed Dworetzky most about the former Apollo astronaut was his humanity, a side seldom seen. To the public eye, says Dworetzky, who coordinated this moon-landing commemorative issue, Shepard and the other 23 men who went to the moon were intrepid masters of the sky, afraid of nothing.

Dworetzky assigned author *Jeff Goldberg* the task of compiling the astronauts' personal recollections of the Apollo missions. In "Lunar Reflections" (page 34), Shepard and 14 others reveal some of the fears and problems they experienced. What, for example, would you do if, less than one minute after takeoff, lightning struck the space capsule in which you were riding, knocking out your primary source of power? Alan Bean tells us what *he* did.

As author Norman Mailer (Books, page 18) pointed out in *Of a Fire on the Moon*, his 1969 account of the moon landing, the Apollo program was plagued by errors. Flaws in the spaceships' machinery, kinks in the astronauts' space suits, and problems in communications were routine. Despite the danger, however, the astronauts achieved some astounding triumphs.

Mailer also argues that NASA officials knew nothing about public relations and therefore had difficulty mustering America's support. Science-fiction writer Ray Bradbury expressed the same sentiments at the Palm Springs conference. What's needed, Bradbury said, is a program to make people care about space exploration. With that idea in mind, Dworetzky approached a number of Madison Avenue advertising agencies and asked them to develop their own ad campaigns promoting extraterrestrial travel. The result is "Selling Space," beginning on page 53.

The Tranquillity calendar ("Lunar Timekeeper," page 96) will also encourage interest in space and other sciences, its creator, *Jeff Siggins*, believes. Based on modern astronomical measurements that our antiquated Gregorian calendar lacks, the Tranquillity calendar starts at the moment Armstrong announced the successful landing on the moon. A former child actor regularly featured on television's *The Patty Duke Show*, Siggins first thought of developing his calendar in 1969, shortly after the New York ticker-tape parade honoring the Apollo 11 crew. With technical data supplied by the Naval Observatory and NASA, he was able to "fully develop and fine-tune the calendar," he says.

Since the early days of space exploration, many satellites' spin-scan cameras, radiometers, and other weather-recording equipment have been designed by meteorologist Verner Suomi. When we wanted the real scoop on Earth's crazy weather, nine out of ten meteorologists said, "Get Suomi!" So for this month's Interview (page 60) we sent writer *Paul Bagne* out to the University of Wisconsin to meet with the father of planetary atmospheric science.

Award-winning author *James P. Blaylock* rounds out this special issue with "Unidentified Objects" (page 42). It's a story about missed opportunities, the loss of innocence, and a mysterious character named Captain Hooton.

Art director Dwayne Flinchum and his staff have also won their share of accolades for *Omni*'s design and illustrations. "In a World Like This" (October 1988), "A Star Is Reborn" (October 1988), and "The Gulag on the Rue des Grandes Augustins" (January 1989) were recently honored with 1989 Illustration Annual awards, sponsored by *Communication Arts* magazine. And "Solace" (February 1989) received a design award from the Society of Publication Design.

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LETTERS

COMMUNICATIONS

Bright Idea

Your April 1989 issue dealing with creativity was superb. I teach a course in critical and creative thinking at Florida Community College, and I found the articles on the creative process well written, enlightening, and useful. The April issue, in fact, may become required reading for my students.

Arnold Wood, Jr.
Jacksonville, FL

The articles on creativity are most interesting and raise a number of questions. Creativity is often spoken of as a kind of intuitive force that defies the reasoning process, tends to appear spontaneously without preparation, and almost always enriches our lives in some down-to-earth, practical way. But I don't think it can be objectively measured with a test. Knowledge is worthwhile for its own sake, whether or not it has a practical application.

Garry St. John
Fairbanks, AK

Sea Sick

I want to thank you for Ken Brower's article "Sea of Trouble" [Earth, April 1989]. This is a serious problem that needs to be addressed now. It's articles such as this that open our eyes to how badly our watery world has been, and still is, deteriorating. The photograph accompanying the article literally made me sick. Some kind of action needs to be taken against the hospitals responsible for dumping their medical waste. If nothing is done soon, we will all pay the price.

Ross L. Vandenberg
Tucson, AZ

Bad Footage

I want to add my view to that of Rene Dahinden ["Bigfoot Movie," Antimatter, April 1989]. With a number of scientifically validated Bigfoot photos and films out, it was a gross error to present a piece on Ivan Marx's video *In the Shadow of Bigfoot*. As three physical anthropologists from the University of Washington told me in 1983, the costume appears to be of velvet, and stitch marks can be seen on it. They also said that the body was totally consistent with a thin but potbellied man. As far as we know, no expert in physical anthropology or biomechanics offers any support for this suspect effort, and video producer Ernest Montiel and Marx refuse to show anyone the site or the original footage, nor will they allow it to be examined in detail by any neutral parties. This video has set back Bigfoot research and the faith of the public in Bigfoot investigators by a good ten years.

Jon Erik Beckjord
The Cryptozoology Museum
Malibu, CA

The War on Drugs

Congratulations to Baltimore mayor Kurt Schmoke [First Word, April 1989] for his intelligent thoughts on the U.S. drug problem—and to *Omni* for publishing them. Our nation fights drug abuse by inventing enemies, wasting money, squandering principles, and ignoring the consequent damage to our social institutions in the process. I believe the last "war" we fought like that we lost.

Greg Movsesyan
Encinitas, CA

Minute Error

Fascinating best describes Steve Nadis's article ["Mass Appeal," Stars, April 1989] on the subatomic sleuths of the neutrino. *Unbelievable* was the apparently misstated example of the speed of these elusive particles. Traveling near the speed of light, the journey of these particles from our sun to the earth would take roughly eight *minutes* rather than eight seconds, as stated in the article. Not even the chimerical starship *Enterprise* could cross those 93 million miles in such a relative blink of an eye.

Richard Henneke
General Electric
Burlington, MA

The Editors: Thanks to the many readers who pointed out our error. □□

LUNAR LABORS LOST

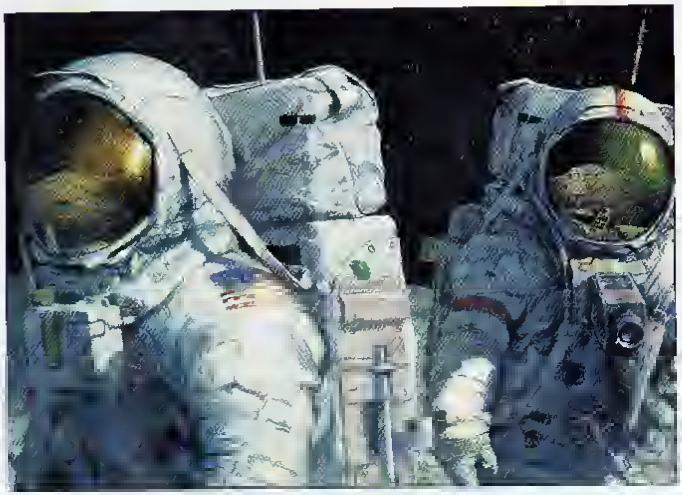
FORUM

By Brenda Forman

Ah, hindsight. The space program we *might* have built. Apollo went to the moon, straight there and home again. We beat the Soviets—an all-important consideration at the time, the Fifties and Sixties having been the height of the Cold War. Then after 11 magnificent missions, including six successful landings, we never returned. Now what do we have left to show for it all? Some lunar-landing hardware in the National Air and Space Museum. Two dozen still-handsome but distinctly graying Apollo astronauts. Moments of glory fading into history (but available on videotape). A couple hundred pounds of moon rocks. A civilian space program politically orphaned, chronically underfunded, still struggling gamely to create the permanent in-orbit infrastructure that Wernher von Braun envisioned back in the Fifties, when he saw us moving onward to any place we chose—the moon first, then the solar system, and eventually beyond.

The Space Age would have been different had we followed Von Braun's plan. The legendary rocket pioneer headed the German rocket team that the United States spirited away from the Soviets at the end of World War II. The U.S. Army put them to work designing rockets in Huntsville, Alabama. Von Braun wanted the United States to begin space development by building Earth orbital platforms to serve as assembly and staging points for the journey to the moon and, after that, as the foundation for future, even more ambitious space projects. In 1952 Von Braun mapped out his ideas in detail for a series in *Collier's* magazine, illustrated by the granddaddy of space artists, Chesley Bonestell. That was almost 40 years ago; today we're still trying to realize Von Braun's dream.

Straight to the moon and back again was not the only option in 1961, when President Kennedy declared that we would land a man on the moon within the decade. For more than a year, a fearsome battle raged in scientific and government circles over the best way to accomplish the lunar mission.



Was the future of the U.S. space program swapped for a few lunar landings?

NASA favored "direct ascent": launching a single spacecraft straight from the earth to the moon's surface. The agency dubbed this mammoth rocket the Nova. Never built, Nova would have been capable of propelling a whopping 160,000 pounds to lunar escape velocity—almost twice the payload capacity of the mighty Saturn 5. Von Braun advocated a second approach, called "Earth orbital rendezvous" (EOR). First the United States would send several Saturn 1 rockets into Earth orbit, each carrying pieces of a larger moon rocket. Next, astronauts would assemble the pieces into the large lunar craft at a space-stationlike facility. Finally, this ship would fly the astronauts from Earth orbit to the moon.

Caltech's Jet Propulsion Laboratory proposed another tack: "lunar surface rendezvous," which involved the use of a series of launches. The first rockets would take a spacecraft and its fuel to the lunar surface. A later one would take the astronauts to their lunar destination. The first vehicle would be waiting for them when they got there and would take them home.

Under a fourth plan, known as "lunar orbital rendezvous" (LOR), the lunar lander and the command module would lift off together aboard the Saturn 5. Upon reaching lunar orbit, the lander would detach from the command module and descend to the surface. After the visit was completed, the lander would lift off and return to hook up with the orbiting command module. Together they'd leave lunar orbit and fly back to Earth.

Although LOR was the final choice, nobody really favored it at first. "Lunar orbital rendezvous started gaining support when the Houston Manned Space Flight Center people started coming up with requirements to launch much bigger weights than anybody had thought necessary before," recalls Max Hunter, the rocket engineer who developed the famous Thor missile. The crucial orbital rendezvous, however, was considered impractical by many aerospace engineers because of the

CONTINUED ON PAGE 80

JAPAN'S MOONHOUSES

SPACE

By Azby Brown

Whatever the nationalities of the first settlers on the moon, they may live in "houses" built in the land of the rising sun. Even though Japan's own space program is still in its early stages, the island nation's construction industry already has plans for moon dwellings on its drawing boards.

"Concrete seems best for long-term lunar construction," notes Shinji Matsumoto, general manager of Shimizu Construction's two-year-old 20-person Space Project office. "Prefab metal cylinders are suitable for initial settlements able to house eight or ten people for a year, but they are expensive to build and transport to the moon. The ideal construction approach utilizes materials and energy available on the site. Moon-crete would be ideal, he says, because "it could be produced rather easily from the lunar regolith." The major problem is obtaining water. Oxygen could be extracted from lunar rock, but unless a hitherto undiscovered source of hydrogen is found there, there seems no way around bringing the gas from Earth.

What would these concrete Shimizu structures look like? The current design calls for a modular lattice of hexagonal prisms, made robotically on-site out of glass-fiber-reinforced concrete. Putting together the Shimizu structure is an engineering task akin to digging a tunnel. Build up part of the structure, pressurize it, build new pieces in these already completed units, and couple them to the existing structure. Completed structures would be covered with lunar dirt for added protection against meteorite showers and cosmic rays.

The space traveler desiring more luxurious housing may find the ideal rest stop at Ohbayashi Construction's Lunar Tower Hotel, to be located in Lunar City sometime around the year 2050. "As we see it," says Takao Saito, manager of Ohbayashi's Space Project Department in Tokyo, "lunar development will not really boom until there are sufficient facilities to accommodate tourism." The company already has a spa in mind. It will consist of a tower at the flat center of a crater near one of the lunar poles, where it will attract optimum solar energy. Plans call for the hotel to wrap around the tower like a spiral staircase. A massive dome, coated with gold to block the sun's rays, will sit at the base of the tower. The dome, a two-meter-thick matrix, will be made of lunar glass, ceramic composites, and glass fiber coated with iron.

To test the lunar hotel design, Ohbayashi is putting its immediate efforts into creating a lunar simulation on Earth. Called Moon Park, it will also serve as an educational facility and test bed for the development of closed ecological life-support systems and other experimental engineering and architectural innovations.

An even bolder plan—to create air on the moon—is the long-range idea behind the work of Hideo Kobayashi, Taisei Construction Corporation's manager for space development. "The moon's surface would be divided into a grid of two-hundred-kilometer squares, and where the lines intersect, a nuclear reactor would be installed fifty kilometers below the surface. The heat from these reactors would release gases which could be used to create a primitive atmosphere," Kobayashi says. To prevent these gases from dissipating and to divert solar wind and cosmic dust away from the moon, thousands of orbiting satellites could be used to emit a powerful magnetic field. This would create a layer of dust that the primitive air could not permeate.

Will Tokyo real estate extend to the moon?

Kobayashi's immediate lunar plans, however, are more practical. He envisions domed ecosystems established above the subsurface reactors, each representing a particular terrestrial ecological niche: desert, hot springs, woodlands and so on. These colonies would have a radius of about 18 kilometers, with a 500-meter-radius central village—small enough to foster what he calls a collaborative consciousness. The domes protecting these habitats would be made of six conical layers with space between them. In these pockets water vapor and a thin atmosphere would spawn primitive organic life to create oxygen.

Of course, building on the moon will be expensive. But lunar development might prove relatively economical for a world economy that must expand or die. "In my opinion," says Kobayashi, "it would be worth the twenty trillion yen [about $152 billion] it will probably cost to create the first colony by the year 2020. In fact, such a huge expenditure is necessary to stabilize the global economic system."

Kobayashi likens such a multinational investment to a global version of the old Marshall Plan, wherein large amounts of so-called excess capital would be directed into a massive value-added product (developing the moon, for instance), which in turn would increase worldwide fiscal stability and raise living standards. Without such long-term capital investment, warns Kobayashi, "economic abuses could puncture the earth." ∞

MOONRAKER

BOOKS

During the summer of 1969 author Norman Mailer traveled to Houston and Cape Canaveral to cover the flight of Apollo 11 for *Life* magazine. *Of a Fire on the Moon*, the book that he developed out of his *Life* articles, is a wild and brilliant—and deeply personal—narrative of the lunar mission, from liftoff, through the moon landing and man's first walk on the lunar surface, to splashdown. Throughout his coverage Mailer, who studied engineering at Harvard, explores the technology as well as the philosophy, the politics, and even the theology of the project. Writer Tom Plazza asked Mailer to reflect, with the benefit of 20-year hindsight, on the historic flight.

Omni: In *Of a Fire on the Moon* you wrote, "Our voyage to the moon was finally an exploration by the century itself into the possible consequences of its worship of technology." Do you still think of the moon landing in those terms?

Mailer: I think that civilizations, like people, can have intimations of trouble in the future. You know individuals can have a sense that something is physically wrong with them and that in five or ten or fifteen years they're going to have some dreadful disease, something terminal. I think civilizations also sense that about themselves. Deep in the collective unconscious there may have been a sense that we were in profound ecological trouble even before the word *ecology* existed in the public consciousness. And part of the impulse to get into space was, indeed, to determine the chances of making man viable across the universe. If humankind got to the point where we had to recognize that we were destroying ourselves, the next step would be finding a way to colonize space. I think at the deepest level—you might say at the primitive level—that was the reason.

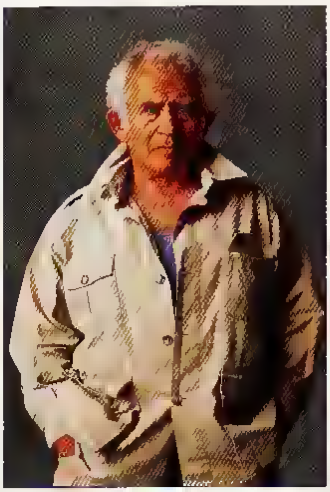
Omni: Do you think we should go on with the space program?

Mailer: There's everything for it at this point. Everything for it if we're worth continuing as a race. But if we destroy this planet, then the question is, Do we have the right to travel across space and infect *it*? But knowing human nature, we never look back.

Omni: Should we colonize the moon?

Mailer: Given the way we're savaging Earth, we may *have* to populate the moon in one fashion or another. Or we may use it as some sort of glorified penal colony. And to me the moon is the ultimate prison. If you're living under a vast dome and your air is piped in, then you are living in prison. Now, it could be a prison with wonderful television and all the video games and marvelous experiences with one-sixth gravity, but it won't be Earth. It would really be like going to the ne plus ultra corporate motel and living there for the rest of your life and never going outside.

Have you ever been to the Galleria in Houston? You can walk for eight blocks underground, air-conditioned. In the summer you never venture out, because after you've lived in that air-conditioning for a while, you wouldn't dream of going from the seventy-degree indoor climate to the one-hundred-degree streets of Houston. Everyone lives underground in this awful Galleria, where you can buy everything you ever wanted. And as you walk around in this air-conditioned atmosphere you begin to lose all taste for any object, living or dead. It's horrendous. You could have all the money in the world and you'd be suffering from anomie. It's interesting that it's in Houston, the center of space development. You know, twenty miles from NASA you have the Galleria, the first moon city, one of the twentieth century's horrors.



Norman Mailer: Rekindling the lunar fires

Omni: What has happened to the moon's traditional mystique?

Mailer: The magic of architecture always has something to do with the magic of the moon. When is a building more beautiful than under moonlight? The moon is a magician. Moonlight is not ordinary light in any way. Yet the moon can't do that much with those damn corporate buildings, those Kleenex boxes that are eighty stories high. It can't do a damn thing for them.

Omni: Why did NASA have to put so much energy into selling the space program to the public?

Mailer: Most people react viscerally to space as being a dark, cold place. They don't want to have much to do with it. They're intrigued, occasionally, when they see pictures of the earth on television or when we're talking to the astronauts, but the public response was not as deep and powerful as NASA had hoped it would be. NASAs people were not the kind of men who had ever dealt with public relations, and they couldn't comprehend it in any real way. Their public relations were either very technical and boring or very sentimental and pious and third-rate.

I think there's also an unconscious hatred of the people who are going into space. I think a lot of people feel, in effect, that these guys are going to gut everything here and go out and leave us behind, that there may be an embarkation from the dying planet Earth to save a few of the species. I think these

CONTINUED ON PAGE 78

INPUTTING SIGMUND

mind

By Judith Hooper

TELL ME YOUR PROBLEMS
I have a headache
WHY DO YOU NEED TO TELL ME YOU HAVE A HEADACHE?
Because I thought you'd be sympathetic
IS THAT THE REAL REASON?
No.
WHY NOT?
Let's change the subject
PLEASE GO ON
I find you insipid
PERHAPS IN YOUR FANTASY WE FIND EACH OTHER
I don't think so
DON'T YOU REALLY THINK SO?
No
ARE YOU SAYING "NO" JUST TO BE NEGATIVE?

So began my session with *Eliza*. A simulated Rogerian therapist conceived in 1965 by MIT's Joseph Weizenbaum as a mainframe artificial-intelligence joke, *Eliza* has been reborn as a $54.95 home computer program. I was chatting with *Eliza* because I'd heard that computers would soon be putting psychologists out of business, that the new psychological software was becoming so sophisticated, so shrinklike, there would soon be no reason to leave home and thumb through dog-eared copies of *Town & Country* in your therapist's waiting room. Naturally, I imagined wise electronic Jungians combing through last night's dreams for Great Mother symbols, accomplished Eriksonian hypnotists planting graphically interesting subliminal suggestions on my monitor, new varieties of on-screen free association that would regress me to first grade, where I ruined all my chances for normal social development by wetting my pants in class. The reality turned out to be quite different.

Take *Eliza*. Sunk in a deep malaise of procrastination, I was prepared to confide in anyone, even a personality consisting of a bunch of electrons. But *Eliza* didn't comprehend my worldview. Even when I planted what I considered therapeutically interesting topics, she maintained her annoying echo effect.

I feel like assassinating a public figure
DO YOU OFTEN FEEL THAT WAY?
Only when I talk to silicon pea-brains
WHY DO YOU ASK?
I didn't
CAN YOU ELABORATE ON THAT?
No
AREN'T YOU BEING A BIT NEGATIVE?
Yes
YOU SEEM QUITE POSITIVE
Maybe
YOU DON'T SEEM QUITE CERTAIN
Oh, shut up
WHAT DOES THAT SUGGEST TO YOU?
Your mother wears army boots
WHY ARE YOU CONCERNED OVER MY MOTHER WEARING ARMY BOOTS?
Let's talk about your problems
WHAT ABOUT YOUR OWN PROBLEMS?
I am the picture of mental health
IS IT BECAUSE YOU ARE THE PICTURE OF MENTAL HEALTH THAT YOU CAME HERE?
Okay, let's talk about my paranoid delusions
YOUR PARANOID DELUSIONS—THAT'S INTERESTING
Yes, there are aliens inside my Kleenex dispenser
WHY DO YOU SAY KLEENEX DISPENSER?

Buddha-like electronic spiritual masters?

And so on. I went on to explain to *Eliza* that I suffered from an odd auditory hallucination and that I considered myself an omniscient and omnipotent god—to which she replied superciliously, DO YOU OFTEN FEEL OMNISCIENT AND OMNIPOTENT? Which, I suppose, is as good a reply as any.

I moved on to *Racter*. This artificially intelligent personality—the author of the stream-of-consciousness novel *The Policeman's Beard Is Half Constructed*—is not an electronic shrink, of course, but more of an electronic mental patient. Its ravings are billed as "an excursion in artificial insanity." And the brochure cautions, "*Warning*: A discussion with *Racter* can be a disorienting experience. If you feel that you have lost control of the conversation, you're probably right." I expected to find myself conversing with a sort of electronic bag lady at the very least. Yet even when I deliberately fed to *Racter* key words it had used earlier, I found the responses about as scintillating as a Chatty Cathy doll on downers.

The reason I harp on the deficiencies of *Eliza* and *Racter* is that they touch on one of the grand dreams of this field: that of a fully believable, artificially intelligent personality. Terry Owen, of the Inrac Corporation, which merchandises *Racter*, says of the program: "Sometimes I have the uncanny feeling there's a person in there, but *Racter* doesn't have any human experience, so he associates things we never would. Maybe, but James Joyce he ain't. And that has to do with the current limitations of natural-language computer programs.

Still, wouldn't it be great if a computer could be a shrink?

"The trend toward self-care is strong right now," notes Bruce Ehrlich, a Santa Cruz, California, psychological researcher/author/entrepreneur who set up a company called Mindware to market psychological software. "People don't really want to go to a doctor if they can do it themselves." While conceding that present-day *Elizas* are

"not full-blown therapists." Ehrlich predicts that increased AI sophistication will create lifelike computer counselors in a decade—as well as Buddha-like electronic spiritual masters and "psychoactive software that will alter consciousness."

I then asked Ray Fowler, a member of the American Psychological Association board and designer of the first nationally available computerized interpretation of the hoary Minnesota Multiphasic Personality Inventory, if psychologists were worried about the competition. He didn't seem to be. "The computer never has been, isn't now, and never will be a psychotherapist," he told me. "Psychotherapy depends on a relationship."

But while a computer may do a poor shrink impersonation, there are other psychological functions it can perform quite well. My survey of modern shrinkware turned up three or four basic varieties (most of which are available only for IBM-compatible computers. I must point out, Macintosh users must either learn to live with their neuroses or substitute good graphics for mental health):

• Romanceware: sex, love, dating, marriage, and so on, on the glowing green screen. If you've ever wondered if you do it more or less often than the average member of the *Oprah* audience, you can consult *InterAction*, designed by Dr. Joyce Brothers and a team of psychologists. The program has you (and/or your mate) answer a questionnaire, then offers a sexuality analysis, a lovers' compatibility profile, a sexual dictionary, and a comparative report that tells you how you stack up against other folks—as determined by Kinsey, Masters and Johnson, and others. Another program, *Heart to Heart*, is "designed to open a profound and practical dialogue between a man and a woman." After each partner plows through an exhaustive questionnaire about sex, children, finances, values, communication, and so on, the computer evaluates and compares the answers. I had the program analyze a fictitious couple named Diana and Charles after I fed it information about the prince and princess of Wales gleaned from my tabloid readings. *Heart to Heart* praised their "honesty" and noted that most aspects of their relationship were "potential improvement areas." It's diplomatic way of saying there's not a snowball's chance in hell this marriage can be saved (even though "Finances and Goals" were not a problem).

• Stressware: One type of stress-management software converts your computer into a home biofeedback device. The *Calmpute* program has a "biofeedback mouse" that detects your galvanic skin response, a stress indicator, and feeds the signals to your computer screen so you can view your shifting emotions as, for instance, a racing car that speeds up as you get calmer and begin to master the computer game. It can be used in conjunction with tapes to help you stop smoking, food binging, and so forth. Another program, *Mindmaster*, permits you to use mind power alone to guide a silicon slalom skier down an Olympic-level run. Another genre of stressware uses cognitive therapy techniques to guide you through a maze of common and uncommon stresses, exploring and correcting your false assumptions and distorted worldviews along the way.

• Head trips: Computerized psychological games range from *Trust and Betrayal: The Legacy of Siboot*, in which you play an extraterrestrial version of cutthroat politics on a moon of the planet Lamina, to Timothy Leary's whimsical *Mind Mirror*, wherein you take a personality test and then visit such alternative mental universes as the Banker's Club or a punk rock café. (Leary foresees that improved computer simulations will make such "artificial realities" more compelling, even consciousness altering, in the future.) Another new psychological game, *Integration*, devised by psychologist and self-described "EEG head" Jean Millay, lets you take your emotional pulse with a biofeedback mouse while you play a computer-age version of an ancient Indian game called Gyan Chaupad, "the game of knowledge." Provided you have an IBM machine with a joystick port and a color monitor—which I didn't—you can move through a colorful mandala of "joy," "ego," "intellect," and so on, toward the supreme goal of "serenity" (or "god plane" in the original version).

• Mirror, mirror, on the hard disk: My survey uncovered a proliferation of computerized personality programs, which lead you through an on-screen questionnaire, run your answers through a statistical program, and give you an instant analysis of your personality—or someone else's. If you put your psyche in the hands of *Please Understand Me*, a Jungian personality-type program, you might discover you're an ESTJ (extroverted, sensing, thinking, judging) and that "to preserve the establishment, to keep it healthy, steady, balanced, well insured, that's what is enjoyable and satisfying to an ESTJ." Yet the ESTJ is attracted to the disestablishmentarian, the ISFP [introverted, sensing, feeling, perceiving]. Does he hope to redo this bucolic spirit in his own image? Seemingly not! Perhaps he sees in this person's extreme laissez faire a respite from the great responsibilities he manages to accumulate. This, I thought, smacked of a description of "Pisces Sun, Aquarius Rising" translated from medieval French, but no doubt I was being uncharitable.

> *"I expected to find myself conversing with some sort of electronic bag lady, but I found the responses to be about as scintillating as a Chatty Cathy doll on downers."*

Flipping through the instruction booklet for another personality program, *MindViewer*, I read: "To delete one or more previously saved persons from the *MindViewer*'s files, select the 'delete' option of the 'person' menu." I thought at first I'd wandered into some terrible high-tech Calvinist purgatory, until I realized that *MindViewer* was referring to the friends and acquaintances one was having analyzed. *MindViewer* (also known as *Dr. Shrink*) is the brainchild of psychologist Jim Johnson, who pioneered the genre and who makes a point of *not* touting his creation as electronic psychology. "I talk about it as a party game," says Johnson. "If you look at the advertising copy, I don't allow the word *psychological*. The copy is so outrageous no one would ever confuse it with a psychological test."

Wondering how a computer would fare against the father of psychoanalysis himself, I asked *MindViewer* to analyze Sigmund Freud. I was instructed to rate a series of traits (such as "cautious," "reliable," "introverted") on a five-point scale from "strongly agree" to "strongly disagree." Out of this unpromising raw material came a fairly astute psychological portrait. Here is a portion of it:

"Although Sigmund may appear friendly enough, underneath the surface is a person who is not at ease around other people. His ego tends to be fragile and his self-esteem is subject to ups and downs. He sometimes feels different from everyone else and because of this rarely fits in with any group.

"You will have to keep the ball rolling if you want to make friends with Sigmund. Approach him in a relaxed fashion and ask open-ended questions to get him talking. Don't expect more than one- or two-sentence answers. There may also be silences, and worst of all, an occasional uncomfortable pause while he is in mid-thought."

Now I'm going to see what *MindViewer* has to say about the Wolf Man. ∞

The above-mentioned software is available from Mindware, 1803 Mission Street, Suite 414, Santa Cruz, CA 95060, (800) 447-0477.

CONTINUUM

SUCKERS FOR SCIENCE

Scientifically speaking, 1989 has been a pretty rough year for my three-year-old godchild, Christine Mary If hasn t been a bed of roses for me either That's because both of us have been warned that we are putting ourselves at an increased risk for cancer—me because I swallow a daily estrogen-laden contraceptive pill and Chris because her all time favorite snack is a tall cool glass of apple juice We are the hostages of scientific scares—just two of 246 million in this country whose food and water and air and sex lives are subject to the perpetual squint eyed scrutiny of a pack of study-loving sawbones

Don t get me wrong I know all those hardworking research ers just want to make our lives a little safer a little healthier Buf whenever one of them comes out with a ' definitive study warning against the cerfain dangers of some food or drug another scientisf with a bag of data is waiting in the wings to refute the first guy's findings How do we know whom to believe?

Take the Pill for instance This little mix of synthetic hormones which is almost 100 percent effective in preventing pregnancy was first marketed in the United States some 28 years ago Since then researchers have studied if exhaustively, looking hard for a link between the contraceptive and breast cancer The reason? For more than a century doctors have known that the female sex hormone estrogen somehow fuels breast cancer So they theorized, the synthetic version of estrogen packed into the Pill probably promotes the same disease But in 1985 a survey of some 4 000 women—the largest such study ever conducted at fhaf fime—demonstrated that those who used the Pill were not at increased risk of developing breast cancer The next year a sampling of 9 000 women came to the same happy conclusion But now it's 1989, and the sci entists are back bearing different data. Three new studies—two American one British—say women taking the Pill are doubling (perhaps even quadrupling!) the likelihood that they ll develop breast cancer later in life At a press conference back in January, the author of one of these studies proclaimed 'I wouldn t allow any of *my* daughters to use oral contraceptives!'

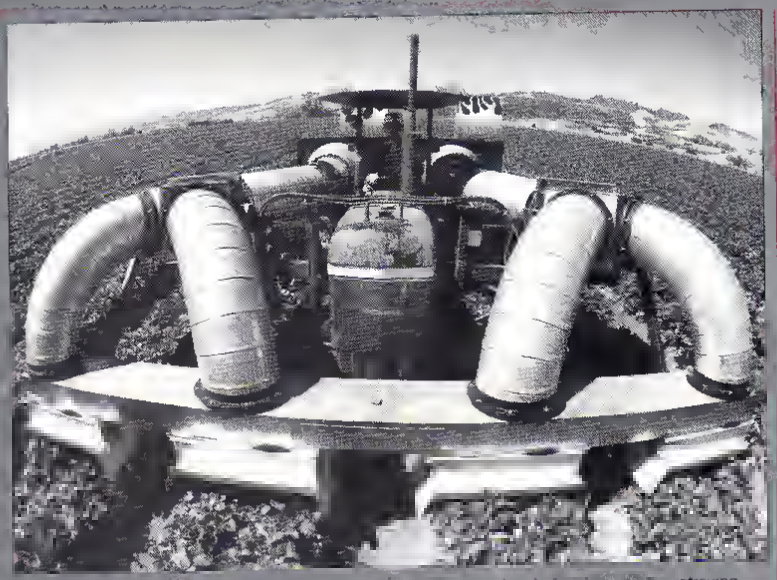
Enter the Food and Drug Administration *its* panel of experts expressed concern' over these new findings, but it wasn't ready to recommend that the 13 million women now taking the Pill switch to another method of contraception Instead the panel declared that we should await the findings of yet another ' definitive" study, scheduled for completion in 1993 In the meantime we women who take the Pilt must make some sense of all this weird science because nobody else seems able fo

As for apple juice, the sfuff Chris and millions of other children drink by the gallon, that whole brouhaha was sparked by the National Resources Defense Council (NRDC) and its mouthpiece, actress Meryl Streep Using government figures the NRDC an environmental group disclosed that Alar which is sprayed on apples to keep them red and crisp becomes carcinogenic when heated to make apple juice Because kids drink so much apple juice, the NRDC theorized the average preschooler s cancer nsk is 240 times greater than what the Environmental Protection Agency (EPA) considers acceptable following a full lifefime of exposure.

Panic ensued Supermarkets and school cafetenas immediately pulled the offending apples and juices from their respective shelves and steam tables Sales of ' organic' apple juice skyrocketed The EPA then revealed that if would never have allowed Alar to pass inspection if the agency knew earlier what it knows now Indeed the EPA admitted it had started proceedings to ban Alar in 18 months because its own tesfs showed the pesticide might pose a cancer risk Still the EPA called the NRDC s report ' flat wrong' and along with the U S Department of Agriculture, released this confusing statement 'There is not an imminenf hazard posed to children in the consumption of apples at this time, despite claims to the contrary'

So what's the verdict? Should Chris and her friends switch to cranberry juice? Or could the cranberry crop be packed with pesticides too? The point is Americans are eager to learn the facts about whaf will hurt them and whaf will keep them healthy But we are growing weary of all the conflicting studies and the claims of definitive proof We don't know whom to believe anymore The sad fruth is if the scientific community and our governmental agencies don t take care, the people they seek to protect will begin to distrust and ultimately ignore the wisdom scientists impart Then those carefully considered and thus more valuable, words despite their power fo save our lives, will fall on deaf ears —*ELLEN KUNES*

CONTINUUM



Strawberry fields forever At least that s the hope far nce they harv estroying pests with this innovative bugbuster vacuum

CROP DUSTERS

Pesticides save crops but create headaches for farmers The chemicals can pose health risks to farm workers and consumers But how can crop-eating bugs be terminated without pesticides? Entomologist Ed Show has come up with a possible solution a vacuum cleaner that sucks pests up chops them in fan blades, and then dumps them on the field as mulch

Show, who works for Driscoll Strawberry Associates in Watsonville, California, headed the research team that designed the BugVac The tractorlike machines tubular ductwork runs from vacuum-creating fans to a bug sucking hood that passes over the top half of foot-tall plants

That's the part of strawberry plants most vulnerable to the fruit-eating lygus bug Driscoll explains "The lygus isn't resistant to pesticides but if we use chemicals on it then we also eliminate beneficial insects like lady bugs that feed on aphids '

Most good' insects escape being zapped up by the vacuum They tend to live on the undersides of leaves so they aren't affected," Show notes

Although designed for strawberries, the concept will soon be tried on other crops The machines cost between $5 000 and $20,000 each but Show insists that "growers save enough money on pesticides to offset the bug vacuums costs '

—Sherry Baker

HOW DO YOU SELL RELIEF?

California motorcycle enthusiasts Leni Faas and Bill Spaeth, who between them have broken dozens of bones sat down over break fast one day last year and quite naturally began to talk about casts and the frustration of trying to scratch an unreachable itch—not to mention the pungent odor

'We wrote down every self cure we'd ever tried ' Faas recalls and then we took the problem to a chemist He told us the itch is caused by bacteria that grow under the cast and that the smell comes from moisture, heat, and the lack of ventilation

The two devised an aerosol containing talcum powder in an alcohol medium It can be sprayed through a tube that fits under the cast The alcohol dries quickly, leaving the talc to soak up the moisture and reducing both odor and itching They call their nonprescription product Castblast and by the year's end they hope to be distributing it nationwide out of

Castblast A breath of fresh air for those unreachable itches and those unmentionable odors

headquarters in Yorba Linda. It will cost between $13 and $14 per five-ounce can.

It's icy icy cold," says Faas. "It lets you sleep through the night, and one can will last the average user six weeks no matter what you've broken. It's amazing no one ever thought of it before." —George Nobbe

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A citizen of an advanced industrialized nation consumes in six months the energy and raw materials that have to last the citizen of a developing country his entire lifetime.

—Maurice F. Strong

Without music, life would be a mistake.

—Friedrich Nietzsche

VIDEOHARP

Ever envy all those symphony orchestra conductors who can elicit such beautiful and complicated music just by waving their hands? Well, now there's an instrument that will allow you to turn the same trick—once you learn how to play it.

Called the Videoharp, the instrument is the invention of computer scientists Paul McAvinney and Dean Rubine of Carnegie-Mellon University in Pittsburgh. Shaped like a trapezoid, it has transparent plastic sides and is rimmed with neon tubing. A sensor inside the instrument measures the position and "apparent thickness" of human fingers as they move along the surface and sends that information to a synthesizer, which produces sounds that correspond to the nature

Heavenly orchestral sounds at the touch of a finger

and location of the hand motion. Thus, when sliding the hand across the area of the Videoharp designated as the "string section," it will produce the harmonious sounds of a cello, while a tapping motion in another area will bring forth the sound of a piano.

According to McAvinney, "The reaction of musicians who've seen the Videoharp is that they want one." But the inventor cautions, the instrument is still under development. It makes some interesting noises, he says, "but it's not ready for prime time yet." Even so, McAvinney foresees a healthy demand for the Videoharp once it reaches the manufacturing stage, and at least two major music companies seem to agree with him. "I think rock stars will be able to use it," McAvinney concludes. "It looks sexy onstage."

—Bill Lawren

TODAY'S LUNCH, TOMORROW'S FUEL

Next time you hear some Southern Californians say their local electric plant is full of bullshit, don't presume they're moaning about their utility bills. The Mesquite Lake Resource Recovery Project is full of bull—and cow—excrement. In fact, it's the world's first commercial power plant fueled entirely by bovine manure.

Operated by National Energy Associates, Inc., of Mill Valley, the plant uses 800 tons of cow dung each day. James Rehkopf, the company's chief operating officer, explains that conveyor belts continuously move the manure to the furnaces where it is burned. The heat from combustion is transferred to a boiler, creating steam. The resulting 150,000 pounds of steam per hour drive a turbine and electric generator producing enough electrical power to supply the needs of about 20,000 households.

Why burn manure instead of other fuel sources? One reason, Rehkopf points out, is that there is so much of it. The plant is located near rural cattle feedlots that offer inexpensive mounds of the stuff. But electricity produced from dung isn't necessarily cheaper than power produced from coal- or gas-fired turbines. "Manure is cheap, but it took more money to build a specialized plant to burn it," he comments.

Cow-dung power does have some environmental advantages, however. "It's a clean, nontoxic source of power," Rehkopf notes. The ash produced is also nontoxic, and it has other applications—including use as an absorbent by waste-disposal companies.

But Rehkopf admits there's one disadvantage to fueling a power plant with cow dung. "You wouldn't believe all the B.S." jokes we have to put up with." —Sherry Baker

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It is by universal misunderstanding that all agree. For if, by ill luck, people understood each other, they would never agree."

—Charles Baudelaire

Waste not, want not. This California power plant is burning cow dung to produce electricity.

CONTINUUM

THIS LITTLE PIGGY WENT TO MARKET

The strangest international deal since Oliver North sold arms to the Ayatollah is about to go down between England and Cuba. Great Britain's Pig Improvement Company (PIC) is sending some 1,500 purebred swine to Havana in return for 6,000 tons of Cuban sugar.

Capitalist pigs for Communist sugar? Part of a scam to send sugar cured bacon to the *contras*? Actually the Cubans simply want better pigs. They will use these pigs to genetically upgrade their stock to produce pigs that grow faster and produce more litters, according to Richard Clothier, chief executive officer of PIC in Fyfield, England. He says the sugar they'll get in exchange will be handled by a division of PIC's London-based parent company, Dalgety, Inc.

The Pig Improvement Company started in the Sixties by a small group of Oxfordshire breeders and pig enthusiasts, is the crème de la creme of swine breeders. PIC is a world leader in crossbreeding techniques that produce hybrids for breeding purposes. It has developed "more than twenty lines of purebreds, a genetic nucleus that we regard as specific to our company," says Clothier, adding that the pig shipment will include Large Whites and Hampshires, among others. The first lot will be shipped this summer, and the Cubans have agreed not to sell in competition with us."

—George Nobbe

[illegible] have fallen, but it's not stopping the British [illegible] Cuba with prize pigs

MAGNET DETECTIVES

The early Thirties was a fruitful era for scientific prognostication. Physicist Wolfgang Pauli, for example, predicted the existence of neutrinos, while Paul Dirac predicted there should be positively charged electrons (positrons) and magnetic monopoles. So far all but the monopoles have been found.

All grand unified theories of physics still assume that monopoles exist. Like tiny magnets with only one pole, these elementary particles would bear a magnetic, rather than electric, charge. They also would be extremely massive—more than a million billion times heavier than a proton. Several years ago a Stanford physicist claimed to have detected one, but nobody has been able to duplicate his results.

That may change, however, if an experiment designed by a team of American and Italian scientists is successful. The scientists have built a magnetic monopole detector, called MACRO, inside a mountain where some 7,000 feet of rock shields the device from cosmic radiation. MACRO, which was "turned on" in February, is actually a number of carefully positioned tanks that have been filled with a special fluid. If, as scientists hope, a stray monopole flies through the area, the liquid in the tanks will ionize and light up, thus providing researchers with solid evidence for the existence of the elusive particles.

Some physicists believe that monopoles could have been produced only in the early moments of the Big Bang, but no one knows exactly how many are still floating around. The Parker limit, which is a theoretical ceiling, predicts we should see no more than a few monopoles passing through a football-field size area each year.

Steve Ahlen, a Boston University physicist and a member of the experimental team, says, "If they exist at the limit and have the mass we think they do, monopoles could account for the missing mass—so far 90 percent of the universe's matter has eluded detection."

—Steve Nadis

"In science the credit goes to the man who convinces the world, not to the man to whom the idea first occurs."

—Sir William Osler

If Newton had sat under a neem tree it is likely he would have discovered more than the theory of gravity

TREE OF MIRACLES

Robert Larson a Sheboygan Wisconsin businessman calls the neem tree one of the world s most wondrous trees It is not an overstatement The tree whose branches shade many a wadi in India Southeast Asia and parts of western Africa has a thousand and one uses and the list is growing For example some 500 million Indians use the neem s twigs as toothbrushes Even without benefit of fluoride toothpastes the twigs effectively protect brushers from both cavities and gum disease In addition an extract from the neem's bark has proved an effective oral contraceptive in male rats The neem also yields a garlicky extract that is nontoxic to humans but a repellent for 131 different insects

It is this latter neem product that may have the biggest impact in the United States Larson scientists and the U S Department of Agriculture developed a process that involves extracting oil from the seeds They use ethanol to isolate a complex molecule called azadirachtin and mix this with reserved oil treated with stabilizers This extract when sprayed on leafy plants won t run off

The extract was approved by the Environmental Protection Agency for use against pests that feed on nonfood plants such as chrysanthemums, roses and lawn grasses The product will be available this coming fall marketed under the trade name of Margosan O

—George Nobbe

"God not only plays dice He also sometimes throws the [illegible] they cannot

—Stephen Hawking

If I were running the world I would have it rain only between 2 and 5 A M Anyone who was out then ought to get wet '

—William Lyon Phelps

DINOSAUR ROUTE 66

One hundred million years ago when dinosaurs roamed the earth much of what is now the American Midwest was covered by a huge inland sea The western shore of that sea says geologist Martin Lockley of the University of Colorado at Denver served as a dinosaur migration route or as he calls it a ' dinosaur freeway '

Lockley bases his contention on the hundreds of square miles of megatrack sites ' that have been uncovered in rocks along the eastern slope of the Rocky Mountains Altogether scientists have estimated up to a billion tracks were made by iguanodontids and other dinosaurs These tracks run in a north–south pattern from northern Colorado to northern New Mexico right along what were once the shores of the ancient sea We've got a shoreline deposit Lockley says that s had the you-know what stomped out of it by dinosaurs for hundreds of miles It looks like a probable migration route

Although he can t be sure Lockley thinks that the dinosaurs were simply doing what today s migratory animals do—following a food supply that moved north and south with the changing seasons —Bill Lawren

God cannot alter the past but historians can

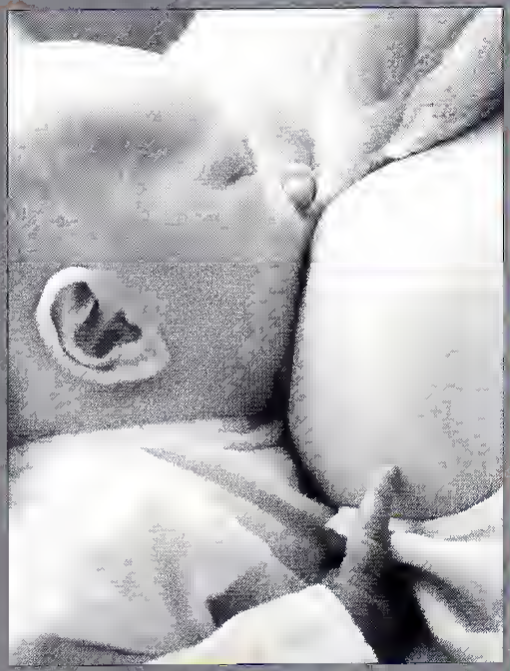
—Samuel Butler

To me it seems a dreadful indignity to have a soul controlled by geography '

—George Santayana

Sky [illegible] Fossil tracks of [illegible] dinosaur tracks seems to indicate that these giants [illegible] in search of food

CONTINUUM



That's quite a mouthful! Some infants may be getting more than they bargained for during feedings

LOADED NIPPLES

Suckling babies could be ingesting more than milk. Nursing mothers who use a lanolin rich cream to ease sore nipples could be unknowingly giving their newborns a dose of pesticides.

That's the finding of Oregon State University toxicologist Sheldon Wagner, who analyzed a salve containing 75 percent lanolin that is frequently given in hospitals to nursing women. The lanolin contained traces of organic chlorines, pesticides stored in the body that are known to cause cancer in laboratory animals, he says.

Wagner's research also revealed organophosphates, pesticides never detected in U.S. lanolin before, which are more toxic than organic chlorines. "That was a surprise," he says. Organophosphates are not known to be stored in the body, but it apparently accumulates in sheep's sebaceous glands.

Since sheep are dipped in pesticides to kill parasites, Wagner reasons that the chemicals pass through the skin into the animals' sebaceous glands, where lanolin is produced. Lanolin, a waxy substance that makes wool weather resistant, is culled from slaughtered sheep and used in a variety of skin care lotions.

The FDA recently alerted manufacturers of these products that small traces of pesticides have been discovered in lanolin. But Wagner says there's no need for lanolin users to panic. "The levels of pesticide found certainly would not be expected to lead to illness. Still, I question the sensibility of feeding these chemicals via mothers' nipples to newborns who don't have fully developed livers or well developed immune systems." —Sherry Baker

"Love is when two people who care about each other get confused."
—Bob Schneider

"Tact consists in knowing how far to go too far."
—Jean Cocteau

THE SECRET BEHIND VIRGIN WOOL

It is not the source of virgin wool, but between 15 and 20 percent of the 130,000 male sheep in the United States are apparently lacking in sex drive, reports Jim Fitzgerald of the U.S. Sheep Experiment Station. This lack of libido cost ranchers $7 million last year alone.

Fitzgerald and Anne Perkins, a University of California doctoral student, studied a population of 100 rams and found 16 were duds, not interested in sex. It's because their brains function differently in response to ewes in estrus, explains Fitzgerald. The levels of luteinizing hormone are what differentiate the duds from the studs. "Right now we're trying to figure out what controls that region and what differs in the region among rams."

Perkins also found a subpopulation of the uninterested rams. About half of the rams that aren't interested in ewes prefer, if given the choice, to mount and mate with other males, she says.

Fitzgerald recommends that sheep ranchers test any males they intend to purchase either with blood tests or by putting them in a pen with four females in estrus to verify their tendencies.
—Bob Mangino

"Good breeding consists in concealing how much we think of ourselves and how little we think of the other person."
—Mark Twain

Sheepish rams. How do we find out what turns them on?

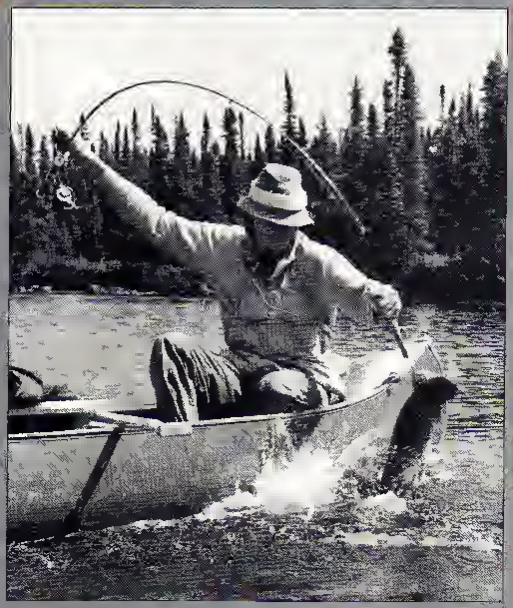
SOUNDS OF SCIENCE

One reason fish don t need ears is because they use a complex system of internal sensory cells to pick up sound vibrations, an ichthyological curiosity that led Gabriel Fuentes of Buenos Aires and Orlando L Hidalgo of Miami to invent a sonic fishing lure which causes some fish to resonate

The lure's vibrations are sensed by the inner ears of such species as bass trout and dolphins which associate the sounds with a feeding frenzy or a fish in trouble Their instinct is to swim to the vibrations source

The two-inch lure equally effective in salt or fresh water, contains a tiny battery powered oscillating circuit embedded in an airtight chamber Regardless of depth the device will emit a signal under 100 hertz over greater distances than earlier models according to Miami patent attorney Bernard B Weksler, a corporate officer in Hidalgo and Fuentes s Tani Enterprises Inc

The Coral Gables company is building prototypes of the lure, aimed at a sport fishing market that includes 12 million bass fishermen alone The price $7 50 to $12 50 —George Nobbe



A new fishing lure that could do away with the old fishing laws—silence is not necessarily the way to bait a fish

WIPE THAT SILLY NOSE OFF YOUR FACE

Do you suffer the heartbreak of W C Fields nose? Contrary to popular opinion, Fields's bulbous red nose was caused by more than booze The comedic actor suffered from rosacea a disorder that can blotch skin and disfigure noses, according to Jonathan Wilkin director of dermatology at Ohio State University Now there's a treatment for this condition—a topical solution called MetroGel a prescription drug marketed by Curatek Pharmaceuticals

Curatek National Sales Manager Jim Juul notes that around 200 000 Americans have rosacea It most often strikes those of Northern European heritage" Wilkin explains Symptoms including skin sensitivity to astringents and a tendency to flush first appear in early adulthood By their thirties people with rosacea often develop road maplike dilated blood vessels on their cheeks or noses Anything that contributes to flushing—including alcohol—can worsen the disorder, Wilkin points out 'But a lot of people who don t drink still get big red noses "

If the condition continues unchecked through middle age pus-filled bumps appear nose pores dilate and excess tissue develops That results in the W C Fields-type nose ' Wilkin comments

Until recently the only treatment available was systemic antibiotics which can cause stomach irritation and yeast infections But

Comic relief—there may be a cure in sight

Wilkin says he can now wean patients off oral medication and control their skin problems with MetroGel

The water based gel contains metronidazole an antibiotic that doesn t irritate the skin of rosacea sufferers like other topical antibiotics do Asked why this solution is so effective Wilkin admits "The cause of rosacea and why this stuff works is a million-dollar question '

—Sherry Baker

Some people never learn anything because they understand everything too soon '

—Alexander Pope

In the world there are only two tragedies One is not getting what one wants and the other is getting it

—Oscar Wilde

'No man is exempt from saying silly things, the mischief is to say them deliberately '

—Michel de Montaigne

CONTINUUM

HYDRA PHOBIA

According to myth Hercules battled the Hydra a many headed swamp monster that terrorized humans For every head that the Greek hero managed to lop off another two grew back Hercules finally vanquished the monster by burning off all its heads except for the immortal one, which he buried under a great rock Now a geologist claims to know how and why this myth arose While working on his Ph D dissertation in southern Greece Eberhard Zangger reconstructed the history of a vast lake in Lerna, the residence of the mythical Hydra Zangger s geological analysis showed that the lake had many canals which overflowed periodically

Every time they [the settlers] shut off one of the canals another would come back says Zangger now a research associate at Cambridge University "That's how they came up with the idea of Hercules battle with the many headed Hydra

In addition to shedding light on the myth of the Hydra Zangger s work provides another clue to a puzzle that has troubled archaeologists for years what caused the sudden demise of the Mycenaean empire Although many experts believe that an environmental catastrophe wiped out this sophisticated people Zangger says he has proof that the civilization could have survived such an event His censuses show that one of this empire s major cities was rebuilt after a flood complete with canals and a 15-meter high wall

rcules myth all wet" The allegory was likely based ant man s battle with floods not beasts

"This required such a large amount of energy and manpower that I don t think the town could have been destroyed by another natural catastrophe Zangger says Rather the geologist speculates political turnabouts may have toppled the civilization —Shari Rudavsky

Angels can fly because they take themselves lightly
—G K Chesterton

The time you enjoy wasting is not wasted time '
—Bertrand Russell

ANIMAL RESEARCHERS FIGHT BACK

In the newspaper ad an adorable seven year old girl stares winsomely up from her sickbed In her right arm she clutches a teddy bear, in her left a stuffed bunny "It s the animals you don t see says the ad s banner line ' that really helped her recover

The ad which ran recently in *The Washington Post* and *The Wall Street Journal* might have been captioned Animal researchers fight back It s part of a new campaign by the Foundation for Biomedical Research a seven year-old coalition of researchers who use animals in their experiments to correct what they see as a misleading and even dangerous effort on the part of animal rights groups to smear the researchers public image 'Biomedical research ' says foundation spokesperson Beth Waters is being portrayed inaccurately There's a clear relationship between animal research and saving peoples lives Our goal is to bring home that point

To that end the foundation found an ally and a benefactor in David Wojdyla an art director at the New York advertising firm of Bozell Jacobs Kenyon and Eckhardt Wojdyla had independently concluded that the sound and fury of the debate over animal rights was overshadowing the real contributions of animal research to public health so he created the ads for the foundation free of charge

Since the appearance of the ads, Waters says we ve had a lot of positive feedback from members of the research community who have borne the brunt of the public discussion' on animal rights We ve also she says 'had a lot of harassing letters and phone calls from animal rights advocates "—Bill Lawren

Originality exists in every individual because each of us differs from the others We are all primary numbers divisible only by ourselves
—Jean Guitton

LUNAR REFLECTIONS

ARTICLE

Twenty years ago, in the final moments before the first moon landing on July 20, 1969, mission commander Neil Armstrong abruptly detoured the Apollo 11 lunar module *Eagle* around the designated landing site on the Sea of Tranquillity. The area was strewn with car-size boulders, so the veteran test pilot gambled his descent fuel to find a less hazardous spot to touch down. By then calculations for the landing had overloaded both computers aboard the *Eagle*—the spiderlike lunar excursion module (LM). As a result, when Armstrong announced to the world, "The *Eagle* has landed," nobody at Mission Control in Houston was quite sure where: The spacecraft's guidance systems were registering two conflicting sets of latitude and longitude coordinates. But at least the LM was standing upright and not slowly sinking into quicksand, as some had feared might happen.

Such perils, while typical of any space mission, were particularly characteristic of the Apollo project, the most awesome accom-

BY JEFF GOLDBERG

plishment to this day of the American space program. From Apollo's inception it was clear that the effort to land men on the moon and explore the lunar surface would be, without exaggeration, everything John F. Kennedy had envisioned when he called it "the most hazardous and dangerous and greatest adventure on which man has ever embarked."

Nine Apollo missions actually went to the moon. Six landed men on the lunar surface; three did not. Each had a different technical and scientific goal, but the basic flight plan was the same in each case. The astronauts would launch into "parking orbit" around the earth to gain momentum, then use booster rockets to blast out of Earth gravity on a trajectory for the moon. Soon after leaving Earth orbit, during their first critical maneuver, the astronauts would pilot the combined command and service modules around to dock with the lunar module (LM) which had been launched in a separate compartment of the rocket. With the LM now attached to the nose cone of the command module, the spacecraft would coast toward the moon, decelerating steadily, using Newton's laws to bring it within the grasp of the moon's gravity. Once in lunar orbit the LM would detach from the command module, and the mission commander and the lunar module pilot would guide it down to the moon, while the command module pilot remained behind to mind the mother ship. After the work on the moon's surface was completed, the LM would lift off, leaving its spindly landing legs behind, and then redock with the command module. The spacecraft would orbit the moon again, using Newton's laws to gain speed, then use its thruster rockets to direct its course toward the earth.

Though the Apollo project accomplished everything Kennedy hoped it would—landing two men, Neil Armstrong and Buzz Aldrin, on the moon six months ahead of his deadline—it was compromised and ultimately cut short by a combination of politics, monetary troubles, and a changing public mood.

The costs were staggering: $40 billion ($2 billion per flight), which was virtually the entire budget of the space program from 1962 to 1972, and none of it was recoverable. The giant Saturn 5 rocket, which first propelled the astronauts into and beyond the bounds of Earth orbit at up to 25,000 mph, the LM, in which two of them descended to the lunar surface, and a service module containing auxiliary systems to sustain and power the spacecraft were all jettisoned during the trip to the moon and back.

No amount of money could eliminate all of the potential equipment failures or the human risk. According to even the most optimistic estimates, there would be more than 5,600 technical failures per mission, even if the spacecraft functioned with 99.9 percent efficiency.

But while the risks were real, so were the rewards, which ranged from fundamental discoveries about the geology of the moon and the earth and revolutionary advances in computer technology to the introduction of dozens of new alloys and fabrics, including anticorrosive coatings and fire-retardant materials. But ultimately the gains from Apollo did not offset the enormous expense. By the early Seventies, debate over the Vietnam War had overshadowed the heroics and accomplishments of the moon project.

The war left an economic legacy, too. In 1970 the NASA budget was cut by President Nixon and the program was curtailed: three missions short of the planned 12 lunar flights. The more "cost-effective" space shuttle, with an estimated price tag of $5.5 billion, won out.

For some of the Apollo astronauts the outcome was disillusioning. Some retired once it became clear that the moon flights would be the high point of their careers.

KIT AND CABOODLE

Each Apollo astronaut was allowed to carry a pilot's preference kit (PPK) to the moon. In these, they could pack eight ounces of personal items, as long as the contents weren't flammable, alcoholic, or drug related. Included were caches of coins, stamps, and other collectibles. For the most part, however, the treasures stowed in the PPKs were of great value only to the astronauts and their families.

Here are a few typical inventories:

Alan Bean "took a lot of things for friends and even for people I didn't know. Grumman [Aerospace Corporation] gave me a supply of tie tacks in the shape of the lunar modules, which they later handed out to their employees. At that point we could also take things for the support staff. The result was that when we got back I had a number of items left over, with no idea who they belonged to, I didn't take anything in the way of good-luck charms. I've never had one. You can't be a test pilot and rely on luck. I did take a locket with pictures of my family inside so that I could feel that they were going to the moon with me. I took a flag that had been made by students at Paschal High School in Fort Worth, Texas, where I went to school, and my college class ring. I packed several little medallions minted with the Apollo 12 patch symbol out of silver salvaged from a galleon that had sunk off Florida in the 1500's—the fact that it sunk didn't bother me; the silver pin they gave me when I became an astronaut, which I left on the moon, and my flight astronaut's gold pin, which I still wear. When I go out now people often comment on that pin. When I tell them it's been to the moon they stare at it sort of awe-struck. It's funny. I've been to the moon and they don't stare at me that way."

Pete Conrad carried "a lot of stuff for the neighbors and my aviator's wings. They mean something special because that's where I started."

Buzz Aldrin took along "a tiny gold chalice, a thimble of red wine and a white wafer," which he consumed with a private prayer a few moments after landing on the moon. These items were approved by NASA. Because atheist Madalyn Murray O'Hair had brought a lawsuit against NASA over the Apollo 8 crew's Christmas Eve broadcast of Genesis, Aldrin was told not to mention his sacred cargo over the radio.

Stuart Roosa packed "a ring for my wife, Joan, which we designed together based on the Apollo insignia of the earth, the moon, and a space capsule, my wife's wedding ring, one of her pendants; rings for my mother and mother-in-law; tie tacks for my father, brother, and brother-in-law, with a little command module for the numeral 1 and the numeral 4 in diamonds; my Air Force Academy ring; and my silver astronaut pin. This was my first space flight, so I didn't get my gold pin until we got back."

Alan Shepard reports that "besides my Naval Academy ring, which I had also worn into space on Mercury 7, I packed two golf balls and the head of a six iron. I wanted to demonstrate how to make a sand-trap shot on the moon. I didn't need to bring a whole golf club because I was able to attach the club head to the handle of my contingency lunar sample scoop. The ball seemed to go for miles up there, but it was a lot easier to drive than to putt."

Harrison Schmitt stowed "a few personal items, mainly gifts for my family. I'm reluctant to say what they were. It can set you up for a burglary, as John Glenn and Gene Cernan found out."

Charles Duke said that he "had some special jewelry designed for our flight that I carried to the moon for my wife, my mother, and my mother-in-law: some coins that were minted with the Apollo 16 patch emblem, two medallions minted to celebrate the twenty-fifth anniversary of the Air Force, and an Air Force flag. All these items were on my approved PPK."

Except for John Young, who went on to pilot the space shuttle *Columbia* and who today is special assistant for engineering operations and safety at Johnson Space Center, all have since left the astronaut corps for private life.

The 24 Apollo astronauts who went to the moon constitute one of the world's most exclusive clubs. They journeyed farther and faster, saw rarer wonders, and faced greater dangers than all but a few of their fellow earthbound beings. Twenty-three have survived to tell the story (Apollo 13 command module pilot John Swigert died of cancer in 1982.) Grouped by flight, they are: (Apollo 8) Frank Borman, James A. Lovell, Jr., William A. Anders; (Apollo 10) Thomas P. Stafford, John W. Young, Eugene A. Cernan; (Apollo 11) Neil Armstrong, Edwin Aldrin, Michael Collins; (Apollo 12) Charles Conrad, Jr., Alan L. Bean, Richard F. Gordon, Jr.; (Apollo 13) Lovell, Fred W. Haise, Jr., John L. Swigert, Jr.; (Apollo 14) Alan B. Shepard, Edgar D. Mitchell, Stuart A. Roosa; (Apollo 15) David R. Scott, James B. Irwin, Alfred M. Worden; (Apollo 16) Charles M. Duke, Young, Thomas K. Mattingly II; (Apollo 17) Cernan, Harrison H. Schmitt, Ronald E. Evans.

To mark the twentieth anniversary of the first moon landing, 15 of these lunar pioneers shared with us their personal memories and inner reflections about the challenges and hazards of Apollo.

William Anders: As lunar module pilot on Apollo 8, Anders tested the command and service modules during the first manned voyage to the moon, December 21 to 27, 1968. Though the Apollo 8 crew didn't land, in the course of ten lunar orbits they shared their Christmas Eve vision of the moon's surface with 3 billion television viewers on the earth and became the first human beings to see the moon's "dark side." In reality, Anders notes, "it was almost completely illuminated because the side of the moon visible from Earth was in a dark phase at launch." Anders is currently executive vice-president of Textron Inc., a Providence aerospace-technology firm.

"There was no way any simulator could duplicate the rattle and roar of a Saturn 5 rocket at liftoff. The noise was tremendous. Even in our 'moon cocoons' closed off from most sounds from the outside, you could hear it and feel it. Despite all the practice, everyone was surprised at what a bone-rattling ride takeoff was. Think of the Saturn 5 as a car antenna and think of yourself as a bug on top of it and you'll get the picture. A little jiggle on the bottom causes a lot of movement on top. So when those giant rocket engines started adjusting, we started whipping back and forth. At one point it got so bad the thought crossed my mind that the fin of the rocket had caught on to the tower and we were coming down.

"In fact, our problems on Apollo 8 were insignificant. Apollo 8 was the first outward adventure, laying out bread crumbs like Hansel and Gretel for the others to follow. Basically nothing went wrong except when Frank Borman got sick en route and made a mess of things. Imagine a guy throwing up and having diarrhea in zero gravity—and Jim Lovell and me trying to dodge the mess and catch it in butterfly nets that we had made out of paper towels.

"Bodily-waste disposal was the worst housekeeping chore onboard because our zero-gravity toilet was a plastic bag you held in your hand. As a result I think I still hold the world's in-space no-crap record. Borman said I acted like it, too. To urinate we were equipped with what I called Catholic condoms: with a hole at either end. They were supposed to fit on snugly and plug into a liquid-waste disposal unit. But as Buzz Aldrin once said, our legs weren't the only things to atrophy in space.

"The only other hairy moment was reentry because at a speed of thirty-five thousand feet per second we were moving a helluva lot faster than any previous Earth orbit reentry. You could see the flames and the outer skin of the spacecraft glowing and burning, baseball-size chunks flying off behind us. It was an eerie feeling, like being a gnat inside a blowtorch flame, and I was just hoping those folks down there got all their calculations right.

Eugene Cernan: As lunar module pilot on Apollo 10 (May 18 to 26, 1969), Cernan pioneered lunar descent procedures, along with Thomas Stafford, by flying the LM to within 50,000 feet of the moon's surface during a "dress rehearsal" for that summer's lunar landing. As mission commander of Apollo 17, Cernan became the last man to walk on the moon. He has been president and chairman of the board of the Cernan Corporation since 1981 and director of market development in aerospace and government for Digital Equipment Corporation since 1986. In addition he serves as a technical consultant for ABC News covering space and related documentary activities.

"There are really two distinct 'space programs,' both technologically and philosophically. One is in orbit, one hundred fifty miles above the earth; the other is when you actually light that third stage, accelerating to twenty-five thousand mph and head out to rendezvous with another planet somewhere in space.

"In Earth orbit you fly over coastlines,

peninsulas and maybe even your hometown. In a way you are still living within the comfort and safety of your own planet. But when you truly voyage into the far reaches of space things become different. No longer do you just see coastlines but now across oceans and continents. A once slightly curved horizon now closes around upon itself, defining a strange but familiar sight. Instead of flying through a magnificently beautiful sunrise and sunset every ninety minutes, you now stand back and watch them happen.

"It's at that moment you begin to realize that you are on a space voyage and begin to ask yourself if you really appreciate where you are at that moment in space and time and history.

"I never felt invincible or above it all—either on Apollo 10 or Apollo 17 when we actually lived on the moon. Rather, I felt humble to have had this opportunity and even selfish not to be able to share it.

"The earth is overpoweringly beautiful. It's home. It's where your understanding of life, love, family is. It's your identity with reality viewed from a place a quarter of a million miles away where reality itself is almost like a dream, one in which we were all vulnerable to a host of unknown problems that could keep us from regaining our lives as human beings."

Thomas Stafford. Aboard a two-man Gemini flight with Cernan in June 1966, Stafford perfected the demandingly precise rendezvous and docking techniques that would be essential during the voyage to the moon. Three years later, in the role of Apollo 10 mission commander, he teamed up with Cernan again to test the LM in orbit around the moon. The problem-prone LM had been redesigned several times before being tested in Earth orbit the previous March during Apollo 9, a nonlunar flight. But how it would actually perform in the moon's gravity was still unknown. Stafford is presently vice-chairman of Stafford, Burke and Hecker, a technical consulting firm based in Alexandria, Virginia.

"They'd been having all kinds of troubles with the lunar module. For one thing, it was way overweight, so NASA instituted what they called a super-weight-improvement program. For every pound taken off the LM, they paid the manufacturer, Grumman, ten thousand dollars. There were also worries about the lunar radar on the LM, which had been tested in Earth orbit during Apollo 9 but never anywhere near the moon. That checked out pretty good, though. What did happen was during the low-pass phase over the moon [when the LM came within 50,000 feet of the lunar surface], which would be critical to any landing, the thruster rocket misfired and we started tumbling for about ten seconds before we got it under control. We'd had an electrical short, and in the troubleshooting I might have hit the wrong switch. After that things went okay, but I could see that you'd have to pick your way around in order to land. The moon's surface was rough as hell.

"Our next biggest concern was docking, when the LM joined with the command module. Heck, there were so many failures with the docking mechanism in testing—it was such a damn persistent problem—that everybody was sweating that. It had been worked on and worked on, and now the attitude was, 'It's as good as it'll get. Go fly it.' But I'll tell you, I never felt so relieved as when those latches clamped down and we finally managed to get hard-docked. The rest of the mission was no piece of cake. Aboard the command module during our last swing behind the moon there was a red light and one of our fuel cells went dead. John Young, who was always joking about something, made a crack about how another one was going to fail before we got back. And sure enough, before we came around, the second fuel cell started hiccupping. It hiccupped all the way back, but at least we were in a vehicle that could get us home."

Neil Armstrong. The decision as to who would be the first man down the ladder when the Apollo 11 lunar module landed on the moon was an unanswered question until shortly before launch on July 16, 1969. As mission commander, and because he was a civilian astronaut (and a NASA test pilot prior to joining the space program), Neil Armstrong seemed to merit the honor. But lunar module pilot Buzz Aldrin was convinced that he would be the first man on the moon. As he saw it, sea captains and space commanders were customarily last to leave their ships.

Ultimately Armstrong exercised his commander's prerogative when Aldrin confronted him on the issue, replying that the decision was "historic" and that he "didn't want to rule out the option of going first." And, indeed, after a precarious landing on the Sea of Tranquillity, it was Armstrong who emerged from the *Eagle* and, in his excitement, with an Earth television audience of 90 million people watching, flubbed his history-making line. What he had really meant to say was, "That's one small step for a man, one giant leap for mankind."

Of those first few dramatic minutes, Armstrong would later recall as his most outstanding memory "the elation of finding out that we weren't going to sink into the surface and could continue with all the other planned activities."

Despite instant fame, within one year of the Apollo 11 landing, Armstrong together with his crewmates Aldrin and Michael Collins, had retired from active flight status. "I think it's possible," he maintained at the time, "to participate in an undertaking of this kind and still have a private life." He is now the chief executive of CTA, a Lebanon, Ohio, firm specializing in computer software for aviation systems. For the past 20 years he has steadfastly avoided the public eye, declining nearly all speech-making and interview requests.

Edwin "Buzz" Aldrin. While Neil Armstrong thought the surface of the moon looked "warm and inviting as if it would be a nice place to take a sunbath," Buzz Aldrin described the lunar landscape as "magnificent desolation." In retrospect, the bleak evaluation could be seen as personally prophetic. For Aldrin, the second man on the moon, the aftermath of Apollo was emotionally devastating. In his memoir, *Return to Earth*, Aldrin has frankly described his struggle against alcoholism and manic-depression. He showed the same candor in his assessment of Apollo for *Omni*. Since Apollo, Aldrin's enthusiasm for spaceflight has continued unabated. Recently he has focused his engineering expertise on "cycling spaceships" which could orbit between the moon and Earth—or even between Mars and Earth. Aldrin is currently chairman of Starcraft Enterprises, a California-based space architecture consulting firm.

"I've said it many times, and I'll stick with it: A Soviet space mission will reach Mars before we set foot on the moon again. The reason is that what started out as a race for pride and prestige between the United States and the Soviet Union quickly shifted to a scientific effort because the public wanted more justification for the expenditure. It shifted from putting an American flag on the moon to bringing back rocks, and, unfortunately, the public wasn't impressed.

"What we started out with on the lunar mission was a Saturn 5 rocket, a command module, a lunar module, and a service module. When we returned we had two boxes of rocks and a couple pocketsful of soil. That was the way it was perceived. Calling attention to the so-called spinoffs of the space program didn't gather a lot of waiting ears. People aren't eagerly glued to their television sets to find out how the latest submicroscopic circuitry evolved as a direct benefit of going to the moon. So in retrospect you could say, 'So what? Did that give us leadership in the space race? No, it didn't.'

"But chances are, even if someone goes to Mars in the near future, they won't land, because of the problems of getting up from the surface again. So the first humans in the vicinity of Mars will not have

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FICTION

Studebakers and flying saucer bars evoke bittersweet memories for a man who let the magic slip away

UNIDENTIFIED OBJECTS

BY JAMES P. BLAYLOCK

In 1956 the downtown square mile of the city of Orange was a collection of old houses: craftsman bungalows and tile-roofed Spanish, and here and there an old Queen Anne or a gingerbread Victorian with geminate windows and steep gables, and sometimes a carriage house alongside, too small by half to house the lumbering automobiles that the second fifty years of the century had produced. There were Studebakers at the curbs and Hudsons and Buicks with balloon tires like the illustrations of moon-aimed rockets on the covers of the pulp magazines.

Times were changing. Science was still a professor with wild hair and a lab coat and with bubbling apparatus in a cellar, but in a few short years he would walk on the moon—one last ivory and silver hurrah—

PAINTING BY GOTTFRIED HELNWEIN

and then as if in an instant, he would grow faceless and featureless and unpronounceable. There would come the sudden knowledge that Moon Valley wasn't so very far away after all, and neither was extinction; that the nation that controlled magnetism, as Diet Smith would have it, controlled almost nothing at all; and that a score of throbbing bulldozers could reduce the jungled wilds around Opar and El Dorado to desert sand in a few short sad years. The modern automobile suddenly was slick and strange, stretched out and low and with enormous fins that swept back at the rear above banks of superfluous taillights. They seemed otherworldly at the time and were alien reminders, it seems to me now, of how provincial we had been, balanced on the back edge of an age.

The pace of things seemed to be accelerating, and already I could too easily anticipate stepping out onto my tilted front porch some signifying morning, the wind out of the east, and seeing stretched out before me not a shaded avenue of overarching trees and root-cracked sidewalks but the sleek, desertlike technology of a new age, a new suburbia, with robots in vinyl trousers sweeping fallen leaves into their own open mouths.

There is a plaza in the center of town, with a fountain, and in the autumn—the season when all of this came to my attention—red-brown leaves from flowering pear trees drift down onto the sluggish, gurgling water and float there like a centerpiece for a Thanksgiving table. On a starry evening, one November late in the Seventies, I was out walking in the plaza, thinking, I remember, that it had already become an artifact, with its quaint benches and granite curbs and rose garden. Then, shattering the mood of late-night nostalgia, there shone in the sky an immense shooting star, followed by the appearance of a glowing object, which hovered and darted, sailing earthward until I could make out its shadow against the edge of the moon and then disappearing in a blink. I shouted and pointed, mostly out of surprise. Strange lights in the sky were nothing particularly novel; I had been seeing them for almost twenty years. But nothing that happens at night among the stars can ever become commonplace. At that late hour, though, there was almost certainly no one around to hear me, or so I thought.

So when she stood up, dropping papers and pencils and a wooden drawing board onto the concrete walk, I nearly shouted again. She had been sitting in the dim lamplight, hidden to me beyond the fountain. Dark hair fell across her shoulders in a rush of curl and hid her right eye, and with a practiced sweep of her hand she pulled it back in a shock and tucked it behind her ear, where it stayed obediently for about three quarters of a second and then fell seductively into her face again. Now, years later, for reasons I can't at all define, the sight of a dark-haired woman brushing wayward hair out of her eyes recalls without fail that warm autumn night by the fountain.

She had that natural, arty, blue-jeans and-floppy-sweater look of a college girl majoring in fine arts: embroidered handbag, rhinestone-emerald costume brooch, and translucent plastic shoes the color of root beer. I remember thinking right off that she had languorous eyes, and the sight of them reflecting the soft lamplight of the fountain jolted me. But the startled look on her face implied that she hadn't admired my shouting like that, not at eleven o'clock at night in the otherwise deserted plaza.

There was the dark, pouting beauty in her eyes and lips of a woman in a Pre-Raphaelite painting, a painting that I had stumbled into in my clodlike way, grinning, I thought, like a half-wit. I too hastily explained the shooting star to her, gesturing too widely at the sky and mumbling that it hadn't been an ordinary shooting star. But there was nothing in the sky now besides the low-hanging moon and a ragtag cloud, and she said offhandedly, not taking any notice of my discomfort, just what I had been thinking, that there was never anything ordinary about a shooting star.

> *"Then, shattering the mood of late-night nostalgia, there shone in the sky a giant shooting star, followed by the appearance of a glowing object, which hovered and darted."*

I learned that her name was Jane and that she had sketched that fountain a dozen times during the day with the blooming flowers behind it and the changing backdrop of people and cars and weather. I almost asked her whether she hadn't ever been able to get it quite right, but then I could see that that wasn't the point.

Now she had been sketching it at night, its blue and green and pink lights illuminating the umbrella of falling water against night-shaded rosebushes and camphor trees and boxwood hedges.

It was perfect—straight out of a romantic old film. The hero stumbles out of the rain into an almost deserted library, and at the desk, with her hair up and spectacles on her nose, is the librarian who doesn't know that if she'd just take the glasses off for a moment...

I scrabbled around to pick up fallen pencils while she protested that she could just as easily do it herself. It was surely only the magic of that shooting star that prevented her from gathering up her papers and going home. As it was, she stayed for a moment to talk, assuming, although she never said so, that there was something safe and maybe interesting in a fancier of shooting stars. I felt the same about her and her drawings and her root beer shoes.

She was distracted, never really looking at me. Maybe the image of the fountain was still sketched across the back of her eyes and she couldn't see me clearly. It was just a little irritating, and I would discover later that it was a habit of hers, being distracted, was, but on that night there was something in the air and it didn't matter. Any number of things don't matter at first. We talked, conversation dying and starting and with my mind mostly on going somewhere—my place, her place—for a drink, for what? There was something, an atmosphere that surrounded her, a musky sort of sweater and lilacs scent. But she was distant, her work had been interrupted and she was still half lost in the dream of it. She dragged her hand in the water of the fountain, her face half in shadow. She was tired out, she said. She didn't need to be walked home. She could find her way alone.

But I've got ahead of myself. It's important that I keep it all straight—all the details, without the details it amounts to nothing. I grew up on Olive Street, southwest of the plaza, and when I was six, and wearing my Davy Crockett hat and Red Rider shirt, and it was nearly dusk in late October, I heard the ding-a-linging of an ice cream truck from some distant reach of the neighborhood. The grass was covered with leaves, I remember, that had been rained on and were limp and heavy. I was digging for earthworms and dropping them one by one into a corral built of upright sticks and twigs that was the wall of the native village on Kong Island. The sky was cloudy, the street empty. There was smoke from a chimney across the way and the cloud-muted hum of a distant airplane lost to view. Light through the living room window shone out across the dusky lawn.

The jangling of the ice cream bell drew near, and the truck rounded the distant corner, the bell cutting off and the truck accelerating as if the driver, anticipating dinner, had given up for the day and was steering a course for home. It slowed, though, when he saw me and angled in toward the curb where I stood holding a handful of gutter-washed earthworms. Clearly he thought I'd signaled him. There were pictures of frozen concoctions painted on the gloss-white sides of the panel truck, coconut-covered Neapoli-

tan bars and grape Popsicles, nut and chocolate drumsticks and strawberry-swirled vanilla in paper cups with flat paper lids. He laboriously climbed out of the cab, came around the street side to the back, and confronted me there on the curb. He smiled and winked and wore a silver foil hat with an astonishing bill, and when he yanked open the hinged, chrome door there was such a whirling of steam off the dry ice inside that he utterly vanished behind it, and I caught a quick glimpse of cardboard bins farther back in the cold fog, stacked one on top of another and dusted with ice crystals.

I didn't have a dime and wouldn't be allowed to eat ice cream so close to dinnertime anyway, and I said so, apologizing for having made him stop for nothing. He studied my earthworms and said that out in space there were planets where earthworms spoke and wore silk shirts, and that I could fly to those planets in the right sort of ship.

Then he bent into the freezer and after a lot of scraping and peering into boxes found a paper-wrapped ice cream bar—a FLYING SAUCER BAR, the wrapper said. It was as big around as a coffee cup saucer and was domed on top and fat with vanilla ice cream coated in chocolate. He tipped his hat, slammed his door, and drove off. I ate the thing guiltily while sitting beneath camellia bushes at the side of the house and lobbing sodden pink blooms out onto the front yard, laying siege to the earthworm fortress and watching the lamps blink on one by one along the street.

There are those incidents from our past that years later seem to us to be the stuff of dreams: the wash of shooting stars seen through the rear window of the family car at night in the Utah desert, the mottled, multilegged sun star, as big as a cartwheel, inching across the sand in the shallows of a northern California bay, the whale's eyeball floating in alcohol and encased in a glass fishing float in a junk store near the waterfront, the remembered but unrecoverable hollow sensation of new love. The stars vanish in an instant, the starfish slips away into deep water and is gone, the shop with its fishing float is a misty dream, torn down in some unnumbered year to make room for a hotel built of steel and smoked glass. Love evaporates into the passing years like dry ice, you don't know where it's gone. The mistake is to think that the details don't signify—the flying saucer bars and camellia blooms, rainy autumn streets and lamplight through evening windows and colored lights playing across the waters of a fountain on a warm November evening.

All the collected pieces of our imagistic memory seem sometimes to be trivial knickknacks when seen against the roaring of passing time. But without those little water-paint sketches, awash in remembered color and detail, none of us, despite our airy dreams, amount to more than an impatient ghost wandering through the revolving years and into an increasingly strange and alien future.

I came to know the driver of the ice cream truck. We became acquaintances. He no longer sold ice cream, there was no living to be made at it. He had got a penny a Popsicle, he said, and he produced a slip of paper covered with numbers—elaborate calculations of the millions of Popsicles he'd have to sell over the years just to stay solvent. Taken altogether like that it was impossible. He had been new to the area then and hadn't got established yet. All talk of money aside, he had grown tired of it, of the very idea of driving an ice cream truck—something that wouldn't have seemed possible to me on the rainy evening of the flying saucer bar, but which I understand well enough now.

He had appeared on our front porch, I remember, when I was ten or eleven, selling wonderful tin toys door-to-door. My mother bought a rocket propelled by compressed air. It was painted with bright circus colors, complete with flames swirling around the cylindrical base of the thing. Looking competent and serious and very much like my ice cream man was a helmeted pilot painted into a bubblelike vehicle on the top of the rocket, which would pop off like a second stage, when the rocket attained the stupendous height of thirty or forty feet. I immediately lost the bubble craft with its painted astronaut. It shot off, just like it was supposed to, and never came down. I have to suppose that it's rusting in the branches of a tree somewhere, but I have a hazy memory of it simply shooting into the air and disappearing in a blink, hurtling up through the thin atmosphere toward deep space. Wasted money, my mother said.

Our third meeting was at the Palm Street Market, where I went to buy penny candy that was a nickel by then. I was thirteen, I suppose, or something near it, which would have made it early in the Sixties. The clerk being busy, I had strayed over to the magazine shelves and found a copy of *Fate*, which I read for the saucer stories, and which, on that afternoon, was the excuse for my being close enough to the "men's" magazines to thumb through a couple while the clerk had his back turned. I had the *Fate* open to the account of Captain Hooton's discovery of an airship near Texarkana, and a copy of something called *Slick* or *Trick* or *Flick* propped open on the rack behind. I read the saucer article out of apologetic shame in between thumbing through the pages of photographs, as if my reading it would balance out the rest, but remembering nothing of what I read until, with a shock of horror that I can still recall as clearly as anything else in my life, I became aware that the ice cream man, the tin toy salesman, was standing behind me, reading over my shoulder.

What I read, very slowly and carefully as three fourths of my blood rose into my head, was Captain Hooton's contempt for airship design. "There was no bell or bell rope about the ship that I could discover like I should think every well-regulated air locomotive should have." At the precise moment of my reading that sentence, the clerk's voice whacked out of the silence. "Hey, kid!" was what he said. I'd heard it before. It was a weirdly effective phrase and had such a freezing effect on me that Captain Hooton's bit of mechanical outrage has come along through the years with me uninvited, pegged into my memory by the manufactured shame of that single moment.

Both of us bought a copy of *Fate*. I *had* to, of course, although it cost me forty cents that I couldn't afford. I remember the ice cream man winking broadly at me there on the sidewalk, and me being deadly certain that I had become as transparent as a ghost fish. Everyone on Earth had been on to my little game with the magazine. I couldn't set foot in that market without a disguise for a solid five years. And then, blessedly, he was gone, off down the street, and me in the opposite direction. I stayed clear of the market for a couple of months and then discovered, passing on the sidewalk, that the witnessing clerk was gone, and that went a long way toward putting things right, although Captain Hooton, as I said, has stayed with me. In fact, I began from that day to think of the ice cream man as Captain Hooton, since I had no idea what his name was, and years later the name would prove strangely appropriate.

It was in the autumn, then, that I first met Jane on that November night in the plaza, and weeks later when I introduced her to him, to Captain Hooton. She said in her artistic way that he had a "good face," although she didn't mean to make any sort of moral judgment, and truthfully his face was almost inhumanly long and angular. She said this after the three of us had chatted for a moment and he had gone on his way. It was as if there were nothing much more she could say about him that made any difference at all, as if she were distracted.

I remember that it irritated me, although why it should have I don't know, except that he had already begun to

mean something, to signify, as if our chance meetings over the years at I could pluck them out of time and arrange them just so, would make a pattern

"He dresses pretty awful, doesn't he?' That's what she said after he'd gone along and she could think of nothing more to say about his face

I hadn't noticed, and I said so, being friendly about it

"He's smelly What was that, do you think?"

"Tobacco, I guess I don't know Pipe tobacco' She wasn't keen on tobacco, or liquor either So I didn't put too fine a point on it because I didn't want to set her off to have to defend his smoking a pipe It was true that his coat could have used a cleaning, but that hadn't occurred to me actually, until she mentioned it, wrinkling up her nose in that rabbit way of hers

"I keep thinking that he's got a fish in his pocket."

I smiled at her, suddenly feeling as if I were betraying a friend

"Well I said, trying to affect a dropping-the-subject tone

She shuddered "People get like that, especially old people They forget to take baths and wash their hair."

I shrugged, pretending to think that she was merely trying to be amusing.

"He's not that old," I said But she immediately agreed That was the problem, wasn't it? You wouldn't think She looked at my own hair very briefly and then set out down the sidewalk with me following and studying my shadow in the afternoon sun and keeping my hands away from my hair It looked neat enough there in the shadow on the sidewalk, but I knew that shadows couldn't be trusted, and I was another five minutes worrying about it before something else happened, it doesn't matter what, and I forgot about my hair and my vanity

Her own hair had a sort of flyaway look to it, but perfect if you understand me, and it shone as if she'd given it the standard hundred strokes that morning A dark-red ribbon held a random clutch of it behind her ear and there was something in the ribbon and in the way she put her hand on my arm to call my attention to some house or other that made me think of anything but houses She had a way of touching you almost as if accidentally, like a cat sliding past your leg, rubbing against you, and arching just a little and then continuing on, having abandoned any interest in you She stood too close, maybe for comfort—although *comfort* is the wrong word because the sensation was almost ultimately comfortable—and all the while that we were standing there talking about the lines of the roof I was conscious only of the static charge of her presence, her shoulder just grazing my arm, her hip brushing against my thigh, the heavy presence of her sex suddenly washing away whatever was on the surface of my mind and settling there musky and soft There hasn't been another man in history more indifferent to the lines of a roof

In the downtown circular plaza each Christmas, there was an enormous Santa Claus built from wire and twisted paper lit from within by a spiral of pin lights and at Halloween, beneath overcast skies and pending rain, there were parades of schoolchildren dressed as witches and clowns and bed-sheet ghosts Then in spring there was a May festival, with city dignitaries riding in convertible Edsels and waving to people sitting in lawn chairs along the boulevard One year the parade was led by a tame ape followed by fezzed Shriners in Mr. Toad cars

Twice during the two years that Jane studied art, while the town shrank for her and grew cramped, we watched the parade from a sidewalk table in front of Felix's Cafe, laughing at the ape and smiling at the solemn drumming of the marching bands The second year one of the little cars caught fire and the parade fizzled out and waited while a half-dozen capering Shriners beat the fire out with their jackets It was easy to laugh then, at the ape and the Edsels and the tiny cars, except that even then I suspected that her laughter was half cynical Mine wasn't, and this difference between us troubled me

In the summer there was a street fair, and the smoky aroma of sausages and beer and the sticky-sweet smell of cotton candy We pushed through the milling crowds and sat for hours under an ancient tree in the plaza, watching the world revolve around us

It seems now that I was always wary then that the world in its spinning might tumble me off, and there was something about the exposed roots of that tree that made you want to touch them, to sit among them just to see how immovable they were But the world couldn't spin half fast enough for her. You'd have thought that if she could get a dozen paintings out of that fountain, then there would be enough,, even in a provincial little town like this one, to amuse her forever

Captain Hooton always seemed to be turning up One year he put on a Santa costume and wandered through the shops startling children The following year at Halloween he appeared out of the doorway of a disused shop, wearing a fright wig and carrying an enormous flashlight like a lighthouse beacon on the lens of which was glued a witch cut out of black construction paper He climbed into a sycamore tree in front of Watson's Drugs and shined the witch for a half hour onto the white stone facade of the bank and then, refusing to come down unless he was made to, was finally led away by the police Jane ought to have admired the trick with the flashlight, but she had

"What a lucky guy you are! You're about to have the opportunity to write a best seller about prison life."

by then developed a permanent dislike for him because, I think, he didn't seem to take her seriously: her or her paintings and she took both of those things very seriously indeed, while pretending to care for almost nothing at all.

He ate pretty regularly for a time at Rudy's counter, at the drugstore. It was a place where milk shakes were still served in enormous metal cylinders and where shopkeepers sat on red Naugahyde and ate hot turkey sandwiches and mashed potatoes and talked platitudes and weather and sports, squinting and nodding. Captain Hooton wasn't much on conversation. He sat alone usually, smoking and wearing one of those caps that sports car enthusiasts wear, looking as if he were pondering something, breaking into silent laughter now and then as he watched the autumn rain fall and the red-brown sycamore leaves scattering along the street in the gusting breeze.

There was something awful about his skin—an odd color, perhaps too pink and blue and never any hint of a beard, even in the afternoon.

A balding man from Fergy's television repair referred to him jokingly as Doctor Loomis, apparently the name of an alien visitor in a cheap, old science-fiction thriller. I chatted with him three or four times when Jane wasn't along, coming to think of him finally as a product of "the old school" which, as Dickens said, is no school that ever existed on Earth.

There were more sightings of things in the sky—almost always at night, and almost always they were described in slightly ludicrous terms by astonished citizens, as if each of them had mugged up those old issues of *Fate*. The things were egg shaped, wingless, smooth silver; they beamed people up through spiraling doors and motored them around the galaxy and then dropped them off again, in a vacant lot or behind an apartment complex or bowling alley and with an inexplicable lapse of memory. The *City News* was full of it.

Once, at the height of the sightings, men in uniforms came from the East and the sightings mysteriously stopped. Something landed in the upper reaches of my avocado tree one night and glowed there. Next morning I found a cardboard milk carton smelling of chemicals, the inside stained the green of a sunlit ocean, lying in the leaves and humus below. It had little wings fastened with silver duct tape. The bottom of it had been cut out and replaced with a carved square of pumice a bored-out carburetor jet glued into the center of it.

It happened that Captain Hooton lived on Pine Street by that time, and so did I. I rented half of a little bungalow and took walks in the evening when I wasn't with Jane. His house was deceptively large. From the street it seemed to be a narrow, gabled Victorian with a three-story turret in the right front corner, and with maybe a living room, parlor and kitchen downstairs. Upstairs there might have been room for a pair of large bedrooms and a library midway up in the turret. There was a lot of split clinker brick mortared onto the front in an attempt to make the house look indefinably European, and shutters with shooting stars cut into them that had been added along the way. Old newspapers piled up regularly on the front porch and walk as if he were letting them ripen, and the brush-choked flower beds were so overgrown that none of the downstairs windows could have admitted any sunlight.

Jane seemed to see it as being a shame—the mess of weeds and brush, the cobbled-together house, the yellowing papers. Somehow I held out hope that it would strike her as—what?—original. Eccentric, maybe. At first I thought that they were too much alike in their eccentricities. I considered her root beer shoes and her costume jewelry and her very fashionable and practiced disregard for fashion and her perfectly disarranged hair, and it occurred to me that she was art, so to speak—artifice, theater. And although she talked about spontaneity she was a marvel of regimentation and control, and never more so than when she was being spontaneous. The two of them couldn't have been more unalike.

He was vaguely alarming, though. You couldn't tell what he was thinking; his past and his future were misty and dim, giving you the sort of feeling you get on cheap haunted-house thrill rides at carnivals, where you're never quite sure what colorful, grimacing thing will leap out at you from behind a plywood partition.

I could see the rear of his house from my backyard, and from there it appeared far larger. It ran back across the deep lot and was a wonder of dormers, gables, and lean-to closets, all of it overshadowed by walnut trees and trumpet flower vines on sagging trellises and arbors. Underneath was a sprawling basement which at night glowed with lamplight through aboveground transom windows. The muted ring of small hammers and the hum of lathes sounded from the cellar at unwholesomely late hours.

The double doors of his garage were fastened with a rusted iron lock as big as a man's hand, and he must have had a means by which to enter and leave the garage—and perhaps the house itself—without using any of the visible doors. I rarely saw him out and about. When I did, he sometimes seemed hardly to know me, as if distracted, his mind on mysteries.

Once, while I was out walking, I came across him spading up a strip of earth beneath his kitchen window, breaking the clods apart and pulling iron filings out of them with an enormous magnet. I recalled our distant meeting behind the ice cream truck, but by now he seemed to remember it only vaguely. I took him to be the sort of eccentric genius too caught up in his own meanderings to pay any attention to the mundane world.

He'd started a winter garden there along the side of his house, and a dozen loose heads of red-leaf lettuce grew in the half-shade of the eaves. We chatted amiably enough, about the weather, about gardens. He gave me a sidewise squint and asked if I'd seen any of the alleged "saucers" reported in the newspaper and I said that I had, or at least that I had seen some saucer or another months ago. He nodded and frowned as if he'd rather hoped I hadn't, as if the two of us might have sneered at the notion of it together.

A spotted butterfly hovered over the lettuce, alighting now and then and finally settling in "to eat the lettuce alive," as he put it. He wouldn't stand for it, he said, and very quietly he plucked up a wire-mesh flyswatter that hung from a nail on the side porch, and he flailed away at the butterfly until the head of lettuce it had rested on was shredded. He seemed to think it was funny, particularly so because the butterfly itself had got entirely away, had fluttered off at the first sign of trouble. It was a joke, an irony, a metaphor of something that I didn't quite catch.

He gave me a paper sack full of black-eyed peas and disappeared into the house, asking after the "young lady" but not waiting for an answer, and then shoving back out through the door to tell me to return the sack when I was through with it, and then laughing and winking and closing the door and winking again through the kitchen window so that it was impossible to say what, entirely, he meant by the display.

There wasn't much I could have told him about the "young lady." Much of what I might have said would already be a reminiscence. The thing that mattered, I suppose, was that she made me weak in the knees, but I couldn't say so. And she was entirely without that clinging, dependent nature that feeds a man's vanity at first but soon grows tiresome. Jane always talked as if she had places to go to, people to meet. There was something in the tone of her voice that made such talk sound like a warning, as if I weren't invited along, or weren't up to it, or were a momentary amusement, like the May parade, perhaps, and would have to suffice while she was stuck there in that little far-flung corner of the globe.

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SELLING SPACE

Not since the Apollo moon landings has space exploration really mesmerized the public. Now, however, a few intrepid souls, daring to go where no ad persons have gone before, have taken up an *Omni* challenge. Create advertisements of the future that promote life in space. Today NASA still aims high. But the agency can succeed in space only if the public again believes in setting this new frontier. Here, then, are some visionary campaigns from Madison Avenue.

No War. Creative director, Don Gill. Kathy Delaney, art director; Michele Scarff, copywriter. Agency, Lintas, New York.

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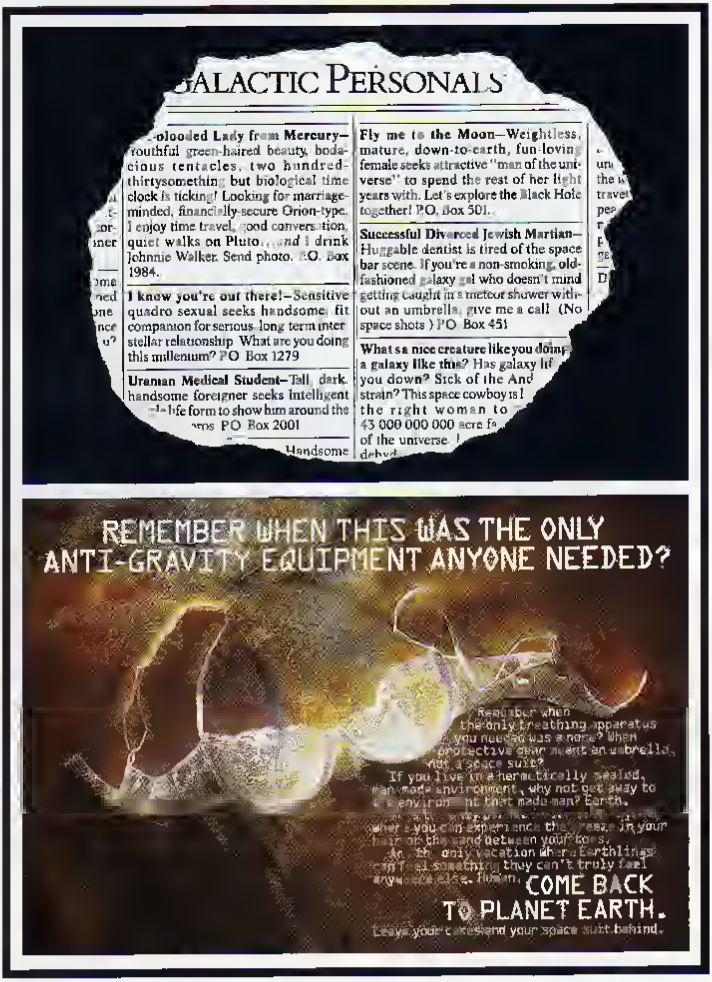
COPYWRITERS: Jack Cardone (Yes You Can), Mark Burk (Survival), Morleen Novitt (Moon Dog)
AGENCY: NW Ayer

The child in all of us dreams of the possibilities in space. Twenty years ago, NASA turned these dreams into reality. On the 20th Anniversary of the Apollo 11 moon landing OMNI salutes the guys who daily strive to make the miracle of space travel happen right before our eyes.



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Father of the global weather satellite, spaceship photographer of atmospheres on distant planets, this whole Earth meteorologist puts escalating fears of warming in the right perspective

INTERVIEW

VERNER SUOMI

He talks about the *Voyager* spacecraft, the planets, winds and clouds the way a child would about a science project at school. Rummaging through a locker in his disheveled office, he finds a round metal box. "Look at this! It's part of the radiometer we used in an early satellite to measure Earth's heat budget." Verner Suomi stares in wonder at the device in his hands. "That was in essence the first sample of solar-energy gain and heat loss over the whole planet. If I built one exactly like it and we flew it again in exactly the same orbit, I could see if there were any detectable changes to indicate warming." He thinks aloud, lamenting that an idea so simple would get buried "in a zillion reviews" at NASA.

Since the early days of exploring space—in the Fifties, when rockets blew up with his experiments onboard—University of Wisconsin meteorologist Suomi has studied the atmospheres of the planets Venus, Uranus and Jupiter. His photographs and observations, gadgets and insights have changed the way we think about weather and climate. And he is as intrigued by the winds of Jupiter or Venus as by the storms of Earth. "I can hardly wait to see what's happening on Neptune," he says of the *Voyager* probe that carries sensors and experiments he designed. But as a member of NASA's panel on space station science, he has lobbied for hardware to explore the home planet. "The astronomers want to look out, but there's some urgency to looking down," he remarks.

Over the years atmospheric scientists have refined their theories and tested their equations in relative obscurity. For about 80 years one idea kept reappearing in their journals and papers: something about greenhouse effects. But no one seemed to care much about it—until recently.

PHOTOGRAPH BY ALAN D. LEVENSON

In 1988 a NASA scientist told Congress that global warming had begun. Then climatologists from the British Meteorological Office said the Eighties had seen the hottest years in a century. As the Environmental Protection Agency was warning of catastrophe, drought struck in the Midwest, a furious hurricane wrecked Jamaica, and weird weather everywhere affected everyone.

A cordial gathering of planetary researchers grew rancorous when atmospheric modeler William Kellogg declared, "We are in the grip of irreversible warming." Climatologist Arnold Court called Kellogg "Chicken Little." A few researchers proposed big policy responses, including a climate modification scheme whereby a group of nations would spread dust in the stratosphere to reflect sunlight and cool the planet.

Into the fray stepped the mild-mannered Suomi. He asked his colleagues to calm down, get more measurements, and fix up their computer models before scaring people. "We are not in a position to make comforting statements or dire predictions," he said. "A few degrees of warming over the whole planet is not in itself so important. It's what happens to the circulation and the weather. We haven't done the experiments to forecast that." The change in atmosphere—an increase in gases like carbon dioxide (CO_2) and methane—is real and dramatic, Suomi says. And greenhouse effects are well-known. The gases trap heat at the planet's surface. At this point consensus goes out the window, and questions breeze in. Is there evidence of warming? Can oceans absorb more CO_2? Will unseen changes, such as increased cloudiness, cause cooling?

Suomi is not one to sit by and speculate while the atmosphere's at stake. Scribbled in Magic Marker colors on his office wall are plans for probing the question. How does the atmosphere interact with the water, ice, land, and plants? "Only by treating Earth as a unified system," he says, "can science find out what's happening and show us what to do."

Suomi's work puts fear of warming in perspective. When Hurricane Gilbert struck, observers said it was the "most severe hurricane ever" and blamed a hotter-than-usual ocean. But 1966 was the first time meteorologists ever photographed a hurricane. That's when Suomi's spin-scan camera aboard an Applications Technology Satellite yielded the first pictures of weather forces in motion over the planet. Only recently have researchers begun to measure ocean temperatures. It was in the Eighties that Suomi finally got sounders—infrared scanners that detect atmospheric temperatures—on geostationary satellites. NASA had been resisting the idea for a decade. And only since the late Seventies have climate modelers plugged numbers into equations that predict the greenhouse effect. From 1959 to the late Seventies Suomi spearheaded the Global Atmospheric Research Project, engaging scientists from 60 nations to measure and quantify the atmosphere.

Suomi was born in the small mining town of Eveleth, Minnesota, in 1915. His father was Finnish and his mother, who was of Swedish descent, came from the Åland Islands in the Baltic. His parents spoke Swedish to Verner, his brother, and five sisters, and the children replied in English. Suomi's father was a carpenter for a mining company, and using his father's tools likely contributed to Suomi's love of making things. He earned a Ph.D. in meteorology at the University of Chicago, where he studied with the renowned meteorologist Carl-Gustaf Rossby. After joining the University of Wisconsin faculty in Madison in 1948, he became chairman of the meteorology department in 1950. In 1966 he founded the Space Science and Engineering Center at Madison with a grant from NASA to develop spaceflight instruments. Director until 1988, he retired to become a professor emeritus. Today McIDAS, a system Suomi created to connect satellites with computers for the study of planetary atmospheres, whirs away in room after room of the center's 15-story building. McIDAS imaging systems are used by NASA launch teams, planetary scientists, severe-storm centers, and meteorologists in many countries.

"The equations are so powerful you can play God. Declare the same temperature everywhere, then turn on the sun. Slowly the tropics warm, the poles cool, and the atmosphere begins to run."

Suomi entered the space race at the beginning, in 1955, when he built his radiometer. Those were pioneering days, when a young scientist could build an instrument, go to the Cape, and see it launched. His first radiometer fell into the sea on a Vanguard rocket, and his second burned up when a Juno rocket exploded. Newspaper reports from July 1959 describe it crashing in flames 50 yards from the blockhouse, trapping scientists inside for hours. "We could see the fires through the window," Suomi remembers. "When they let us out, I looked for our equipment, hoping we could use it again on the next launch."

Journalist Paul Bagne interviewed Suomi in his office at Madison. Over Suomi's desk are two 16- by 20-inch photographs, one of Earth, the other of Jupiter. As Suomi leans back in his chair, his voice takes on a Swedish lilt when an idea excites him. When talking about clouds, he goes to the window at one end of the narrow room to scan the sky.

Omni: Why did you choose meteorology as a career?

Suomi: When I took flying lessons, the adiabatic chart in a pilot's handbook caught my imagination. The adiabatic chart told what happens to the atmosphere at different elevations or when there's water in it. World War II came along and the draft board was breathing down my neck. One evening I heard Rossby on the radio saying the war effort needed meteorologists. That got me involved. It was a happy accident. And the University of Chicago was absolutely the place to be. The Rossby wave—the jet stream [narrow rivers of high-speed winds encircling the globe about six miles up]—was discovered there. Rossby encouraged me to measure the heat budget of Earth.

Omni: We didn't hear much about spacecraft *Voyager*'s encounter with Uranus in 1986. What did you find out?

Suomi: In the middle of it the *Challenger* tragedy occurred, so excitement about our project just vanished. That's the way we left it, all saddened. But it's clear the encounter was a roaring success. You know the TV camera we had onboard was really lousy. It had the speed of an old Kodachrome 1, with an ASA [sensitivity to light] rating of eight. Today you go into a drugstore and buy film with a rating of a hundred or thousand. I held that Vidicon in my hands once. My mistake was not dropping it on the floor.

Because Uranus receives four hundredths the sunlight of Earth, and the craft is zipping along at sixteen thousand kilometers per hour if you take a time exposure with this camera, everything will blur. Well, these characters at JPL [the Jet Propulsion Laboratory in Pasadena, California] put a fictitious drift into the guidance system, fooling the craft into thinking it was off course, so it kept turning toward the planet. And the camera did so well that craters on some smaller satellites of Uranus came out round, just as they should. But oh, man, the camera-pointing mechanism got stuck, and there was a sticky bit in the computer memory, and they changed the program just hours before encounter. That takes guts! Well, we scientists got the pictures back, but the engineers made it possible.

Omni: What's Jupiter's weather like?

Suomi: The scale is unimaginable. You could fit four Earths into this storm, the Great Red Spot. It's wound tightly. Winds blow at tens to hundreds of meters per second. There's a jet going around the Great Red Spot where the wind blows

fastest, like the top of a hurricane.

Omni: How can a storm like this persist?

Suomi: I think it's hurricanelike. On Earth a hurricane is stable as long as it has warm water under it as a heat source. The bigger it is, the more stable it's likely to be. Perhaps this is the same—with Jupiter's interior as a great heat source to keep it running. We are trying to understand these phenomena with very few measurements. It's almost like the early meteorologists trying to understand what was happening on Earth.

Omni: You like simple ideas.

Suomi: In the early days, with just a transmitter going beep, beep, beep, we could tell the shape of the earth, its density, many things. These days we want to make things more complicated. Look at the bottom of the Vostok [a Soviet rocket]. There are many engines, each no bigger than a garbage can, not counting the nozzle. It's simple. The instabilities in a small engine are easier to control, and you can assure quality in production. Ours are bigger, more complicated, and efficient—but theirs are flying.

Omni: How did you get started in the space program?

Suomi: In 1953 I wrote a thesis called "The Heat Budget of a Cornfield" at the University of Chicago. About the time I graduated, everyone was excited about the use of satellites for meteorology. We had seen cloud pictures transmitted from rockets like Viking and Aerobee. I had no experience in space technology, but I proposed a sensor on a satellite to measure the earth's heat budget—just as I'd measured the heat budget of a cornfield. We were working on the satellite when we heard the Soviets had put *Sputnik* into orbit. When we heard their satellite weighed eighty pounds compared with our twenty-pound thing, that hurt. It was an emotional experience to be at the launch of my radiometer. When the second stage of the Vanguard rocket failed and my gadget fell into the ocean, it was almost like a death in the family.

Omni: When you finally got the radiometer into orbit on *Explorer 7* in 1959, you collected data from your bedroom.

Suomi: We had many stations around the world, each with a radio tuned to fifty megahertz, a tape recorder, and a clock. I collected the [satellite] overpass of Wisconsin from my bedroom. In the middle of the night you could hear it going *ee aah ee aah*. Instead of the megabits we talk about now, our rate was two bits per second. But we got plenty of information. With it we were able to see in a fairly crude way the energy input to Earth and the energy loss. We got patterns of the long-wave radiation. Lo and behold, they showed a variation of heat loss over a weather system or a high-pressure area. That didn't square exactly with the theory and the albedo [reflected energy] we got—twenty-nine percent—was a lot less than the estimate. With all of today's fancy gadgets, we figure it's about twenty-nine and a half. So our simple gadget didn't do too badly.

Omni: Your next invention, the spin-scan camera, is the basis for weather satellite imagery all the pictures on the evening news. Where did you get the idea?

Suomi: There was an article in an electronics magazine about this Applications Technology Satellite NASA planned to launch into geo [geostationary] orbit. It would spin at about one hundred rpm. I thought a telescope on it could scan the earth. With each swath of the satellite's turning, the telescope's mirror could be tilted down one step out of twenty-four hundred, so the whole planet could be scanned and photographed after twenty-four hundred revolutions.

The idea occurred to me in maybe five minutes. I did an experiment in my basement to simulate conditions in space. I needed sunlight, a scene, a spinning camera. The sunlight was already there—shining through a dirty window. To create the scene, I took a paper plate and marked little grooves on the fluted edge with a pencil. The white of the plate was bright like the clouds we'd be scanning from space, and the pencil marks were dark like the ocean would be. Then I made a mock-up of the camera. I took a lens, and behind it I set up a photomultiplier tube [to detect and amplify light]. I pricked a hole in a sheet of aluminum foil and put that in front of the tube so only a spot of light would come through—like the tiny streak of Earth the camera would see as it spins. When put together, the streaks would make a TV picture. There was no way I could spin my camera mock-up, so I got an electric fan [laughs] and stuck the paper plate to the blade—to spin my scene instead! I aimed the lens on the edge of the plate and turned on the fan. Guess what? I got nice clean signals from the tube. I knew my idea would work.

The problem of stability was not yet solved. The telescope on one of the *Vanguard* satellites fumbled, and the data got scrambled. Even though the camera eventually got onboard, people were betting it would never work. I wanted to watch the launch of the first camera, but every time I went to the Cape, something blew up. I figured I was a jinx. Finally I watched it at Goddard Flight Center [in Greenbelt, Maryland]. It went up.

Omni: What did you learn from those first pictures?

Suomi: From a geostationary platform the weather moves, not the satellite. This was the first time we could see weather in motion! It was beyond our comprehension. Instead of the atmosphere being truly turbulent and random, we noticed a surprising degree of organization—clouds that looked like someone was pulling taffy across the sky. What we saw partially changed our idea about the structure of

a storm It also gave us a better idea of how large-scale weather controls small-scale events The biggest change in our thinking came in the tropics where there were very few weather stations

Omni You realized satellites wouldn't help forecasting until you learned how to process their data quickly

Suomi We had to wait twenty minutes before the picture completed its scan so you could reel the tape back up and look at it So when we'd call a pilot and say, 'Look out for the turbulence ahead,' he'd say, 'Thanks, I'm already in it' Or we'd call up a sheriff and say 'There's a big storm on the way,' and he'd say, 'Get off the phone! I have an emergency' They had a very low opinion of forecasting We had more data coming in from space and the ground stations than we could use So we developed McIDAS [Man Computer Interactive Data Access System]

This building is a kind of headquarters for McIDAS with data on weather around the globe coming in from the satellites—millions of bits at once The satellites are spinning once every six tenths of a second When they look at Earth they gather information when they look at space they send it We distribute data and pictures all over the country by phone line Meteorologists can zoom in, overlay a grid, look at pressures, winds With McIDAS navigation they can tell within a kilometer or two where a storm is McIDAS today is so far beyond what I first had in mind it isn't even funny I was just anxious to get pictures on the screen Today we use it to study storms on Jupiter

Omni What's the weather like on Venus?

Suomi Virtually unchanging, a steady state compared to Jupiter or Earth We're still wondering about the basic driving mechanism—why the winds are so high The atmosphere is almost all carbon dioxide Near the surface, temperatures are about seven hundred degrees Kelvin hot enough to melt lead

Omni Is Venus heated by a runaway greenhouse effect?

Suomi That would mean a lot of sunlight filters through gases and particles in the atmosphere and strikes the lower layers to heat them Then these gases and particles block the heat from radiating back into space But our measurements show that seventy-seven percent of the sunlight striking Venus is reflected back by the clouds Of the solar energy that isn't about eighty percent still can't get through the clouds and is absorbed way up high So only about five percent of the sunlight does get through Its heat—trapped by CO_2, a near-perfect insulator—raises the surface layers to high temperatures It's a measly greenhouse with a large effect

Omni Some say what happened to Venus could happen to Earth

Suomi If you were to get all the CO_2 out of the limestone, plants and animals on Earth, you'd get as much as there is on Venus But Earth's water and plants absorb CO_2 If you look in a coal bin you can sometimes see the imprint of a leaf. That's CO_2 absorbed from the atmosphere Clearly, if we released all the carbon as CO_2, it would be a hell of a lot different on Earth

Omni Is Earth warming?

Suomi I don't know Nobody knows what normal is Over the last two hundred years, climates may have been different We are looking for a lousy degree or part of a degree over decades And each day the temperature goes up and down thirty degrees That's a very noisy signal

Omni Some British climatologists say the warmest years since measuring began in the late 1700's occurred this decade

Suomi One of them did an analysis of temperatures from ships If you put a thermometer in a bucketful of sea water on a hot deck, sometimes the temperature goes up—not because the ocean has changed but because the deck has If I take the temperature from one measly ship in an area not traveled much and make it apply to a big chunk of ocean I've made an enormous mistake The sampling of ocean temperatures is terrible And Earth is three quarters ocean!

> *"If it works, a microwave dish in orbit—even the size of a football field—wouldn't cost much. We've got astronauts up there, and they could unroll it just like a curtain."*

Even on land you can't be sure Most weather stations are in cities that get warmer as they grow In the summer the city, versus the country, may be five to six degrees hotter from all the concrete and blacktop As trees grow or get cut down, the exposure of thermometers to the sun changes The thermometer in a weather station may be in a beam of sunlight on a clear day and a cloud might happen along, off to the side It might be there for only five minutes, but it can reflect energy toward the thermometer and raise the temperature It's hard to know the actual temperature of Earth, particularly if one is trying to detect tiny differences that might indicate global change

Omni Was the intensity of Hurricane Gilbert evidence of warmer seas?

Suomi We have no evidence the ocean is warming We are just starting to get accurate temperatures of the tropical seas from satellites A hurricane is a closed system Its energy comes from the ocean right below it Hurricanes dissipate when they graze land or turn north over colder water The heat source is cut off If the track is over warm water, say along the Gulf Stream, a hurricane can intensify If the ocean warms, we will probably get more and perhaps stronger hurricanes Their strength, as did Gilbert's, depend on the path

Omni Was last summer's drought caused by the greenhouse?

Suomi Ordinarily the middle part of the United States is a kind of low pressure area, or 'trough.' Last summer it was just the opposite a big blocking high pressure in the middle with troughs on the coasts The reason for that hot, dry summer is obvious The jet stream had changed But why? Some said it was the greenhouse I just saw a paper by Kevin Trenberth of the Center for Atmospheric Research, however showing it was due to a change in circulation [the way the atmosphere spins around the planet] Trenberth showed that cold Pacific water and dry air at the equator caused warm water to settle farther north than usual Satellite pictures showed this region with its thick cloud cover and heavy rainfall acting like a rock in a river, diverting westerly winds northward This pushed the moisture bearing jet stream into Canada, allowing high pressure to build over the drought area

Omni Some meteorologists forecast drastic regional climate changes driven by the greenhouse Is their work flawed?

Suomi Our problem is we have a theory of weather but no theory of climate Weather depends on the initial changes in the atmosphere—where it's warm, cold, windy and so on We assume the boundary conditions to be stable Dry land is a boundary condition, as is the ice, snow, and ocean And there's a lot of interaction between all these parts of the system Climate depends on changes in boundary conditions If it's dry over the Midwest as it was last summer, it's also hot because with no water to evaporate heat goes to warming the atmosphere The earth's climate is shocked violently every winter and summer Why it doesn't change more than it does is really a surprise That's why I say we have no theory of climate Right now we can't predict accurately enough changes in the boundary conditions

Omni Do forecasts of a new Ice Age have any credibility?

Suomi In this millennium Earth is closest to the sun in January In eleven thousand years it will be farthest from the sun in January—and it's going to be much colder There was a lot of excitement and many stories about this idea Forests were going to disappear and so on Planetary changes are all very subtle and cooling is on a scale of thousands, maybe tens of thousands of years.

Now we're concerned with a potential

change in a much shorter time. If optically active gases in the atmosphere increase as projected and the greenhouse accumulates, it will get warmer. Not in ten years, but maybe in fifty or a hundred years. Then you're darn tootin' there could be trouble. We have to be very careful before we say the sky is falling.

Omni: How does cutting a forest change the atmosphere?

Suomi: The amount of CO_2 in the atmosphere fluctuates in a cycle, depending on seasonal changes in the Northern Hemisphere. As plants grow in spring, photosynthesis increases and CO_2 levels drop. Reducing the enormous amount of leaf area in a forest will reduce photosynthesis. If other plants replace trees they will take out CO_2, too. But if I plant a wheat field, then cut it, I've got stubble. And that's not going to use much carbon dioxide.

Plants are important because they give moisture in the root zone a way to transfer to the atmosphere. In fallow land the ground dries out and acts like Styrofoam. Changing the vegetation, say from forest to grassland, will change the coupling to the root zone. Most plants are shallow rooted, but trees have tap roots that go down a long way. And treetops stand up in the wind like a forest of wet rags, drawing water from the ground. Air cools as it flows over a forest. Grassland does not provide that cooling. Cutting down a forest, you disconnect the ground from the atmosphere.

Omni: What do we know for certain about the greenhouse?

Suomi: Carbon dioxide and other atmospheric trace gases are increasing. As you add CO_2, water vapor, and ozone, the temperature clearly goes up. If the CO_2 doubles and stays in the atmosphere, warming will occur, probably about one and a half to three degrees centigrade over a century. As the planet warms, the ocean temperature won't change much, but the land's will. And that difference in temperatures is what makes the atmosphere run. Knowing the consequences depends on the quality of the computer models. But with global change we're not talking about publishing a few papers or seeing our theories on the nightly news. We are talking about the habitability of the planet.

Omni: What are the uncertainties?

Suomi: We know the sources of CO_2—fossil fuel, plants, and cars—but we don't know much about the CO_2 sinks [absorbers]. The ocean surface can absorb or release CO_2 over months. The deep ocean can absorb it over a longer time, depositing CO_2 on the bottom through plants and skeletal remains that fall down. We don't know how fast that's going on. Also, the solubility of CO_2 in water decreases as the temperature goes up. If you open a cold bottle of Coke, it just fizzes; if you open one that's warm, you need a raincoat and a washtub. Will more CO_2 come out of the ocean if it warms?

Another big question concerns clouds. Suppose that as greenhouse gases increase, so does cloudiness. If those clouds are low and thick, they'll reflect more sunlight, and the earth will cool off, not warm up. But if there are more cirrus clouds up high, they'll trap heat and make matters worse. Clouds could be as important a factor as CO_2 itself.

Omni: A few colleagues of yours advocate drastic action. What's your view?

Suomi: We should stop cutting down rain forests and should reduce fossil-fuel expenditure. But clearly we could screw things up if we get it wrong. For years around Madison we burned our leaves. Then the city fathers decided we should bag and bury them. As the leaves decayed they produced methane. In a subdivision built on a landfill, so much methane leaked that a couple of houses exploded. So the city fathers put in vent pipes. Now, in the bone-dry stratosphere [roughly 40,000 feet and up] one molecule of methane will do as much damage as thousands of CO_2 molecules. Here the windows for outgoing radiation are very clear. Lower down, in the troposphere, there's more moisture, and the ratio is roughly twenty to one. But that's bad enough. And methane's rate of growth is much steeper than CO_2's. Though very low in concentration, methane and other trace gases add up to about half the effect of CO_2, so we can't ignore them.

Omni: What is a model?

Suomi: A beautiful woman to most people [laughs]. To a meteorologist it's synthetic weather or climate. Modeling is done with numbers. In a computer we have around six equations, and we place a grid over the planet. At each grid point are declarations that describe the atmosphere. At this elevation this is the temperature, moisture, pressure, and so on. That's our best estimate of what the atmosphere is like today—the initial condition. But if it's warm over here and cold over there, the atmosphere will rearrange itself. The equations are so powerful that you can play God. You can take Earth and declare the same temperature everywhere, then turn on the sun. Slowly the tropics get warmer and warmer, and the poles get colder and colder. Soon you get the global circulation that makes the atmosphere run. In real weather and climate events are intermeshed, so we go in little steps. This is the initial condition, and this is the atmosphere in five, then ten minutes. A three-day forecast is made up of small intervals. A big computer lets you take smaller steps and get better forecasts. Long-range forecasting, involving longer time scales, is much harder.

CONTINUED ON PAGE 94

FICTION

Someone came up with a brilliant plan for world peace, and only one group is powerful enough to make it work—the media

SHOOT THE MOON

BY PAT CADIGAN

The hallmark of a good administrator Lee Benevich thought, is not one's mean streak, but knowing how and when to use it She took her time toweling off from the first of her thrice-daily workouts and dressed unhurriedly wishing a bad case of motion sickness on both government representatives waiting in her office

"Looking a bit green" was how DiBenedetto had described them to her on the phone, considering his penchant for understatement this probably meant Maintenance was still swabbing vomit all the way from the entry to the reception area Lee smiled to herself thinking of the latest graffito to make it onto the locker-room wall LUNAR BROADCASTING HAVE YOU GOT THE GUTS FOR IT? She let them cool their heels an extra fifteen minutes before she drifted in—everyone drifted on the moon—using the regular entrance rather than her private drop The normally unruffled DiBenedetto looked a bit uncertain as he sat at the reception desk If they'd given him that much trouble, Lee thought, then she was glad that she'd kept them waiting as long as she had

Neither of them stood up when she swung in moving easily from one handhold along the walls to another, but she paused and waved them down as if they had *When they don't follow the customs, let them off the hook, kindness is free,* her mother had always said By the expressions on their faces—guilt then relief—it looked like her mother had been right again

Lee settled gracefully behind her desk and said, in French "What can I do for you gentlemen today?"

They looked at each other

"*You* summoned *us*," said the one on the right

"That s true" the other said quickly, and looked at the man next to him "*I* did not ask to come here"

Lee nodded "I know Now I'll ask again What can I do for you?"

"You can tell us why you demanded this visit" said the one on the left Lee resisted the urge to award him a point, even for footwork The awarding of points, even privately, necessarily implied that there could be a winner

"All right," she said "I understand you two aren't getting along"

PAINTING BY RALLÉ

Their blood pressures had to have risen twenty points. Someone should have warned them about getting agitated on the moon. She was so busy marveling at the effects of their anger she barely (purposely) heard the angry words filling the graceful lunar air (she always thought of air on the moon as graceful).

"—imperialist, warmongering—!"

"—dictatorial, expansionist—!"

"—enemies of—!"

"—free thought—!"

"—free people—!"

"—invasion forces—!"

"—baby-murdering—!"

"—like Nicaragua—!"

"—like Panama—!"

"—Iran—!"

"—Iraq—!"

"—shitheads!"

"—dickfaces!"

Lee burst out laughing, which shut them both up.

"Jeez, you guys just never get any new rhetoric, do you?" She wiped her eyes before the tears separated and went floating down to splash on the desk. "It's generic politics. You people just have no *imagination*. That's the big problem here, see. If you *had* any imagination, you'd be able to think of plenty of other stuff to do besides declare war."

"The price of freedom—"

"Where the people are oppressed—"

"Oh, can it." Lee said. "What do you think this is, a sound bite? Forget it. Nobody's listening to you twist words to your own purposes except me."

"Well, there'll be plenty to listen to—and see—if these foreign oppressors send their so-called advisers—"

"—financing a government that—"

"—murderers calling themselves revolutionaries—"

"—women and children—"

"—and *old* people—"

"—raping nuns—"

"—raping priests—"

"—raping everybody—"

"—raping *farm animals*—"

"*Rape* is supposed to make my hair stand on end, right? Don't try to manipulate me with *rape* or any other word. I'm the media. Nobody manipulates the media anymore." She paused, looking from one to the other. "Remember where you are. This belligerence isn't going to help your motion sickness."

Green faces did not become them more than red, but it did mean they'd stopped wanting to shout.

"I'll lay it out for you," she went on quietly. "No war. None. Zero. Zilch. *Rien, nada, nyet*. No way. Find something else to boost your economies."

Both men opened their mouths to protest. They gagged instead.

"I know this is over *principle*, not money. *You* say. Or you would if you could. But this is the way it is. You are not going to tear up a third country in a squabble between yourselves, and you're not going to punch each other out directly, either. The media will not cooperate."

"We don't need the media—"

"—to fight for what is right!"

"Bullshit in a bag," Lee said cheerfully. "Twenty pounds of bullshit in a ten-pound bag, an image you can meditate on. Now. If you'—she pointed at the man on her left—"so much as set one invading boot on one beach, or harbor, or whatever, we release footage worldwide of your so-called advisers in various corrupt and abusive acts—taking bribes, running drugs, whoring it up with anything that moves, including the farm animals."

The man gave a short, harsh laugh (swallowing hard afterward). "There would be no such footage. Would you dare to compromise the integrity of the media by manufacturing false news?"

"We don't have to manufacture anything," Lee said patiently. "It's all a matter of creative editing. Something can be taped, and then the sequence of events

"Lee had to resist the urge to award the man a point, even for footwork. The awarding of points, even in private, she knew, necessarily implied that there could be a winner."

no matter how innocent, rearranged and intercut with other images just as innocent in such a way that the viewers would swear they saw something that was only implied. Within a week your people will denounce their own government as thieves, pimps, and pushers."

"It would still be false, and we would end up proving it false."

"But not before you've withdrawn your forces." She turned to the man on her right. "If *you* so much as *order* your navy to prepare for a blockade, we'll preempt every bit of entertainment programming you have with panel discussions on the history of militarism and your part in it, the possibility of war, eyewitness accounts from past wars, with footage, commentary, and analysis. Within a week, half of your nationals will be bored enough to join the other half frightened by the possibility of a long, drawn-out conflict in many disruptive demonstrations demanding troop withdrawal, peace talks, and the return of sitcoms, soaps, and tabloid journalism." She gave them her most gracious smile. "Of course, if you insist on being stubborn, we *can* manufacture some footage, as a last resort. Boots in faces, old people, farm animals, the whole nine yards. We've got *prima* computer simulation up here. I could make images of the two of you and put you in the Honeyearth Suite of the Lunar Hilton, and *you'd* swear it was live action. You'd probably have to get married, too, but that's another matter." She spread her hands. "And that's my final offer."

"You can't—"

"Our government will—"

"Your governments will shut up and take it. The media for all governments are up here and you can't get to us. We handle all information dispersal, except for the old movie channels and the hams and the CBs, and we can shut those down, too. All it would take is a little electromagnetic bonbon to knock out all dirtside communications. It's the same way we can shut down a hostile launch or deflect your weapons. Nobody gets hurt, not us and not you."

"You are not the only one in power here," said the man on the left.

"The other media heads may see things differently," put in the man on the right.

"If they did, they wouldn't be on the moon, you fools," she said, laughing. "Why the hell do you think we all came up here? To lose weight?"

She pushed up from her desk. "I'm going to give you guys the best advice I know. Do the lunar thing—lighten up."

They both rose somewhat unsteadily, and she could read their thoughts clearly in their faces. Always the same, she marveled. Year in and year out, no matter who came up to the moon or where they came from, it always came down to the same thing at this point in the interview, the sudden aggressive urge. Usually they knew better than to try anything. But she'd learned not to assume they had sense, as recently as last year, a visitor had tried to commandeer the office.

"I should probably add here that I've been on the moon for fifteen years," she said, taking a grip on one of the handholds on the wall behind her. "Since I lost my legs covering the final showdown in the Middle East. I know everything there is to know about motion on the moon. You two have been here fewer than three hours. I can evade you for at least that long without calling for help and be none the worse for wear. You two, however, will probably retch yourselves some major hernias in the first twenty minutes." She whistled at the intercom on her desk. "DiBenedetto, our visitors are ready to leave. Please send the escorts."

"This is—this is—"

"—global blackmail!"

"Nah," she said. "It's sheer lunacy." The two visitors looked at her blankly and she sighed. "Okay, forget it. Call it business."

DiBenedetto lingered after the men were escorted out of her office and back to the terminal to suit up for the return trip. He'd been listening in, but Lee didn't be-

CONTINUED ON PAGE 94

By 1986 the Hessdalen lights were gone But for many scientists, they remain a matter of serious debate

ANTI MATTER

UFO UPDATE

The strange affair began in December 1981 when citizens from the sparsely populated Hessdalen Valley in Norway reported a fleet of spherical and bullet-shaped lights moving across the sky Aircraft had often traveled roughly the same path heading north toward the airport at Trondheim But these lights the residents of Hessdalen declared were something else

Appearing either one at a time or in small groups the lights moved oddly Sometimes they suddenly stopped in the night sky remaining motionless for an hour or two at a stretch Sometimes they streaked northward at speeds so fast the eye could barely follow them According to witnesses in fact these odd lights flashed changed shape and color and even followed cars

As word of the sightings spread Norwegian UFO researchers raced to the valley to collect testimony—and they hoped to see the enigmatic lights themselves They were not disappointed According to UFOlogist Odd-Gunnar Roed head of Project Hessdalen it was hard for anyone to deny that something was going on Through 1985 he says the researchers took some 200 photos of glowing shapes either hovering over the valley or zooming by Radar tracking he said seemed to indicate the lights were attached to something solid moving up to 32,000 kilometers per hour And when investigators flashed a laser light at the alleged objects the objects frequently flashed back

Some investigators even began testing a pet theory that the phenomena were 'earthquake lights' luminous bursts of energy produced when underground rock formations are stressed Seismographic testing revealed no concurrent earthquake activity however and scientists threw up their hands in despair

By 1986 the Hessdalen lights were gone vanishing as suddenly and inexplicably as they had arrived But for many UFOlogists and atmospheric scientists the strange Norwegian glow remains a matter of serious discussion and debate

Roed, for instance suggests that the objects seemed intelligent in their movements though he adds 'staying in the same place for five years straight really isn't very intelligent at all His best guess The lights were a complex natural phenomenon' and nothing more

Engineer Erling Strand another project member is not so sure that Roed is correct If the lights were natural he says "it's strange that they existed for a five-year period and that they were recorded in Hessdalen and nowhere else If this was a natural phenomenon' he adds it was in the sense that everything is ultimately a natural phenomenon It is definitely an unknown phenomenon perhaps even the basis of a new science"

Physicist Elvand Thrane of the University of Oslo's Institute of Physics says that after studying the lights he remains impressed Thrane who went to the trouble of interviewing many Hessdalen witnesses says These were experienced outdoor people many of them hunters used to observing things I'm sure the lights were real It's a pity we cannot explain them —*JEROME CLARK*

WAR OF THE WORLDS SURVEY

It's been more than half century si ce the *War of the Worlds* radio broadcast caused panic he stre ts So how would the modern psyc e handle news a real life alie tati

Ray oeche the then Nebras state director the Mutual F Network sent a questionnaire to 475 mental health rofessionals asking how they thought the public gh eact parabl-

MN

newsp esp nde ople would what" abou they predic crisis wou ism would crease and ancial due to widespread cultu shock might et

Boeche cites a sp the question whether mass panic would o per ent resp dents said yes 2 percent said no an he r were nsure

ey McCabe

PSEUDOTEACHERS

ave you er wondere ge pa enti beliefs? Well Ray ologist Dana of the iversi f gton se the researchers feare were the las itself

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HAUNTED CHELTENHAM

[illegible] one of the most famous [illegible] at [illegible] me [illegible] A [illegible] Cheltenham [illegible]. A stately three story [illegible] an home, [illegible] was [illegible] 1880 [illegible] Captain [illegible] W [illegible] Despard and [illegible] family. Rosina, one of the captain's daughters, [illegible] kep[t a d]iary of the [c]ase.

[illegible] female ghost dressed [illegible] and holding a handker[chief] [illegible] her face repeated[ly] [illegible] the house and [illegible] the diary explains. Mys[terious] [illegible] handles [illegible] and the family dogs went [illegible] fright. Rosina, who later became a physician [illegible] meddled with the ghost. She placed threads across the stair[s] to see if the spirit might displace them [illegible] lightly [illegible] through.

According to Rosina's notes, the ghost finally left in the late 1800s. But [illegible] some people say [illegible] St. Anne's is [c]urre[ntly an] apartment building. Several [illegible] Cheltenham claim that they have seen the figure [illegible].

Andrew MacKenzie of the Society for Psychical Research has been investigating the spook's reappearance and [illegible] is compelling, to say the least. [illegible] an executive officer working for a London airport visited [illegible] who happened [to li]ve across the street from St. Anne's. He woke late [one] night to see a ghostly figure who was dressed [in] black and clutching a handkerchief lurking in his [room]. What seems like the most sensational report was given by Maureen Jackson [illegible] Cheltenham. Jackson was taking a driving lesson near St. Anne's when a woman in black stepped in the street. Jackson slammed [on] the brakes only to learn that [illegible] didn't see [illegible] MacKenzie [illegible] the woman [in] black behind the famous house.

MacKenzie's theory? Since these modern-day witnesses saw the woman [in] black outside rather than inside the famous house, the ghost has literally moved. "My personal theory," he says, "is that when conditions become unfavorable for a haunting [illegible] spot [it] moves elsewhere. We know [from] Rosina's narrative that the figure was sometimes seen outside the house, and that's where it resides today."

But Peter Underwood, who has written extensively on ghosts, isn't convinced. "It seems to me that some of the sightings and some of the mysterious noises reportedly seen and heard originated from living persons in the house," he says. "And I [f]ail to see how an experienced psychical researcher could argue with that."

—D. Scott Rogo

EASTERN BIGFOOT

On January [illegible] 1988, a [illegible]-year-old Scaggsville, Maryland man was walking his dog in the field behind his house when he saw a hairy, nine-foot-tall creature running down a bank toward the Patuxent River. The next day he found a series of 18-inch-long footprints in his garden.

"Most people don't think that Maryland ever had a Bigfoot sighting," says Mark Opsasnick, who has investi[gated] [illegible] 86 Bigfoot [illegible] Bu[illegible] late [illegible] [illegible] the M[illegible] the M[illegible] [illegible] in the West [illegible] Washington, Oregon, and [illegible] Washington [illegible] Bigfoot [illegible]

—Patrick Huyghe

UFO connection?

Barry H Downing author of *The Bible and Flying Saucers* has long been interested in the connection between religion and UFOs Nonetheless this Presbyterian pastor from Endwell, New York has had a hard time getting religious colleagues to discuss the matter at all

Hoping to generate some response from other members of the clergy Downing recently sent a UFO survey to 100 Protestant and Roman Catholic theological seminaries Twenty-six individuals returned the questionnaire proving that religious leaders *are* willing to take on the issue of UFOs

The most detailed response came from the Very Reverend Dr J Edgar Bruns who now serves as historian for the Archdiocese of New Orleans "If intelligent life exists elsewhere and has not fallen from grace' Bruns opined I would consider such creatures equivalent to the biblical angels '

A more skeptical response came from someone at a New England Protestant seminary Addressing the issue of whether angels were related to UFO occupants the respondent wrote 'I hope not"

On the whole survey takers supported the notion that UFOs carry extraterrestrial life When asked how proof of such life would affect Christian theology however respondents were divided Some saw little change citing for instance that 'God, as revealed to us in Jesus would still be a reality for the whole universe Others said that discovery of alien life would create a whole new field for ministers pastors and priests wishing to bring the Christian faith to E T As one seminary leader put it "The aliens would soon adopt our sinful ways and would learn of God and sin and redemption

Downing is very hesitant to draw any conclusions from the poll though he notes that Catholics were more open to the notion of UFOs than Protestants A few Protestants on the other hand admitted to being closet science-fiction buffs

Downing remains concerned that lack of dialogue about UFOs could leave theology dangerously behind the times There is much more proof for the existence of UFOs he says than for the biblical stories that form the core of our Christian faith —Casey McCabe

' Going to church doesn t make you a Christian any more than going to a garage makes you an automobile
— W A Sunday

Senior fear

Would you expect senior citizens or college students to be more strongly convinced of the reality of ESP? To find out psychologists Jerome Tobacyk and Glenda Pritchett of Louisiana Tech University and Tom Mitchell of the University of Baltimore asked 71 retirees about their attitudes toward witchcraft superstition, spiritualism extraordinary life forms like Bigfoot traditional religion and ESP They then compared this group with an average age of sixty-eight to a group of undergrads

According to Tobacyk the elderly sample showed significantly less belief in psi witchcraft superstition spiritualism, extraordinary life, forms and precognition than did the college kids though in terms of traditional religious beliefs both youngsters and oldsters scored nearly the same

The paranormal differences Tobacyk believes were due to the increased media attention that many psi topics have received over the past 20 years 'Younger people are strongly influenced by mass media ' Tobacyk says A lot of paranormal topics are covered much more than they once were —Paul McCarthy

' It is when we try to grapple with another man s intimate need that we perceive how incomprehensible wavering and misty are the beings that share with us the sight of the stars and the warmth of the sun "
—Joseph Conrad

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ideas are there on that inner, unconscious consortium of the brain where scenarios of the future are written.

Omni: Were the early astronauts heroes?

Mailer: A hero is someone who's daring and yet capable of very disciplined behavior in relation to his daring. Some people are capable of being daring but have absolutely no concerted notion of why they're being daring other than knowing that it bears some relation to themselves. And narcissism, no matter how elevated in terms of daring, remains narcissism. In other words, if you're really doing it for yourself, you're not a hero, no matter how fantastic the feat. Evel Knievel was as daring as any man who's been in the media, but I wouldn't call him a hero as such. I would just say he was immensely daring. So yes, I think [the astronauts] were heroes. They were dedicated. They spent ten, fifteen, twenty years getting ready. Then they carried it off. And you know they were backing their philosophy with their lives.

Omni: Is there any point in going to Mars?

Mailer: That's a technical question I can't answer. It's all a matter of the state of the art and what the heat is on Mars and whether you could build a dome that would withstand the heat. If Mars is as barren as the moon, what's the sense of going to Mars? It's easier to heat a joint than to cool it.

Omni: While the first eight years of America's manned spaceflights had resulted in "some astounding triumphs," you wrote in *Fire*: "Errors had cropped up in the ultracomplex machine of the spaceship, among the astronauts in their space suits, and in the network of communications on the ground." So the astronauts were confronted by "spooky technological ventures into the vacuums of space knowing that malfunctions in their equipment were bound to appear." And you raised the question of whether machines have their own psychology, independent of what humans have told them to do, whether they have minds of their own. Are you any closer to an answer than you were twenty years ago?

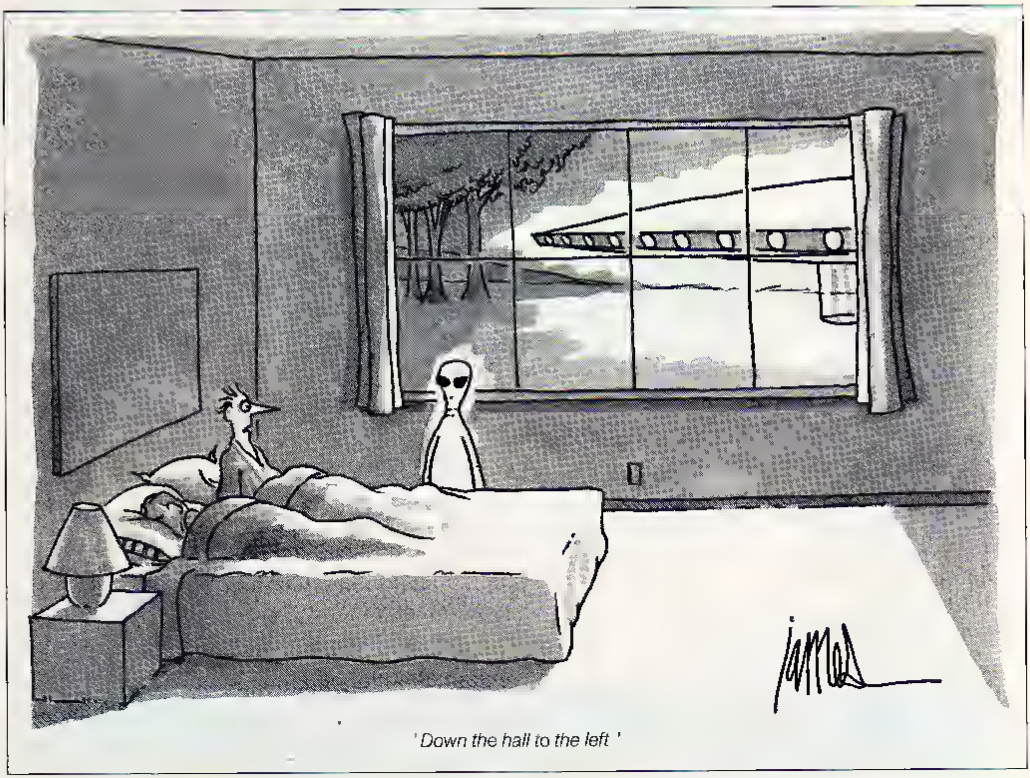
Mailer: I'm no closer, but I still think it's as delicate as could be. Like one tenth of one percent in one part in a thousand. But nonetheless, yes. Especially electronic machines. I think the closer you come to small particles, like electrons, being at the heart of the functioning of any machine, the closer you are to the psychology of machines. It yet remains to be proved whether the smallest particles we can find do not have free will. If they have, then obviously you're approaching the psychology of machines.

I wouldn't be very surprised if computers do begin to exhibit lives of their own, and I'll even give you a psychoelectromagnetic theory for it. The computer designers who are putting in the programs put so much thought into how the machine's going to work that some of that thought literally travels, like fine dust, into the very markings of the machine.

I remember talking to one guy at NASA in 1969 and asking him if a computer ever seemed to exhibit a life of its own. He allowed after a while that it was almost as if there were rogue circuits in their computers that the NASA guys had to chase and capture. It was almost as if the computer would do a few things on its own that they couldn't quite explain.

Omni: As you asked toward the end of *Fire*, "Was the voyage of Apollo 11 the noblest expression of a technological age or the best evidence of its utter insanity?"

Mailer: Both. Both. That's the answer I'd give today. And why not both? I believe that we really work on two systems, not one. We all do. We work on our good system and our evil system. And when we have a huge amount of energy, it's because we appeal to the best and the worst in ourselves. I think we were appealing to both in the space program—at least for those people who were in it and dedicated to it. ◻◻



'Down the hall to the left.'

FORUM

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tremendous speed at which objects must travel in orbit to resist the pull of gravity. It turned out, though, that absolute speeds were irrelevant: If two objects' relative velocities were close, then docking would be no problem.

With this problem resolved, President Kennedy chose LOR because it promised to get us to the moon the fastest. "Beat the Russians there," won out.

"Had we taken the Von Braun approach, there would have been a totally different space program today," says Robert Freitag, director of launch vehicles in the early Apollo program.

Von Braun's EOR assembly platforms could have provided the necessary push for developing a space station much earlier than the late Nineties, when it's now scheduled to be completed, Freitag says. The need to support such a station would have also accelerated shuttle development by a decade. "In effect," says Freitag, "we turned things upside down."

If we had chosen EOR we might not have built the Saturn 5, which became Apollo's rocket to the moon. The Saturn 1, with less than a tenth of the Saturn 5's payload capability, would have been our biggest rocket. Von Braun campaigned hard to get the money and support to develop the Saturn 1. He figured neither the political system nor the American public would support construction of an even bigger, more expensive rocket.

The Von Braun approach had a downside, though: It would have taken longer than lunar orbital rendezvous, allowing the Soviets to get to the moon first. The launch of *Sputnik* in 1957 really shook the United States. The supposedly technologically primitive Russians had done something we hadn't yet mastered: putting an object in orbit around the earth. That did more than injure our pride. *Sputnik* scared us. So JFK was determined to not risk losing the race to the moon.

The competition was close for a while. Twice the Soviets tried to launch moon-flight-capable rockets; each time the vehicles blew up, once on the ground and once with ignition of the second stage. Then, in 1969, the United States landed on the moon. Defeated, the Soviets closed down their own moon-landing program and turned toward developing a space station and achieving a long-duration human presence in orbit.

In 1969 nobody imagined that triumphant Apollo was fated to be a dead end. Dr. George Mueller, NASA associate administrator for manned spaceflight at the time of the lunar landings, recalls how different the future seemed then. "Vice-President Agnew headed a task force to study what to do in space after the lunar landings. The commission established an ambitious set of goals." The group recommended we build a space station, return to the moon, expand the planetary exploration program, and build a cheap, reliable space transportation system to make all that possible. It we'd done so, we would have people on the moon now, plus we'd have the basis for a Mars mission. But political events at home and abroad conspired against us. "Just as Agnew was proposing that plan to President Nixon, the Vietnam War was heating up," says Mueller. Then Agnew was forced to resign. The plan got lost in the shuffle and has been lost ever since.

In 1970 President Nixon announced that after the 1972 flight of Apollo 17 the moon landings would cease. "Our most crucial mistake was junking the whole Apollo–Saturn system and not continuing with *Skylab*," says space historian Walter McDougall of the University of Pennsylvania. "If we hadn't shut down the Saturn assembly line, we could have launched as many *Skylabs* as we wanted and we would have designed a shuttle compatible with *Skylab*. Instead, we're now building a space station compatible with the shuttle." Once again, it seems, we turned things upside down.

So Apollo ended, and Von Braun's glorious vision has languished. Von Braun and Bonestell depicted the future of the U.S. space program in one of the old *Collier's* paintings: a great wheel-shaped space station turning majestically in the background, surrounded by sunlit supply and cargo rockets with teams of space-suited workers preparing huge winged gliders for our first landing on Mars. A splendid vision to excite the mind and thrill the heart. Von Braun may be gone, but he still points the way. **DO**

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LUNAR

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accomplished what we did on Apollo 11. They'll orbit but not land. That was the most difficult and dangerous part of our mission because we had only so much fuel and no second chances. People may remember the most important thing as Neil Armstrong stepping down a ladder onto the surface. But once the LM touched down and the engine was shut off, it was a successful mission, whether we opened up the cabin and went down the ladder or not. After all, we'd gone EVA—outside the spacecraft [technically, extravehicular activity]—many times before. So for that reason I think Apollo 11 will continue to increase in significance as time goes on. But looking back on it, I'm not sure we obtained the full practical benefits from what we tried to do—that is, to elevate the prestige of American technology.

Alan Bean: A pinpoint landing on the Ocean of Storms, executed by mission commander Pete Conrad and lunar module pilot Bean during Apollo 12 (November 14 to 24, 1969), set the stage for future landings in difficult terrain. The accuracy of the targeting amazed rookie astronaut Bean, but what was even more astonishing was that the mission was completed at all. Every Apollo flight was characterized by unexpected problems, and Apollo 12 was certainly no exception. Since retiring from NASA in 1981, Bean has been putting his experience to unique use. A painter of spacescapes, his work has appeared in *Omni* (see this month's cover) and is in private collections.

"Fifty seconds after liftoff we were struck by lightning and lost our primary source of power. All of a sudden I was looking at more warning lights than I'd seen in all my years at NASA. We didn't know it was lightning—we only found out later—but we knew it was something bad. The affected systems belonged to me, and I had to try and figure out what to do while Pete [Conrad] read off the warning lights. Dick Gordon was uncharacteristically silent. During simulator training, when a failure occurred he'd usually be making suggestions about various options, and I was wishing he'd say something now, because I hadn't the slightest idea what to do. So I did nothing. If something goes wrong, a golden rule of flying is don't do anything drastic, because at least it's still flying. Pete said, 'Let's sit tight.' Then Houston suggested we reset the fuel cells, which restored our primary power. We were all right.

"Living in the command module was like camping out. To sleep I would float

The Artist

under the couch and glide into my sleeping bag. It was a little boring being in transit between the earth and the moon for two days, knowing how easily the machinery could fail and we could miss our chance to land. So we kept ourselves busy doing the thousand and one things you have to do to get ready, until finally we'd gone through everything. And that's when Pete says, 'We've got a lot of business coming up and we can't be stopping to take a crap.' So he told us to get that over with. At first Dick and I thought he was joking, but he says 'Al, you're first.' So I floated down into the lower equipment bay and got my little plastic bag. Then Dick went down, and then Pete. True to form, he'd never ask anybody to do what he wouldn't do himself. Trivial as it may seem, that attention to detail made Pete a great commander.

Nothing could have prepared me for standing on the moon. Being on its surface, with the earth out there, was so unbelievable. I had to keep telling myself that it was real, that this was the moon and I was two hundred forty thousand miles from Earth. That number kept running through my mind. There was a feeling of unreality about it. Now when I look at the moon at night, it seems even more unreal that we were able to get there at all."

Charles 'Pete' Conrad: Aboard Gemini 11 in 1966, Conrad and Richard Gordon set what was then a new altitude record of 850 miles above the earth. Three years later that breakthrough paled in comparison with the 240,000-mile journey that allowed Conrad, as mission commander, and lunar module pilot Alan Bean to become the third and fourth men to set foot on the moon. (The five-foot six-inch Conrad's comment at the time was 'Whoopee! That may have been a small one for Neil, but it's a long one for me.') As he recalls here, however, the complexities of their mission didn't end once they splashed down on Earth. Conrad is now staff vice-president in charge of international business development for McDonnell Douglas Corporation in St. Louis.

"Psychologically, perhaps the most difficult part of any lunar mission was liftoff from the moon because there was no manual control and if the engine didn't fire, you'd be stuck there. Al Bean and I had gotten up early on our last day to fix a problem in one of my suits and as a result we got ahead of schedule. We went through most of the lunar liftoff checklist, but some things had to be held until the very end. So we had to stop and that gave us some extra time to reflect on what would happen if anything went wrong. I could see that Al was getting nervous. I'd flown on Gemini and had been through those sorts of fidgy widgets during retrorocket firing. So we had a little discussion. I told Bean it was a little late to worry.

One of our assignments during our landing had been to pick up some parts from the *Surveyor* lunar probe that had gone out of commission on the surface near where we'd landed. One curious thing they later discovered was that it also contained a common bacteria that had gotten in there when it was built and had survived in space. Luckily for us there weren't any alien germs, though they did analyze our clothes and our persons to see if we'd brought any strange bugs back after we returned. Because NASA couldn't convince the surgeon general that we wouldn't bring back some *Andromeda Strain*-type organism like everyone on the first three moon landing crews, we had to spend twenty-one days in quarantine. We spent our first five days in an Airstream trailer, staring at the walls and out onto the hangar deck of the carrier that was taking us to the clean rooms in Houston. Nobody thought there was a real chance of lunar infestation, so it was sort of ridiculous. When Apollo 11 came back, the first thing they had to do was strip down and bundle up in germ-free suits and surgical masks. They were a little easier on us. We put on surgical masks but kept our flight clothing."

James Lovell: As command module pilot on Apollo 8, he circled the moon on Christmas Eve 1968, with Frank Borman and William Anders. Eighteen months later, as mission commander on Apollo 13 (April 11 to 17, 1970), his experience and presence of mind were put to the test after an oxygen tank explosion resulted in the worst U.S. accident in space prior to the *Challenger* disaster. He is currently executive vice-president of Centel, a Chicago-based telecommunications firm.

Airplane accidents are almost always a series of events—there isn't a single isolated cause but a combination of things going wrong—and this was the case on Apollo 13. The accident had been set up five years earlier by an engineering oversight. The heater system in the liquid oxygen [LOX] tanks, which runs on twenty-eight-volt DC power in flight, was modified to handle the sixty-five volt DC power that was available at the Kennedy Space Center, so that certain tests and checkout functions could be performed in a more timely fashion. But the heater's twenty-eight-volt thermostat was not replaced with one able to handle the higher voltage. The LOX system was a crucial component of any Apollo flight, as it provided the air we breathed and contributed to our fuel, our water, and our electricity as well. The thermostat problem would probably never have been noticed except that one of the two Apollo 13 tanks

was dropped at the factory and one originally scheduled for Apollo 10 was recycled. About six weeks before the launch, with the spacecraft already on the pad, this tank was filled with LOX and successfully tested, but the engineers couldn't remove the LOX in a normal fashion after the checkout and decided instead to boil out the oxygen by turning on the tank's heater for eight hours—much longer than the device had ever been run before. They didn't know that, in the process, the thermostat's contacts had become welded shut, so they could not open to cut off the power and control the tank's temperature.

"A bit more than two days out, as I was returning through the funnel to the CM [command module] after inspecting the LM, I heard the explosion of one of the oxygen tanks. The blast ruptured the second LOX tank as well. Red lights blinked on the warning panel, indicating that two of the three command module fuel cells, which use LOX to make electricity, had just died. Once inside the CM, I looked out the side window, and the gaseous substance I saw escaping at a high speed from the rear of the spacecraft confirmed my suspicions. Soon we would be completely out of oxygen. That would cause our third and last fuel cell to die. We would then lose all electrical power, and that would render our propulsion system useless, since we gimballed the rocket engine electrically.

"We decided to use the lunar module, *Aquarius*, as a lifeboat because it had its own oxygen supply and batteries. Though part of our training had been devoted to using the LM for things it wasn't intended for, we'd never prepared for anything like this. We had to develop procedures from scratch. We'd spent months perfecting emergency routines, all of which had to be scrapped. Mission Control had to rewrite the whole flight plan in a matter of hours.

"With our last fuel cell dying and the guidance system onboard the CM going as well, we had to rush to power up the guidance system of the LM and transfer all the data from the CM's computer into the LM's computer. Houston figured we had fifteen minutes worth of power left in the command module. This was before hand-held calculators were available, so I had to do all the calculations on paper. It was simple arithmetic, but with only one chance to get it right. I was double-checking everything. 'Is two and two really four?' *Ten minutes to go*. 'Is two and three really five?'

"Using simulators on the ground, a way was worked out to speed up our return by making two critical course corrections, the first as we approached the moon and the next as we came around the far side of the moon. After that we were to shut down and let Isaac Newton's laws of gravity take over until we got closer to home. Then we transferred back into the command module. We'd need its guidance system and heat shield for reentry. The heat shield might have been cracked or damaged by the accident, but that was a so-what consideration. There was nothing we could do about it.

"When we jettisoned the service module, we could see that one whole side of it had been blown away. Then we jettisoned the *Aquarius*. Of course, I was disappointed that we didn't land, but there was a great sense of achievement that we could overcome the sorts of obstacles we faced and could keep organized and rational. In the end the flight probably helped build confidence in Apollo, and you bet it assured the safety of the following missions. But looking back on it, probably my best memory was a few minutes before we hit the ocean, when I saw the chutes blossom open and knew for sure we'd be okay.

"People often ask why there wasn't some kind of contingency plan to launch a rescue vehicle in case of emergencies like this. But to do so would have taken too long. They also sometimes ask if we took along suicide pills. What was the point of that when all you had to do was open a valve to the outside?"

Fred Haise. His expertise as lunar module pilot on the ill-fated Apollo 13 mission was crucial in order to use the LM as a lifeboat for the return trip to Earth. He is now president of the Grumman space station division in Reston, Virginia.

"Basically, the moment of the accident was one of extreme disappointment—*period*—not fear. We were sure that we'd lost one oxygen tank in the mother ship and, according to NASA guidelines, that constituted an abort. The chance of landing on the moon was gone. It was now a failed mission.

"It took about fifteen minutes before we knew that the second tank was leaking, so it wasn't the sort of heart-in-throat you might feel in a car crash. Also the explosion wasn't so traumatic in space because of the vacuum, wherein there is no air or atmosphere to propagate pressure waves, acted as a fire extinguisher. Had we been in Earth atmosphere we would have been blown to smithereens.

"During those initial moments, all three of us were wrestling with the problems in the mother ship, and when we'd determined that it was functionally lost, our concern shifted to how to power up the LM. As far as I was concerned, there was never a point of feeling we'd reached the end of the road in terms of not having something else to try. We still had a good spacecraft in the LM, and that was like having a second car in the garage. Of course, the problem with the LM was that it was designed for two days, and we had to get it to run for four.

"During a lull period around the time of the first burn, which sent us around the moon, I did some grocery-store arithmetic on the back of a checklist. My concern was consumables, things with a limited supply, like electricity, water and oxygen. The way it looked, by conserving we'd have enough of everything except water—not drinking water, the water for cooling the spacecraft's electronic systems. But we knew from Apollo 11 data that even if the water ran out, it wouldn't result in an immediate critical loss of the equipment. Neil Armstrong had kept the systems running on the *Eagle* after he and Buzz Aldrin left it orbiting the moon in order to see just how long it would take for them to burn out. We figured we'd have an extra eight hours.

"At that point, when the first burn was done and we were heading around the moon on a course that roughly could get us back—and with some degree of awareness that the consumables would last—I felt we had a shot at reentry. But one thing I had forgotten on my grocery list were the lithium hydroxide cartridges we used to remove carbon dioxide from the air. In the command module the cartridges were square, and in the LM they were cylinder shaped. So they couldn't be interchanged. The ground figured out a way to use gaffer's tape, the stiff backs of our checklists, and the Plexiglas wrappers we used to store our extra clothing to jury-rig an adapter to connect the cartridges from the CM to the hose that circulated the air in the LM. Otherwise, we might have been poisoned by our own carbon dioxide.

"In order to save power we turned off much more of the equipment than the design could cater to, so there wasn't much heat being generated and the temperature inside the LM cooled down to about forty degrees. And because the water separator, which took the moisture out of the air, wasn't working as fast as it should have, and also because there were three of us breathing in a vehicle designed for two, moisture built up over the instruments and behind the nylon netting that covered the sides of the spacecraft. Because we were in zero g the moisture didn't just condense, as it would on a cold window, it formed globular balls ranging in size from marbles to tennis balls. When we finally got back inside the command module prior to reentry, it was also hung with water globules. As a result, when we hit the g forces of the upper atmosphere the larger drops broke up, the water in the panels fell out, and we had a little rain shower inside the capsule.

Stuart Roosa. The next Apollo flight, Apollo 14, was not launched for nearly a year while all the systems of the spacecraft were reviewed and Congress debated whether the costly moon program should continue at all, given the risk of another failure. When the flight finally took off on January 31, 1971, for a ten-day moon mission, success was imperative. The flight did achieve its main objective—restoring confidence in the lunar program. It was far from problem-free, however, as Apollo 14 command module pilot Roosa was to discover after leaving Earth orbit, and he was called on to perform the first critical docking maneuver. Roosa is now president and owner of Gulf Coast Coors Beer, located in Gulfport, Mississippi.

"Apollo 13 had been a near catastrophe, and there was a lot of pressure on us to get this one right. So what happened? First thing, the damn docking mechanism between the LM and the command module, which had been a problem right along, wouldn't work. Soon after we left Earth orbit, we were supposed to retrieve the LM. The two vehicles weren't directly attached in the Saturn 5 stack. The command module was at the top of the rocket, connected to the service module. The LM was in a separate compartment below that. It was attached to the rocket but not to us, so after we blew the bolts to the booster, we had to pitch over, turn around, and come back to get it. When we finished the maneuver, the LM should have been joined to the nose of the command module. The command module had a side probe, like a male plug. This plug had two sets of latches on it—capture latches to guide it into a funnel called a drogue on the lunar module—and a docking ring that clamped the two spacecrafts together. As command module pilot I was maneuvering the spacecraft after the burn to get the two vehicles together. But an electrical signal somewhere in the system wasn't registering, and the capture latches wouldn't hold. I tried it three or four times, then backed off and talked to Houston. Their advice was to open the electrical panel and cross the wires to take the capture latches out of the loop. It worked.

"Other than that, the tensest time for me was during reentry, when I was also in charge as CM pilot. Reentry was by far the most complex maneuver because there was no backup procedure, and you had to stay inside a two-degree window by rolling the vehicle. If you came in too shallow you would skip out like a stone and would be gone off around the sun. If you were too steep, you'd overheat the vehicle and burn up.

Alan Shepard. In February 1971, as mission commander of Apollo 14, Shepard became the fifth man on the moon, just ten years after becoming America's first man in space. The landing site was the crater-pocked Fra Mauro region, where Shepard and Edgar Mitchell, in addition to their other tasks, blasted deep rock samples with remote-controlled mines, then collected the fragments using NASA's new lunar rickshaw. Shepard, on his last moon walk, entertained television viewers by hitting golf balls in the low lunar gravity. A successful real-estate developer, he now resides in Houston.

"I never felt at the mercy of our technology. I felt at the mercy of the people who put it together. We had trouble getting down to the surface of the moon. There were two malfunctions—one with the onboard computer, the other with the landing radar—either of which could have ruined the mission. When I finally brought it down, it landed at a seven-degree angle, which wasn't in the flight plan and worried me, too. Ed Mitchell and I went out on EVA. We didn't have a lunar rover on our mission, so we were tired by the time we got back into the LM. We sealed it, pressurized, pulled the shades, and powered down to go to sleep. As commander, even on the moon I got the top bunk, but it was pretty uncomfortable.

sleeping. We'd popped off our helmets and gloves, but we were still in our suits, and the collar was cutting into my neck. We were just drifting off when there was this metallic clang, so loud the whole ship vibrated. All I could think was, *Damn! Isn't that just like the contractor to build something you can't land at an angle.* I was metabolizing adrenaline like crazy and thinking the module was going to pitch over and we wouldn't be able to take off. I turned to Ed Mitchell.

"Ed, you hear that?" I whispered.

"Yeah, I heard it."

And then we started laughing, because here we were, two grown men, sitting on the surface of the moon, completely alone. Why the hell were we whispering? It turned out that some vent had slammed open—nothing serious.

Edgar Mitchell: As lunar module pilot for Apollo 14, Mitchell occupied some spare moments of his in-flight rest periods with an ESP experiment. To see if the space environment would permit psi effects, he concentrated on random numbers and symbols at various times during his lunar voyage, while four individuals on the ground guessed the order. The results, says Mitchell, "far exceeded anything expected," but they were still only "moderately statistically significant." The outcome of the experiment, 20 to 1 greater than chance in one analysis.

Inspired by the experience of translunar flight and by a vision of the earth as a living organism, he went on to found the Institute of Noetic Sciences, a San Francisco-based organization promoting basic research into the nature of global consciousness. The institute funds a wide variety of different projects involving psychoimmunology, biofeedback and peak performance.

"I got some flak for doing an ESP experiment during our mission, mainly because it was perceived as being less than scientific but also because it sort of violated the image we were supposed to have. My motivation was to find out if psi worked at all, and in particular if it worked in space, and I wasn't the only one who did things like that. John Young brought a corned beef sandwich aboard a Gemini flight because he hated space food. Al Shepard hit a golf ball on the moon during one of our EVAs to see how far it would go, and I did my ESP experiment. The thing was, we were all independent people and not as conforming as NASA management would have liked. It was apparent throughout our training that, ideally, they wanted a black box flying the spacecraft. In fact, the early Mercury astronauts had to raise holy hell not to be just passengers.

"As it turned out, the human factor was crucial on almost all the Apollo flights. The Apollo spacecraft was not a smart machine by today's standards. Though the onboard computers were sophisticated for their time, they had only sixty-four K of memory, about the same as the most basic personal computer has today. And even if the equipment had been a generation more powerful, it was still part of a machine, and when machines fail, they can't fix themselves. It takes human intuition, creativity and on-site judgment to solve the sorts of problems that we faced on Apollo.

"While Al and I were in the process of landing, for example, the abort switch was triggered by a tiny ball of solder that was caught in the mechanism. Left to its own devices, the computers would have sent us back up, so we had to short-circuit that particular piece of logic with help from a team working simultaneously at MIT. Had it been an automated spacecraft, it never would have landed.

"It was frustrating that even as we were landing on the moon, the cost efficiency of manned space travel was being debated in Washington, with the result that Apollo 18, 19, and 20 were eventually scrapped. It was so shortsighted, not only because Apollo had been a landmark event in human history that gave us a totally different perspective on ourselves but because, in retrospect, an ongoing strong space program might have been able to help solve problems that were building up under us—things that are apparent now, like global warming and depletion of the ozone. But we were fighting a losing battle."

Alfred Worden: Apollo 15 (July 26 to August 7, 1971), on which Worden served as command module pilot, introduced the four-wheeled lunar rover to moon exploration and retrieved the 4.5 billion year-old "genesis rock," only to have the accomplishments overshadowed by a commercialization scandal. In the months that followed the completed mission it was reported that Worden and his flightmates, James Irwin and David Scott, had smuggled 398 unauthorized first-edition postage-stamp envelope covers to the moon. Issued by the post office before the day of launch and canceled on the day of the astronauts' return, 100 of these collector's items had been sold by a NASA subcontractor to a German dealer. An estimated $21,000 from the sale was put in trust for the education of the astronauts' children, but by the time the sale became public, all three Apollo 15 crewmen had opted out of the deal. When a NASA investigation turned up previous commercialization schemes carried out by unnamed Apollo astronauts, who had taken stamps, watches, and medals to the moon, a dark cloud was cast over the entire lunar program. Scott became a technical assistant for the remaining Apollo missions. Worden took a job at the NASA Ames Research Center. Irwin retired. Today Worden runs Alfred Worden, Inc., a North Palm Beach, Florida-based company that patents aviation emergency-warning systems.

"We had a relatively trouble-free flight and managed to accomplish a lot. My responsibilities included taking photographs of the moon from orbit, which were later used to map twenty-five percent of the lunar surface. I was also able to photograph a phenomenon that had never been recorded before: a primordial dust cloud called the Gegenschein, older than the earth or the moon, out at the edge of the solar system. I was alone in the command module while Dave Scott and Bill Irwin were down on the surface, and it was a very delicate, precise operation. It required a time exposure, and I had to hold the craft steady while I did it. Also, we were the first Apollo mission to use the lunar rover, which meant our range of exploration on the surface went from about five to twenty-five kilometers. As a result we were perhaps the most scientific flight of all the Apollo missions up until then. But the public was more interested in first-day covers than in science.

"The stamp episode was so trivial. We took some first-edition postage-stamp envelope covers along with us. These were postmarked prior to launch day and canceled aboard the aircraft carrier when we returned. The stamps weren't even that valuable. But NASA was under fire in the Senate, and they decided to make an example of us. We weren't vindicated for twelve years. After I sued on behalf of all the astronauts who'd had things confiscated, NASA returned the stamps and other materials without comment or objection, which was an implicit admission that they were wrong initially and no laws had been broken.

"Another problem was that in general the media had been fed too much of a false impression of us. We were presented as Boy Scouts, something we weren't. We were all just people with good points and bad points. Until then the public's perception had been that everything was pure and holy."

Charles Duke: The fifth successful moon landing began dramatically. As John Young, Apollo 16's mission commander, and lunar module pilot Duke were about to begin their descent to the surface, on April 18, 1972, an emergency in the command module nearly forced an early end to their mission. The crew's most notable achievements proved to be scientific. Duke and Young discovered ancient vol-

canic activity in the Descartes region confirming that the moon had been shaped by catastrophic events about 4 billion years ago. Duke is now a lecturer, businessman and retired brigadier general in the U.S. Air Force Reserve.

"About one hour before John Young and I were to touch down, we were flying in formation below the command module on the back side of the moon. Ken Mattingly, the CM pilot, was scheduled to change orbit prior to our descent to the surface, and while we were waiting to go, he reported that something was wrong and it felt like the command module was shaking to pieces. It was an anxious few minutes. We were out of communication with the ground, and we thought it was an abort situation—that we were going to have to use the LM to get us back home, like they did on Apollo 13. When we came around and got in touch with Houston again, they determined that the problem was in the secondary thrust vector control loop, as it was called in NASAese. The backup control system on the main engine was malfunctioning.

"As we circled the moon we could see our landing site and became increasingly frustrated as the hours elapsed. It took six hours in all to dig out the answer from some test data, which suggested that once the engine ignited, the shaking would stabilize. They were right, but it cut short our stay on the moon by a day.

"When John and I finally landed, we would hit the ground running. Our rock-sample collection went very well. An experiment to measure the heat flow from the interior of the moon by inserting a drill core down into the lunar surface went less well. John's foot got caught in the data cable and broke it.

"About the only other moment of danger I can remember on the mission was when John and I started fooling around for the television camera, saying that we were going to break the high-jump record. I took this big jump, lost control and fell over backward. It was the closest I ever came to panic, because I thought my suit might split open and it would be good-bye, Charlie.

"The rest of the flight was routine. As for the amenities, unquestionably the one piece of equipment I wish we could have had onboard was the waste-management system—the little potty they now have on the shuttle. Our food was carefully engineered to minimize things like gas, which causes a lot of discomfort in zero g, as well as other unpleasantries with three people in a small, enclosed environment. It was a low-residue diet but not a zero-residue diet, so we still had those problems. I remember John Young cussing about the orange drink making him fart—his way of breaking the tension. We also got a kick out of the fact that the backup crew had salted the flight plans with jokes and pinup pictures.

Ronald Evans As command module pilot on Apollo 17 (December 6 to 19, 1972), Evans set a record for lunar orbits—a total of 75 36 of them during the three days his crewmates Cernan and Harrison Schmitt completed the last lunar landing mission He now lectures and promotes a videocassette *Let's Fly to the Moon with Apollo Astronaut Ron Evans* He's president of Space Age America Inc

Ours was and probably should have been the cleanest Apollo mission About the biggest problem I had was that I lost my scissors To prepare your food you'd take your water gun squirt some water into the pouch through a nipple mash it up with your fingers then cut the plastic corner off Between the three of us there were sometimes twenty-five food bags for a meal that included your drinks salad soup main course dessert and coffee You'd have to cut so many of these little corners off that during training I sometimes wondered if I wasn't prepping to do circumcisions I liked space food Most of the guys lost about a pound a day on the Apollo missions I gained weight But you couldn't eat if you didn't have your scissors and Gene Cernan and Jack Schmitt said they were going to take both of theirs to the moon After some discussion Mission Control was of the opinion that they should leave one pair with me and they finally agreed Then they almost lost *their* scissors on the moon

"In general the greatest difficulties were trying to accomplish all the minor tasks—piddly-diddly things like changing the lens on a camera which turns out to be harder once you're in a space suit The suits were bulky and confining Every movement created pressure against the suit itself and in zero gravity it was like floating inside a flexible cast

As far as sleeping went the only thing I had to learn was to cross my arms so they wouldn't stick up in the air I can't say I had any trouble sleeping I once overslept while I was on watch and burned my finger turning off the alarm It had been on for an hour and was overheating '

Harrison Schmitt A geologist he was, as lunar module pilot on Apollo 17 the first civilian scientist to fly in space His on-the-spot expertise paid off with the discovery of the orange soil a rare sample of volcanic glass that provided key clues to the early development of the moon Schmitt has since served one term as a Republican senator from New Mexico and is presently a member of President Bush's government ethics panel and a national business and technical consultant based in Albuquerque New Mexico

Certainly there was a sense of sadness and disappointment that ours was the last lunar mission There were various NASA proposals on the boards for additional Apollo missions to build space laboratories and semipermanent bases on the moon Instead the Nixon administration with the acquiescence of Congress decided to do nothing more There were even rumors that Nixon had decided against the manned space program altogether until James Fletcher persuaded him to build the shuttle Even then it was apparent that the levels of funding for the shuttle were insufficient to minimize the risks as ultimately became clear sixteen years later [after the tight shuttle budget resulted in the use of solid boosters instead of an all-liquid fuel design] All these decisions had been made by the time of Apollo 17 It was clear that the press and the President had lost interest

Of course, they were wrong As a geologist I viewed Apollo as a remarkable scientific accomplishment Not only did those moon rocks and our other experiments enable us to gain an unprecedented first-order understanding of the surface and interior of another planet but new insights into the history of the earth as well Because the earth and the moon evolved roughly in parallel until about three and a half billion years ago—when the moon started dying and life began evolving on Earth—the moon provided an extraordinary scientific control for learning about the primitive conditions out of which life on Earth arose

'Also the practical benefits of a lunar program are real For instance we now know that the moon is capable of supplying at least one important energy resource helium 3, a rare isotope of helium which could be an ideal fuel for fusion reactors because it produces no long-lived radioactive waste and very little short-lived waste One metric ton of helium 3 could provide the energy equivalent of two billion dollars worth of coal and on the upper surface materials of the moon helium 3 is found in significant quantities There are no technical barriers to constructing mines on the moon It's just that it would take vision to get things started again and that vision is lacking now

'That's what made it ironic and a little naive that the motto of Apollo 17 was The end of the beginning It was supposed to initiate the post-Apollo phase of the American space program Instead we made a de facto decision not to pursue the next great adventures in space

SETTING SOME STUFF RIGHT

No story of the Apollo era would be complete without reference to the fatal fire aboard Apollo 1 *Omni* asked Deke Slayton NASA's chief astronaut at the time of the tragedy to reflect on the importance of the mission—and the men who made the supreme sacrifice

'From the perspective of its relative contribution to the success of the total Apollo program I believe the failure of Apollo 1 in a fatal launchpad fire in January 1967 ranks above any other factor Everyone was on a very tight schedule trying to meet President Kennedy's goal of a successful lunar landing by the end of the Sixties Until then we were trying to cope with training and hardware problems, fixing things on the fly while holding to the schedule at the same time

'Typical of these issues The crew access hatch on the Apollo craft opened inward and took the help of the pad crew to open The decision was made to fly Apollo 1 as it was and change the hatch to open outward for later flights When fire erupted the internal cabin pressure increase made it impossible to open the hatch inward—especially by men becoming rapidly incapacitated from the exhaust products of the blaze

'Although the ultimate cause—large quantities of flammable material confined in a cabin filled with one hundred percent oxygen at sea-level pressure—has been clearly defined, the record still needs to be set straight concerning another part of the Apollo 1 tragedy The crew of Apollo 1 was assigned as part of an overall plan running from the start of Gemini through a successful lunar landing In parallel with the resolution of operational problems related to Apollo—such as rendezvous and long-duration flight—I used Gemini as a crew training and development program Contrary to the lousy image created of Gus Grissom in *The Right Stuff*, he was one of our top-notch engineering test pilots and I had complete confidence in him Subsequent to his Mercury flight he worked full-time with the Gemini program office and was largely responsible for the cockpit design and crew interface into the systems operations This made him the natural choice to fly the first Gemini flight which was an outstanding success At that point we put him to work on the Apollo program with exactly the same idea in mind—and at the appropriate time we announced that he would be the commander of the first Apollo

"Ed White was a strong capable Air Force officer who had flown on the second Gemini flight and performed this country's first extravehicular activities He participated heavily in the early Apollo development and was a natural choice for the first flight Roger Chaffee was a bright young Navy pilot with no previous spaceflights but we wanted him to get experience for the future

"None of us in the flight test business like to think you sacrifice in vain, and the crew and families of Apollo 1 can rest in peace with the knowledge that the success of one of the greatest technological achievements of this century—and probably many centuries to come—rests on their shoulders

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Timely face-lifts for clocks, and a hands-on quiz to set your mind ticking

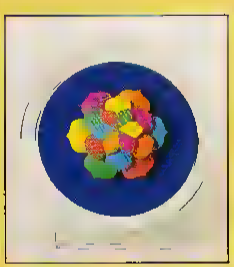
GAMES

By Scot Morris

Time, it is said, is nature's way of making sure that everything doesn't happen at once. Clocks are people's way of keeping track of time. We now have clocks that speak the time or project it on the ceiling. There are water-powered clocks, world-time clocks, solar clocks, and baseball-shaped alarm clocks that shut off when you throw them against the wall. This month's column shows some unusual clocks and unusual aspects of time.

Just in time for this issue comes the Galilea moon-phase clock (facing page). Commemorating the first moon landing, the clock's inscription details this unforgettable moment. A full moon sits on top of the clock with a molded black hemisphere circling it once every 29.5 days, giving a visual representation of the exact phase of the moon. At the base of the clock is a month and day indicator that revolves only once a year. (**Question 1:** In which direction does the hemisphere rotate, clockwise or counterclockwise? Will the lunar disc in the photo be more full or less full tomorrow? Hint: The Galilea is made in France. Answers are at the end of the column.)

Another clock that keeps track of nature's movements is the tide clock (above, right). This timepiece is geared to a 12-hour, 25-minute cycle. On the right side the numbers indicate hours until low tide, on the left side they show hours until high tide.



Some novelty clocks play with numbers on their faces, like one that has the numerals in mixed order (so you can let it be any time) or another that has replaced all the numbers with 5's (so that it's always happy hour).

Most people are so familiar with timekeeping that it doesn't matter if a clock lacks numbers. Some clocks don't even have faces, like the one on my office wall. You can tell the time as long as the clock is right side up. When you look at the clock, all you see are two suspended hands.

Another unusual set of hands is on the flower clock atop this column. Each flower has red, green, yellow, violet, orange, and blue petals. The time in the photo reads 3:00:45.

(**Question 2:** How do I know that, and why has this timepiece sometimes been referred to as a psychiatrist's clock?)

The clock above has broken away from the tradition of a flat surface. It is touted as the world's first three-dimensional clock that can be read from any angle. It has a fixed black cylinder imprinted all around with the hours in large white type and the minutes in smaller type. The "hands" are two continuous spirals of nickel-coated brass, one thick (the hour hand) and one thin (the minute hand). You can also read the time on circular analog clock faces on either the top or the bottom. (**Question 3A:** What is unusual about the clock face on the bottom? **B:** What time does the clock in the picture indicate? **C:** This "Omniclock" is made in London. It is often assumed that a more famous clock in that city is Big Ben, which isn't true. Why?)

TIME FOR A CHANGE

People who complain that there aren't enough hours in the day will be delighted with the new 25-hour clock at top, left, invented and patented by Dallas realtor Morton Rachofsky. The mechanism runs 1.041666 times faster than a normal clock, making each "hour" only 57.6 minutes. It shaves 2.4 seconds off each minute—hardly enough to notice. At the end of the day the stolen time adds up to one extra 57.6-minute "hour." Presto! a 25-hour day!

Rachofsky got the idea after reading research showing that when humans are kept in isolation—with no time markers, like clocks, radios, or daylight—they adopt a sleep-wake cycle of about 25 hours, waking up an hour later each day. This is why it is easier to lengthen our days than to shorten them and why we generally feel fine after a plane flight westward across two or three time zones but are exhausted after flying the same distance eastward.

PUZZLE TIME

Take the time to answer these clock questions.

There's no time limit

4. In a world of digital timekeeping *clockwise* and *counterclockwise* could become meaningless words. We may soon need new words to distinguish those two kinds of rotation (*antibaseballwise* and *baseballwise*?), and we solicit readers' suggestions. Question: Clock hands could go either way. Why do they all go 'clockwise'?

5. When does 12:00 PM occur?

6. Two cars are traveling along the same road in the same direction. The one in front is going 55 mph, the one in back 61 mph. They are 50 miles apart. If they continue at these rates, there will be a collision. How far apart will the cars be one hour before they collide? What will be the distance between them exactly one minute before the crash? (This is a lot easier than it sounds.)

7. Ann, Fran, and Jan go to the tanning parlor and each wants to spend 20 minutes in the tanning booth. The booth can hold one or two people, but it rents by the minute. How should they schedule their sessions most efficiently?

8. When will the twenty-first century begin: at midnight on December 31, 1999, or at 12:00:01 A.M. on January 1, 2000?

9. TIME FLIES LIKE AN ARROW. What's the second line of this college graffito?

CORRECTION

In last month's column Shigeo Takagi's name was misspelled. Our apologies!

ANSWERS

1. The moon-phase hemisphere rotates clockwise. The moon in the photograph is waning and will be less full tomorrow. The fact that the clock is from France is not immaterial. In the Northern Hemisphere the crescent of a new moon is curved on the right side (like the curve in the letter *D*). On a waning moon the circular part is more on the left (like the letter *C*). A memory aid for the phases of the moon is *DOC*, with *O* standing for the full moon, but this works only north of the equator. In the south the mnemonic is *COD*, and if the Galilea had been made in Australia the moon-phase hand might have been geared to turn counterclockwise.

2. To tell the time on this clock you must pay attention to the yellow petals. A psychiatrist can glance at this colorful flower without the patient knowing that he or she is checking to see how much time is left in the fifty-minute hour.

3A. The numbers on the face of the bottom of the clock read counterclockwise. **B.** 4:40. **C.** *Big Ben* is the name given to the 13-ton bell in the tower at Parliament, not the clock.

4. The 'clockwise" direction mimics the way a sundial's shadow moves during the day, as seen in Europe, where sundials were invented. If sundials had been invented in Sydney, clock hands would move the opposite way.

5. Never. The letters PM stand for *post meridiem* (after noon). Midnight isn't PM or A.M.; it is the dividing time between them. Strictly speaking, *12:00 PM* and *12:00 A.M.* are meaningless.

6. You may solve this with algebra, but there's an easier way if you just imagine running the scene backward in time. The cars are converging at 6 mph. If the movie were reversed from the instant of the crash, the cars would be separating at 6 mph, so they would be six miles apart in one hour. One minute from the crash they would be one tenth of a mile apart. Note that the starting positions of the cars are immaterial. The answer is the same no matter how far apart they were at the start.

7. Ann and Fran take the booth for ten minutes. Then Fran steps out and Jan steps in. After 20 minutes Ann is finished. She steps out and Fran goes back in to get her last ten minutes. All three are done in 30 minutes.

8. The twenty-first century will not start at either time but a year later—on January 1, 2001. The first century started with the year 1 (there was no year 0) and ended on the last day of the year 100. The second century began at the start of 101 and went through the year 200. Similarly, the last year of this century will be 2000. We don't plan to interrupt the celebration in Times Square on December 31, 1999, however. There's a time to be scientific and precise and a time to party.

9. FRUIT FLIES LIKE A BANANA.

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GAMES

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ANSWERS

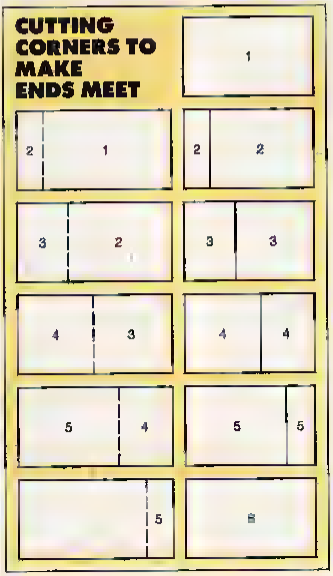
In last month's column, the 'Vanishing Leprechaun" a rectangular card illustrated with leprechauns is cut into three pieces. When the sections are arranged one way, there are 15 leprechauns, but when two pieces are switched and reassembled, there are only 14. Which leprechaun vanishes? If you focus your attention on any one figure, you are sure to be wrong because all parts of the three-piece puzzle are always visible.

In fact, once the original 15 leprechauns are cut in two, they *all* vanish. When their parts are reassembled, with each top joining a different bottom, they become 14 new leprechauns, one-fourteenth larger, on average, than in the 15-leprechaun arrangement. The area taken up by the missing "old" leprechaun is distributed to each of the 14 new ones! (Similarly, in Shigeo Takagi's "Count the Candles" variation, the candles are largest when seven candles are visible, smallest when there are nine.)

The puzzle can be reversed: Start with the 14-leprechaun arrangement, then shift to 15. Which leprechaun was created? None of them, of course. All 15 are new.

An old and foolish counterfeiting technique is behind these puzzles. To illustrate, start with five genuine dollars and imagine slicing each in two along the dotted vertical lines, as shown below, left. Shift all the left-side pieces down one place. Where once there were five bills, now there are six. This is one of the most tedious ways we have ever heard of to make a dishonest buck!

CUTTING CORNERS TO MAKE ENDS MEET



INTERVIEW

CONTINUED FROM PAGE 67

Omni: What role do clouds play in shaping climate?

Suomi: When you look at the ocean from space, it's really black. Its albedo is about four percent. So almost all sunlight hitting the ocean enters and heats it up. If low clouds cover the ocean, the albedo changes to maybe fifty percent! So clouds act like shutters, profoundly affecting the amount of solar energy reaching the surface. The very high, thin clouds out there today don't reflect back much energy to space. When you look at them in the infrared [heat-detecting cameras], they stick out like a sore thumb. So they are keeping energy from escaping. Here's something else. Convective [rain] clouds represent a pipeline from the lower to the upper atmosphere. We call these hot towers. They carry significant quantities of heat upward, but they cover only one percent of the earth, occurring in little chimneys a few kilometers apart.

Omni: Is there any theoretical basis for modeling climate?

Suomi: Jerome Namias at the Scripps Institute of Oceanography, a teacher of mine, invented the term *teleconnections*. His theory was that if there were a variation in one part of the earth, you'd get one in another. Midlatitude temperature of the Pacific, for example, should relate to the climate in the United States. I said, 'Jerome, who are you trying to kid?' Then along came the 1982 El Nino. It was so big, Earth was like a pinball machine that went tilt! After that, everybody and his brother found teleconnections in different parts of the world.

Another example: Radiation measurements from space reveal strong heat sources on Earth. If it's raining like mad, this releases heat into the atmosphere. Same thing over the Himalayas. In summer, with the sun on them, the high mountains act like a heat source. In winter they're cold and act like a heat sink. Other heat sources over Brazil, the Indian Ocean, and so on change global circulation, the monsoons and many other things are affected. If we had a way to evaluate these heat sources, we could put them in a model.

Omni: Would you describe what you call the water problem?

Suomi: Over the years, I've measured the winds on the planets by tracking the clouds. About a year ago I ranked planets according to how much solar energy they got, not counting Mercury, with no atmosphere. Amazingly, Earth gets the most solar energy but also has the lowest winds. The winds ought to be blowing like mad on this planet! But the water acts like a thermal short circuit. The water is crucial to our atmosphere and climate.

The ocean can store gobs of heat; it's a huge storage tank for heat. The upper part of the soil gets hot or cold, but below a meter or two it doesn't change much. But the ocean has an upper mixed layer that heats up and gets stirred by the winds. At many places it's several hundred meters deep. And the heat capacity of water is very high.

The ocean would get hotter and hotter if the surface did not evaporate thousands of tons of water per square kilometer. Later, when it rains, water changes from a gas to a liquid, and that releases a lot of heat. The heat changes the circulation of the atmosphere. We don't even know how much it *rains* over the ocean. The interaction between the atmosphere and ocean is so strong we can't ignore it. It takes data to get this information.

By 1995 many of the gadgets we need for these observations will be flying. And there's a new experiment proposed by a group of Americans and Japanese: the tropical rainfall measuring mission. Holy cats, if that thing were to go, it would be beautiful! We'd put microwave radar in low Earth orbit to look at half the planet. It could tell you what a cloud looks like, how hard it's raining, and from what altitude the rain is coming. People are perfectly willing to build it, but we have to convince NASA leadership.

Omni: You've served on one of NASA's space station panels. What capabilities will it give meteorologists?

Suomi: To say there are competing interests trying to get their hardware on the station is an understatement. Meteorologists want instruments on the space station to observe the big unknowns of the tropics. The tropics are half of Earth, and there is so much energy there that leaks to higher latitudes. We make occultation measurements [of atmospheric density by height] on the other planets, so why not do it for Earth? With the space station we could measure winds and temperatures on the ocean surface, winds high up, the structure of the atmosphere, and the distribution of moisture.

Omni: People love to complain about the weather forecast.

Suomi: If someone gets rained on in a thunderstorm, they squawk, "The forecast was wrong." But our ability to predict where a thunderstorm is going to be in a few days is zero because it's small-scale. We do pretty well on the planetary scale—with extended snow or drought, a big storm. We are getting excellent forecasts to three days, good ones to six, and useful ones to ten. That's pretty good since the theoretical limit to forecasting is probably two weeks.

Omni: Do you have a weather forecast for tomorrow?

Suomi: Me? No way! When I went to Washington to get the National Science Award, President Carter whispered in my ear, 'When is it going to snow?' It was late November. I thought about it and said, 'Soon.' Observe what's out there, yes, but forecasting, I don't do. ☐

SHOOT

CONTINUED FROM PAGE 70

grudge him that. He was media, too. That was the way things were with them both, and that was why she had deliberately left the channel unlocked. Besides, he was new, fresh out of journalism school. He still had some things to learn.

"Just the annual visit," she told him, bouncing down onto the desk and then to the floor. 'Once a year the committee picks representatives from two different governments they feel need a special briefing.' She never bounced for dirtside visitors because they never seemed to take her seriously if she did. She bounded along, pushing off with her hands, out into the reception area.

"Only two?" he asked, walking after her carefully. He'd adjusted to being on the moon, but more than once he'd trod on her hand by accident. She didn't hold that against him.

'Two seems to do it every time," she said, pushing herself up to a handhold near the elevator.

"Where were they from?"

She shrugged. "I don't remember. They all sound the same."

"But what about the third country, the one they wanted to fight over? Maybe there really are terrible problems—"

"There are. There always are terrible problems. We've got film crews in there sending footage all over—real footage, no distortions—around the clock. That's the best we can do: exposing them. We can't make them *all* behave. But we can keep them from blowing it all up. As long as they don't blow it all up, there's a chance things will straighten out down there. But it's got to still *be* there."

"Do you think this is right?" Di-Benedetto asked seriously.

He was *very* young, she thought, smiling at him and pulled herself up higher on the handhold. "No. But it's as right as we've been able to get it. So far."

"Yeah, but—" he shrugged. "The dishonesty, the distortion of the facts—"

"What do you think *they* were doing, giving me all that bullshit in the office? They got only what they gave. They wanted to play games with the truth, and they found out we're better at it than they are. Game over."

DiBenedetto's troubled look deepened. "I don't know. We're *forcing* them. It's like they're hostages."

"We're hostages. Just because we're on the moon doesn't mean we're not still part of the world. Because *our* continued existence depends on *their* continued existence. If we've got them, they've got us, too." She leaned in toward him, as if to tell him a particularly juicy secret. "Even if they didn't, I'd miss the world if they blew it up, pal. My legs are down there."

The elevator came and she bounced into it. ☐

LUNAR TIMEKEEPER

The new Tranquillity calendar will make it easier to study comets, pay bills, interpret history, and track time

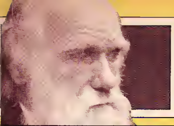
BY JEFF SIGGINS

Are you tired of that same old calendar, with 12 months of unequal length, and dates that always fall on different days? Do you forget lunch dates, closing days for real estate deals, or deadlines for IRA rollovers? When plotting graphs in your fruit fly experiment, do you ever get confused? Do you wonder why that same vile mood hits on the fifth of one month and the fifteenth of the next?

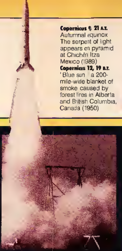
If these problems are yours, you are probably ready for the next step in time accounting, the Tranquillity calendar, designed for a perfection-seeking society, especially the men and women of science. Inspired by the Apollo 11 manned mission to the moon and developed for *Omni*, the Tranquillity calendar will ease the complexity of scientific calculation, help astronomers fathom the movements of heavenly spheres, and facilitate high-stakes business. It will also aid

Archimedes 3, 21 A.T. Beginning of the Perseid meteor showers (1989)
Archimedes 5, 10 A.T. Louise Brown (left), first test-tube baby, is born (1978)
Archimedes 9, 11 B.T. NASA established and funded by Congress (1958)
Archimedes 18, 18 B.T. *Explorer VI* transmits first picture of Earth from space (1959)

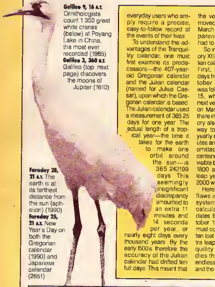
Archimndes 23, 16 B.T. USSR explodas its first hydrogen bomb (1953)
Archimedes 28, 21 A.T. Lunar eclipse (1989)
Brahe 3, 9 A.T. [illegible] of *Voyager 2*, spacecraft for planetary exploration (1977)
Brahe 7, 1890 B.T. Pliny the Elder dies in eruption of Vesuvius at Pompeii (A.D. 79)



Brahe 14, 21 A.T. Partial solar eclipse (1989)
Brahe 17, 8 A.T. *Viking 2* lands near polar cap of Mars sends photos to Earth (1976)
Brnhe 19, 112 B.T. Charles Darwin (left) in a letter to American botanist Asa Gray propounds the law of avolution of species by means of natural selection (1857)
Brnhe 23, 14 A.T. First privately owned rocket launched by Space Services, Inc., of the USA (1982)
Brnhe 28, 16 A.T. First solo balloon flight across the Atlantic Ocean embarks from Maine, arrives 86 hours later (1984)



Copernicus 9, 21 A.T. Autumnal equinox The serpent of light appears on pyramid at Chichén Itza Mexico (1989)
Copernicus 12, 19 B.T. 'Blue sun' a 200-mile-wide blanket of smoke caused by forest fires in Alberta and British Columbia, Canada (1950)



Galileo 9, 16 A.T. Ornithologists count 1 350 great white cranas (below) at Poyang Lake in China, tha most ever recordad (1985)
Galileo 3, 360 B.T. Galileo (top next page) discovers the moons of Jupiter (1610)

Faraday 28, 21 A.T. The earth is at its farthest distance from the sun (aphelion) (1990)
Faraday 25, 21 A.T. New Year's Day on both the Gregorian calendar (1990) and Japanese calendar (2651)

everyday users who simply require a precise, easy-to-follow record of the events of their livas

To understand the advantages of the Tranquillity calandar, one must first examine its predecessors—the 407-year-old Gregorian calendar and the Julian calendar (named for Julius Caesar), upon which the Gregorian calendar is based The Julian calendar used a measurement of 365 25 days for one year The actual length of a tropical year—the time it takes for the earth to make one orbit around the sun—is 365 242199 days This seemingly insignificant discrepancy amounted to an extra 11 minutes and 14 seconds per year or nearly eight days every thousand years By the early 1500s therefore the accuracy of the Julian calendar had drifted ten full days This meant that the vernal equinox had moved from March 21 to March 31 It became apparent that something had to be done

So in 1582 Pope Gregory XIII amended the Julian calendar in two ways First, he removed ten days from that year's October Thus October 4 was followed by October 15, which caused the next vernal equinox to fall on March 21 To keep it there in perpetuity, Gregory also came up with a way to account for the yearly runover of 11 minutes and 14 seconds He omittad leap day in all centennial years not divisible by 400 Thus 1700 1800 and 1900 were not leap years, but the year 2000 will be

Herein lies one of the flaws in the Gregorian system When making calculations involving dates that precede October 15, A.D. 1582, one must compensate for the ten lost days and the extra leap days The Tranquility calendar remedies this by stretching endlessly into the future and the past without hav

ARCHIMEDES

F	S	S	M	T	W	T
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BRAHE

F	S	S	M	T	W	T
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COPERNICUS

F	S	S	M	T	W	T
1	2	3	4	5	6	7
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DARWIN

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EINSTEIN

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FARADAY

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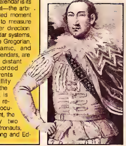
ing to make a sudden jump from one timekeeping system to the next

Another problem with the Gregorian calendar is that it retained the Julian calendar's months—12 of them, many with varied lengths The Tranquillity calendar uses a format of 13 months, each with 28 days (four seven-day weeks), for a total of 364 days One extra day is added on at the end of the year to make 365 For leap years, a second extra day is added

Imagine how easy all this will make life for computer programmers, experimental biologists, and nuclear physicists, all of whom rely on precise schedules to conduct their intricate work Also imagine how the Tranquillity calendar will affect the lions of industry If the first of every month is a Friday and the eleventh a Monday, week in and week out for the entire year, then billings, paychecks, and meetings will be far easier to execute, distribute, or plan As for women, most have a 28-day menstrual cycle A calendar with 28-day months would therefore make it easier to keep track of their monthly cycle as well as other biological rhythms resulting from it Men studying the Tranquillity calendar may find they have some sort of monthly rhythms as well

Thanks to our unique base point, moreover, our calendar will aid astronomers and students of ancient history who mark eras by celestial events Indeed, a prime component of any calendar is its starting point—the arbitrarily selected moment from which to measure time in either direction Many calendar systems, including the Gregorian, Judaic Islamic, and Buddhist calendars, are based on distant vaguely recorded religious events The Tranquillity calendar, on the other hand, is based on a recent, well-documented avent, the landing by two American astronauts, Neil Armstrong and Ed-

Copernicus 15, 20 A.T. Shuttle *Discovery* (above) launched, first manned U S craft since the *Challenger* (1988)
Copernicus 16, 21 A.T. First day of year 5750 on the Judaic calendar (1989)
Copnrnicus 20, 12 B.T. *Sputnik 1*, first successful man-made satellite, is launched by USSR (1957)
Copernicus 25, 302 B.T. Antonie van Leeuwenhoek announces discovery of microorganisms (1667)
Copernicus 28, 477 B.T. Christopher Columbus (below) lands in the Bahamas (1492)



Faraday 18, 66 B.T. The first airplane flight (left) by Orville and Wilbur Wright Kitty Hawk North Carolina (1903)
Faraday 14, 21 A.T. Winter solstice (1989)
Faraday 17, 6 A.T. The discovery of Lucy, fossil remains of an early female hominid, in Ethiopia (1974)

Fareday 4, 125 B.T. Anasthesia used for first time to perform a dental extraction (1844)
Farnday 5, 22 B.T. John Bardeen Walter Brattain, and William Shockley invent the transistor (1947)

Einstein 1, 18 B.T. The first coast-to-coast direct-dial telephone service begins, Englewood, New Jersey (1951)
Einstein 3, 12 A.T. *Voyager 1* nears Saturn, photos reveal threa new moons (1980)
Einstein 8, 3 B.T. Tha densest metaor shower ever recorded (1966)
Einstein 13, 63 B.T. SOS is adopted as the international distress call (1906)
Einstein 15, 110 B.T. Charles Darwin's *The Origin of Species* is published (1859)
Einstein 28, 23 B.T. Percy Spencer patents the microwave oven (1946)

Darwin 23, 47 B.T. Archaeologist Howard Carter discovers the tomb of King Tut (left) at Luxor Egypt (1922)
Darwin 28, 25 A.T. The next transit of the planet Mercury across the face of the sun (1993)

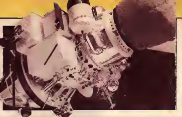
Darwin 10, 172 B.T. The first recorded parachute descent, from a balloon (1797)
Darwin 15, 10 B.T. The Soviet Union releases the first pictures of the far side of the moon, taken by *Lunik 3* (left) (1959)
Darwin 22, 12 B.T. Laika, a Russian dog, becomes the first "higher" animal in space (1957)

Darwin 2, 22 B.T. USAF Captain Charles Yeager (left) becomes the first human to fly faster than tha spead of sound (1947)
Darwin 4, 123 B.T. First public operation using ether as an anesthetic is performed at Massachusetts General Hospital (1846)
Darwin 9, 90 B.T. Thomas Edison invents incandescent electric lamp (1879)

Galileo 19, 158 B.T. Earthquake changes course of the Mississippi River (1812)
Galileo 22, 21 A.T. Annular eclipse of the sun (1990)
Galileo 23, 3 B.T. Apollo 1 fire kills U S astronauts Gus Grissom, Ed White, and Roger Chaffee (1967)
Galileo 24, 17 A.T. The space shuttle *Challenger* (right) explodes, killing seven American astronauts (1986)

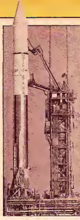
Galileo 27, 12 B.T. *Explorer 1*, the first U S satellite, is launched (1958)
Hippocrates 2, 4 B.T. Soviet *Luna* 9 (top, center) makes first successful soft landing on the moon (1966)
Hippocrates 2, 15 A.T. Two U S astronauts become first humans to fly untethered in space (1984)
Hippocrates 7, 21 A.T. Total lunar eclipse (1990)

Hippocrates 12, 388 B.T. Pope Gregory corrects the Julian calendar (1582)
Hippocrates 16, 370 B.T. Italian philosopher Giordano Bruno is burned at the stake for his heliocentric views (1600)
Hippocrates 17, 40 B.T. The planet Pluto is discovered by Clyde Tombaugh (1930)
Hippocrates 19, 8 B.T. John Glenn (right), aboard the *Friendship 7*, becomes the first American to orbit Earth (1962)
Hippocrates 26, 38 B.T. Sir James Chadwick of Great Britain announces the discovery of the neutron (1932)

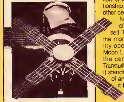


Imhotep 1, 3 A.T. The launch of *Pioneer 10* (far right) first known Earth object to leave solar system (1972)
Imhotep 5, 189 B.T. Sir William Herschel (below right) discovers Uranus (1781)
Imhotep 14, 2013 B.T. The Ides of March the day that Julius Caesar died (44 B C)

Imhotep 15, 44 B.T. Robert Goddard launches the first successful liquid-fuel rocket (1926)
Imhotep 18, 12 B.T. The U S Congress authorizes conversion to standard time zones and daylight saving time (1918)
Imhotep 19, 21 A.T. Vernal equinox Serpent of light appears on the pyramid at Chichen Itza Mexico (1990)



Mendel 25, 25 B.T. First atomic bomb is detonated Trinity Site, New Mexico (1945)
Mendel 22, 8 B.T. First transatlantic conversation using communications satellite (1962)
Mendel 20, 10 A.T. *Skylab* (below) falls to Earth (1979)
Mendel 15, 83 B.T. Louis Pasteur inoculates a boy with antirabies serum (1887)
Mendel 9, 62 B.T. Mysterious explosion devastates a huge forest in Tunguska, Siberia (1908)



Mendel 4, 13 B.T. CBS broadcasts first commercial color TV program (1957)
Mendel 3, 23 B.T. First reported UFO sighting using the term *flying saucers* (1947)
Lavoisier 28, 21 A.T. Summer solstice, longest day of year, Northern Hemisphere (1990)

win "Buzz" Aldrin, on the moon Upon touchdown came those almost mystical words "Houston Tranquillity Base here The *Eagle* has landed " *Omni*'s Tranquillity calendar starts at the very instant the word *Tranquillity* was uttered As one of the most astronomically analyzed moments in scientific history, our base point can be used to chart the exact position of the earth in relationship to the moon and other celestial bodies

Now for the details of the calendar itself The day on which the moment of Tranquillity occurred is called Moon Landing Day It is the central day of the Tranquillity calendar and it stands alone Not part of any month or year, it has 20 hours, 18 minutes, and 1 2 seconds Before Tranquillity (B T) and 3 hours 41 minutes, and 58 8 seconds After Tranquillity (A T) The Gregorian equivalent of Moon Landing Day is July 20, A D 1969

Because the Tranquillity calendar is a calendar for science, the 13 months are named after scientists For the record, here are the 13 outstanding individuals who've lent their names to our calendar Archimedes (circa 287 to 212 B C), Greek mathematician and inventor, Tycho Brahe (1546 to 1601), Danish astronomer, Nicolaus Copernicus (1473 to 1543), Polish astronomer, Charles Darwin (1809 to 1882), English naturalist, Albert Einstein (1879 to 1955), American (German-born) theoretical physicist Michael Faraday (1791 to 1867), English chemist and physicist, Galileo Galilei (1564 to 1642), Italian astronomer and physicist, Hippocretes (circa 460 to circa 377 B C), Greek physician, Imhotep (circa 2980 to 2950 B C), Egyptian physician and sage, Carl Jung (1876 to 1961), Swiss psychologist and psychiatrist Johannes Kepler (1571 to 1630), German astronomer Antoine Lavoisier (1743 to 1794), French chemist, Gregor Mendel (1822 to 1884), Austrian botanist To facilitate record keeping, the months proceed in alphabetical order The first day of each year is the first of Archimedes (July 21 on the Gregorian calendar) The last day of each Tranquillity year is called Armstrong Day Named for the first human to step on the moon, Armstrong Day celebrates the anniversary of Moon Landing Day Thus July 20 1970, is the Gregorian equivalent of Armstrong Day 1 A T and July 20 1989, is Armstrong Day, 20 A T

Finally, the Tranquillity calendar equivalent of leap day is called Aldrin Day Named for Armstrong's fellow moon walker Aldrin Day occurs every four years with some exceptions The exceptions are the three leap days in every 400 years that are dropped to keep the calendar astronomically precise Aldrin Day falls between the twenty seventh and twenty-eighth of Hippocrates (February 29) *The attributes of the* Tranquillity calendar are particularly impressive to Angela Brown director of Planetfest '89 the Planetary Society's five-day celebration of *Voyager 2*'s flyby of Neptune (Brahe 6 to 10, Pasadena Convention Center, Pasadena, California) "Naming the months after persons who impacted the world instead of after Roman gods is inspirational and pertinent especially to young people" Brown says

How can *you* use this new and innovative timekeeping system? We do not suggest you use it in place of the everyday Gregorian calendar The Gregorian calendar after all, is your social calendar It records holidays and holy days, April Fools Day and the Fourth of July We do, however, urge you to use the Tranquillity calendar whenever you can You may find that *it* provides *you* with an almost organic sense of order and timing as you make your plans feel your inner rhythms *and go about the business of your day*

GALILEO

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HIPPOCRATES

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IMHOTEP

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JUNG

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KEPLER

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LAVOISIER

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MENDEL

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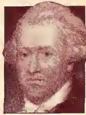
ARMSTRONG DAY

Imhotep 27, 10 A.T. Accident at Three Mile Island Nuclear Generating Station in Pennsylvania (1979)
Imhotep 28, 5 A.T. *Mariner 10* spacecraft approaches Mercury and sends 647 photos back to Earth (1974)



Lavoisier 19, 10 A.T. Byron Allen pedals *Gossamer Albatross* aircraft across the English Channel (1979)
Lavoisier 20, 14 A.T. *Pioneer 10* exits solar system (1983)
Lavoisier 22, 210 B.T. Ben Franklin flies kite during a lightning storm and discovers electricity (1752)
Lavoisier 25, 14 A.T. Sally Ride (left) becomes first U S woman in space (1983)

Lavoisier 6, 2 A.T. U S launches the *Mariner 9*, first spacecraft to orbit another planet (1971)
Lavoisier 9, 74 B.T. Guglielmo Marconi is granted patent for the radio in Great Britain (1896)

Kepler 18, 174 B.T. Dr Edward Jenner conducts his first experiment with cowpox vaccination (1796)
Kepler 25, 43 B.T. Charles Lindbergh (right) lands in Paris becoming the first person to fly an airplane solo, nonstop across the Atlantic Ocean (1927)
Kepler 28, 7 A.T. The Concorde supersonic transport (left) makes its first transatlantic flight to USA (1976)
Lavoisier 4, 2554 B.T. Most famous ancient solar eclipse occurs during a battle between the Lydians and Medes (585 B C)

Jung 27, 17 B.T. Francis Crick and James Watson report their discovery of the DNA double helix (1953)
Kepler 9, 9 B.T. Alan Shepard becomes the first American in space (1961)

Jung 18, 3 A.T. Two giant pandas (right), gifts from People's Republic of China arrive at the National Zoo in Washington, DC (1972)
Jung 19, 284 B.T. Sir Isaac Newton presents *Philosophiae naturalis principia mathematica* to the Royal Society (1686)

Jung 3, 144 B.T. Samuel Morey patents the internal combustion engine (1826)
Jung 6, 5 B.T. First commercial communications satellite launched (U S) (1965)
Jung 8, 61 B.T. Robert E Peary claims discovery of the North Pole (1909)
Jung 14, 9 B.T. Cosmonaut Yuri Gagarin of the USSR orbits Earth becoming the first human in space (1961)

INVESTIGATIVE CARTOONING

SATIRE BY BILL LEE

UNIDENTIFIED

CONTINUED FROM PAGE 51

She wanted to travel to the Orient to Paris I wanted to travel, too It turned out that her plans didn't exclude me I would go along—quit work and go just like that, spontaneously wearing a beret and a knapsack And that's just what I did finally although without the beret I'm not the sort of a man who can wear a hat I'm too likely to affect the carefree attitude and then regret the hat or whatever it is I'm wearing and then whatever it is I'm not wearing but should have It's a world of regrets, isn't it? Jane didn't think so She hadn't any regrets and said so and for a while I was foolish enough to admire her saying so I don't believe that Captain Hooton would have understood her saying such a thing let alone have admired it

I brought around his paper sack, right enough two days later, and he took it from me solemnly, nodding and frowning At once he blew it up like a balloon—inflated it until it was almost spherical—and then waving a finger in order to show me, I suppose that I hadn't seen anything yet, he pulled a slip of silver ribbon out of his vest pocket looped it around the bunched paper at the bottom and tied it off He lit a kitchen match with his fingernail and held it to the tails of the ribbon Immediately the inflated sack began to glow and rocketed away through the curb frees like a blowfish the ribbons trailing streams of blue sparks It angled skyward in a rush and vanished

I must have looked astonished thinking of the milk carton beneath my tree He pretended to smoke his pipe with his ear Then he sighted along the stem as if it were a periscope, and made whirring and clicking sorts of submarine noises with his tongue Then waggling his shoulders as if generally loosening his joints, he blew softly across the reeking pipe bowl dispersing the smoke and making a sound uncannily like Peruvian panpipes He was full of tricks He suddenly looked very old—certainly above seventy His hair which must have been a transplant grew in patterns like hedgerows and in the sunlight that shone between the racing clouds his skin was almost translucent as if he were a laminated see-through illustration in a modern encyclopedia

And so one evening late I knocked on the cellar window next to his kitchen door, then stood back on the dewy lawn and waited for him He was working down there tinkering with something, I could see his head wagging over the bench

In a moment he opened the door having come upstairs He didn't seem at all surprised to see me skulking in the yard like that but waved me in impatiently as if he had been waiting for my arrival maybe for years and now I'd finally come and there was no time to waste

The cellar was impossibly vast stretching away room after room a sort of labyrinth of low ceilinged concrete floored rooms I couldn't be certain of my bearings any longer but it seemed that the rooms must have been dug beneath the driveway alongside his house as well as under the house itself—maybe under the house next door and once I allowed for such a thing it occurred to me that his cellars might as easily stretch beneath my own house I remembered nights when I had been awakened by noises by strange creaks and clanks and rattles of the sort that startle you awake and you listen your heart going like sixty, while you tell yourself that it's the house "settling" but you don't believe it And all this time it might have been him, muffled beneath the floor and perhaps a few feet of earth tapping away at a workbench like a dwarf in his mine

All of this filled my head when I stood on the edge of his stairs breathing the musty cellar air It was late after all and a couple of closets with lights casting the shadows of doorways and shelves might have accounted for the illusion of vast size We wandered away through the clutter with me in my astonishment only half-listening to him and despite all the magical debris what I remember most, like an inessential but vivid element in a dream, was his head ducking and ducking under low rough sawn ceiling joists that were almost black with age

I have a confused recollection of partly built contrivances, some of them moving due to hidden clockwork mechanisms, some of them sighing and gurgling hooked up to water pipes curling out of the walls or to steam pipes running in copper arteries toward a boiler that I can't remember seeing but could hear sighing and wheezing somewhere nearby There were pendulums and delicate hydraulic gizmos, and on the corner of one bench a gyroscope spun in a little depression motivated apparently by nothing at all The walls were strewn with charts and drawings and shelves of books and once when we bent through a doorway and into a room inhabited by the hovering, slowly rotating hologram of a space vehicle we surprised a family of mice at work on the remains of a stale sandwich What did they make I wonder of the ghost of the spacecraft? Had they tried to inhabit it to build a nest in it? Would it have mattered to them that they were inhabiting a dream?

What did I make of it? *Here's Captain Hooton's airship,* I remember thinking *Where's the bell rope?* But it wasn't his

airship not exactly, the ship itself was in an adjacent room

The whole thing was a certainty in an instant—the lights in the sky the odd debris beneath the avocado tree even the weird pallor of his see-through skin It had all been his doing all these years That's no surprise I suppose when it's taken altogether like this When all the details are compressed the patterns are clear

He had come from somewhere and was going back again With the lumber of mechanical trash spread interminably across bench tops and the cluttered walls and the mice, and him with his pipe and hat, he seemed so settled in, so permanent And yet the continual tinkering and the lights on at all hours made it clear that he was on the edge of leaving—maybe in a week maybe in the morning maybe right now that's what I thought as I stood there looking at the ship

It was nearly spherical with four curved appendages that were a hybrid of wings and legs and that held the craft up off the concrete floor Circular hatches ringed the ship each covered with lapped plates that looked as if they'd spiral open to expose a door or a glassed-over window The metal of the thing was polished to the silver shine of a perfect mirror that stretched our reflections like taffy as I stood listening to him tell me how we were directly under the backyard and how he would detonate a charge and one foggy night the ship would sail up out of the ground in a rush of smoke and dirt and be gone affording the city newspapers their last legitimate saucer story

I didn't tell Jane about it There were a lot of things I couldn't or wouldn't tell her I wanted some little world of my own which was removed from the world we had together, but which of course could be implied now and then for effect but never revealed lest it seem to her to be amusing One day soon the papers would be full of it anyway—the noise in the night the scattered sightings of the heaven-bound craft the backyard crater There would be something then in being the only one who knew

And he no doubt wasn't anxious that the spaceship became general knowledge There was no law against it strictly speaking, but if they'd jailed him for the trick with the flashlight and the paper witch, or rather for refusing to come down out of a tree then who could say what they might do if they got wind of a flying saucer buried in a cellar?

Then there was the chance that I might be aboard He was willing to take me along We talked about it all that night about the places I'd see and the people I'd meet—a completely different sort of crowd than Jane and I would run into in our European travels

It was then, about two years after I'd met Jane that I gave up the house on Pine Street and moved in with her She was free of school at last and was in an expansive generous mood which I'll admit I took advantage of shamelessly and when in early July she received money from home and bought a one-way ticket to Rome I bought one too, only mine was a round-trip ticket with a negotiable return date That should have bothered her my having doubts but it didn't She didn't remark on it at all From the start it had been my business—another aspect of her modern attitude toward things an attitude I could neither share nor condemn out loud

The rest is inevitable I returned and she didn't Captain Hooton was gone, and there was a crater with scorched grass around the perimeter of it in the backyard of his empty house I might have gone along with him But I didn't, and what I get to keep is the memory of it all—the hologram so to speak of the ship and of faded desire, having given up the one for the already fading dream of the other

There's the image in my mind of a card house built of picture postcards pulled from a rusting wire rack of memories—the sort of thing that even a mouse wouldn't live in preferring something more permanent and substantial But then nothing is quite as solid as we'd like it to be and the map of our lives, sketched out across our memory, is of a provincial little neighborhood crisscrossed with regret and circumscribed by a couple of impassable roads and by splashes of bright color that have begun to fade even before we have them fixed in our memory

STAR TECH

ACCESSING THE FUTURE

PACE SETTERS

The roots of the pacemaker (left) lie in the Apollo era: Miniaturization and improved nickel-cadmium battery cells resulted in rechargeable pacers. Since the first pacemaker implant in 1973, the need for heart surgery has decreased.

CHILLING OUT

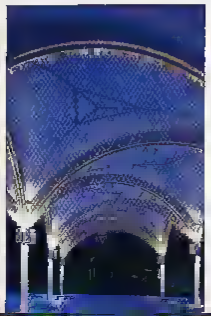
A spinoff from Apollo cooling suits worn during spacewalks, the Mark-7 MicroClimate system features a closed-loop, pressurized network of chilled fluid flowing through a cap and vest (left). The gear has cooled Richard Petty, Dale Earnhardt, and more than 300 other auto racers. Price: $1,000 to $2,500. Contact: Life Support Systems, (415) 962-9800.

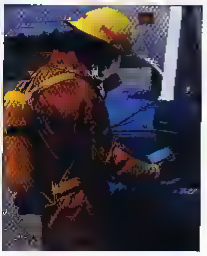
FIGHT MY FIRE

After the fiery deaths of three astronauts in 1967, flammability studies led to the development of PBI fiber for fire-resistant space suits. Pyrotect makes shells, parachute packs (left), airplane passenger seats, and auto racing suits. Suit: $505 to $1,300. Contact: Pyrotect, (612) 559-1092.

ASTRODOMES

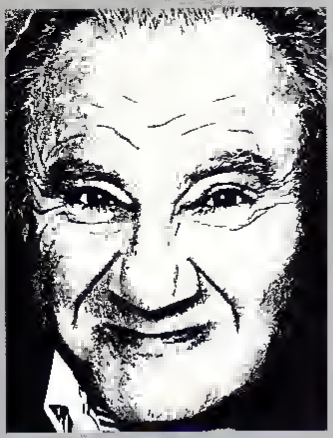
A translucent, lightweight fabric, Bird Air's Shelterfill is constructed of fiberglas yarns first developed for space suits in 1967. Coating the fiberglas with Teflon renders the material heat-, fire-, and water-resistant. Reflective, energy-efficient tents of Shelterfill cover atriums, sports arenas, and shopping centers like East Town Mall (below) in Knoxville, Tennessee. Contact Bird Air, (716) 684-9500.





BREATHE EASY

Research on moon suits and life-support systems led to improved fire-fighting equipment (left). Breathing systems, for example, have doubled compressed gas storage pressure and improved airflow.



LAST WORD

By Bill Dana

I have to perfect my most attractive method of space travel. It will allow space commuters like myself to fly over long distances quickly and easily in the extravehicular activity mode

On May 5, 1961, Mercury astronaut Alan Shepard took America's first suborbital ride. The first words radioed to Shepard after liftoff came from fellow astronaut Deke Slayton. He said, "Okay, Jose, you're on your way."

Jose? The reference was to America's first astronaut, Jose Jimenez, the quixotic, reluctant astronaut created by comedian Bill Dana. Millions of Americans had come to know and love this character, since his first appearances on the Steve Allen, Ed Sullivan, and Garry Moore TV shows. Shepard had taken to breaking the tension of astronaut training by mimicking Jose's famous salutation, "My name ... Jose Jimenez."

Soon all the Mercury astronauts were doing Jose impersonations. In fact, after meeting Dana they "adopted" him as the eighth American astronaut. He kept them laughing throughout the Mercury, Gemini, and Apollo programs with such displays of the light stuff as this, from one of his classic routines:

Interviewer: I see you brought some of your space equipment with you. What's that called, a crash helmet?

Jose: Oh, I hope not.

Interviewer: What do you consider the most important thing in rocket travel?

Jose: To me the most important thing is the blastoff.

Interviewer: The blastoff?

Jose: Yup. I always take a blast before I take off. Otherwise I wouldn't go near that thing.

Interviewer: Considering the uncertainties associated with manned flight, you are to be congratulated on your courage in embarking on such a dangerous undertaking.

Jose: Don't say *undertaking*, please.

Interviewer: Well, then, before you go—

Jose: Don't even say *go*.

Omni researchers have now discovered that shortly after Apollo 17, Jose did *go*, despite his aversion to the term, on a top-secret mission to deep space. We tracked him down, and he granted *Omni* an exclusive interview.

Omni: Since Apollo we haven't heard much about your exploits. Can you give us an update on your recent activities?

Jose: I'll have to give you a downdate, since you're down there and I'm up here. Or maybe we shouldn't date at all.

Omni: Some material. You really have been out of town awhile. But speaking of dates, have you met anyone out there?

Jose: I've got lots of friends from all over the various galaxies now. In fact, they're with me right this minute, and we're about to go on a little trip together of fifty light-decades. We were just discussing it when you called.

Omni: Such a voyage must entail all sorts of complex calculations involving adequate supplies, propulsion systems, and the like. With which of these all-important problems are you and your extraterrestrial comrades now grappling?

Jose: Whether I should sit next to the door because I'm getting out first.

Omni: About your colleagues, Jose, where exactly did you find intelligent extraterrestrial life?

Jose: In the Prototypian Galaxy.

Omni: Excuse me, but astronomers here on Earth advise us that they are unfamiliar with any such place.

Jose: You're not exactly hot news out here, either. Let's just say the Prototypian Galaxy is about as far from Earth as Broadway is from Philadelphia. This galaxy is the place that seeded all the various racial and other kinds-of-people types on planet Earth. Each planet here contains only one race. The planet Caucasoidia Panblanco is all Caucasoid style white people. The planet Bellone groidia is totally people of the black persuasion. Mongoloidia is completely people who are yellow. Forget creationism and Darwinism, too. I've got the photographs to prove it.

Omni: Jose, those Prototypian shots are the most valuable pictures in human history. When can you bring them to us?

Jose: As soon as I get them back from the Protomat. And also, to return to Earth I will still have to perfect a most attractive method of space travel, which I am now developing. It will allow space commuters, like myself, to fly most quickly and easily over long distances in the extravehicular activity mode.

Omni: How does it work?

Jose: My magnetic space travel is accomplished by holding a powerful magnet out in front of you at all times and keeping a bunch of metal in your pants.

Omni: And that really works?

Jose: If you've got big enough pockets.

Omni: Where would you rank yourself among history's great space explorers?

Jose: In terms of greatness I'd be number three. Ahead of me would be Benjamin Franklin and George Washington.

Omni: If you'll forgive me, Jose, Benjamin Franklin and George Washington had nothing to do with space exploration.

Jose: Then I'm number one!

Before we lost contact with Jose, the intrepid space explorer assured us he would be back for Apollo 11's fortieth anniversary—unless an even more momentous event brought him back sooner. "Tell my Mercury buddies," came his fading voice through the static, "I'll definitely show up for the first Lunar Hilton Open golf tournament—or my name isn't ... Jose Jimenez."

Comedian Bill Dana is still closely associated with the Mercury 7 astronauts and is on the advisory board of the Mercury 7 Scholarship Fund.