



FIRST WORD

By Alan B. Shepard, Jr.

• *The Challenger accident has revived the interest that the space program has lacked for more than a decade. Disaster won the attention that skill could not* •

The mission that I'm proud of in the history of the Mercury flight Freedom 7. Americans first manned space missions. But anyone who lived with the space program in those risk-so-distant days, it is astonishing how far we have come in so short a time. In many respects we have made enormous progress. Other events, however, have damaged the space program in ways none of us could have foreseen.

That last "Geminoid" flight never even reached orbit. I had only a minute or so to enjoy the view. In retrospect, what still seems most remarkable is President Kennedy's response to that small success. One month prior to the launch, the scientist advisers had still doubted that man could survive a trip into space. But Glenn, John Glenn, and I had to repeat our safety tests done many times before just to prove that we could survive reentry. It's only three weeks after the flight. President Kennedy, speaking before a full Congress, promised us a moon landing before the end of the decade. Even at NASA they were nervous about that objective.

None of us could have guessed what a powerful tool the space shuttle would be only 25 years later. The Mercury astronauts were not quite Spies in a Car, as the press claimed. But even the Apollo capsule remained cramped and primitive. Not even the most optimistic of us would have hoped for fly passengers who could perform useful work, not least of all the control of the vehicle.

The interest in these early missions was intense. After each Mercury flight, we faced ticker-tape parades, dinners, and endless interviews. Finally we signed an exclusive contract with Life magazine for our stories, not for the money or because publisher Henry Luce had used his political power, but because we needed an excuse to refuse all the other media demands for the "personality." The people sustained the political and economic support we needed.

Continued fan-frenzied enthusiasm of 25 years ago with the quality of recent years. The hours of TV news that once carried launch towers and moon rovers into our living rooms dwindled drastically. Shuttle flights have meant only a few moments of live-tape on the evening news. When Challenger began its brief "brag" flight, hardly a TV station interrupted its normally fast-of soap operas and game shows—until the shuttle exploded in midair. Ironically, disaster won the attention that skill and reliability could not.

NASA's budget has revived the public's interest in space. As long as the nation believed we were in a race with the Russians, NASA received almost all the money it needed. As soon as we reached the moon, the race was over. The public found other interests, and Congress found other uses for government funds. The space program slowed down and has never, in fact, fully recovered.

• The recent Challenger accident has

made NASA in a way that our own budget cuts of the Seventies could, it hardly seems that any good could come of such a tragedy, particularly with both Congress and the administration squinting to pin the blame on NASA executives. But there is something more basic at work.

It now seems that the Challenger accident has revived the broad interest that the space program has lacked for more than a decade. The good news because decisions must now be made that will set the course of space development for the rest of the century. Two have been made already. NASA has announced that it will send another teacher into space when Skylab is back in service. And the President has reaffirmed his commitment to build a permanent space station to fly in the early Nineties. The rest will be welcome to all.

First, however, we must decide what to do about the shuttle. Many planners would simply change its solid rocket boosters in the hope of preventing another mishap. Others have suggested that we build a whole new vehicle to replace the space shuttle. The shuttle's design was frozen some 15 years ago; they point out why not take advantage of today's technology? This is an attractive argument, for someday we will need two-man "space planes" to ferry technicians to orbit, large passenger carriers for scientific and ferry-air boosters to carry 500,000 pounds of building materials into orbit in a single trip. If we adopt the Strategic Defense Initiative, we will need at least three before the end of the century.

We cannot, however, afford to wait. NASA's plans once called for the shuttle to fly four. Eight lives would have been hard pressed to meet the need for launch service much later. Today a third, Challenger, must be replaced as soon as the cause of its accident is found and cured. Two new shuttles would be far better.

Although the headline is the DO-3 of the Space Age, some people will argue against building even one more shuttle, since they have taught space development at every turn. But most likely they will fail. For the Challenger accident has weakened the American people. In polls today only 65 percent support NASA's work. A majority says the agency deserves more funding than it receives. Congress and the administration must hear them.

It is tragic that it took the deaths of several dedicated people to rally us. And their sacrifice could still be wasted. Unless this renewed concern for space outside the news value of the Challenger accident, their loss will be the tragedy it seems. But if the Challenger case has inspired the lasting support we had needed for so long, they will have not died in vain. **DB**

As pilot of the Freedom 7 flight in 1961, Guyton Shepard (United States Navy Ret.) became America's first man in space. A decade later, he flew 13,000 miles to the moon. He is now 56 years of age, which he is a very healthy

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DINES

Exploration—the act of making the unknown known—is as fundamental to man as his ability to comprehend his own mortality. These two seem ineluctably bound: indeed, one is often purchased at the price of the other.

In this issue we celebrate America's 25 years of manned spaceflight and pay homage to the spirit of exploration, which has recently been put to the test by the tragic loss of the seven crew members of the space shuttle *Challenger*. To honor these heroes, O'Neil has designed a special commemorative poster (page 69). We've included a space timeline that spans half a century. This trajectory not only marks our past but also presages events sure to take place in the next 25 years, such as the day pilgrims will arrive on the first moon-based colony.

Among those first colonists will certainly be members of the more than 50 pro-space organizations. In "Missionary Power" (page 46) freelance writer Richard Wakeover chronicles the rise of this movement, which has become the country's fastest-growing public-interest concern. The activist agenda is considerable. While members of the Planetary Society search the skies for signs of extraterrestrial life, those in the L.S. Society plan to build man-made crescents in spheres floating above the earth. And the Young Astronaut Council has already enrolled 250,000 elementary-school children with enthusiasm for the stars.

One of the space movement's most

ardent supporters and a member of the National Commission on Space is Gerard K. O'Neill, professor emeritus of physics at Princeton University. In "Geostar" (page 62) he reports on detailed plans for the ultimate satellite communications network.

O'Neill explains how transceivers—expensive radios—will send and receive digital messages. Hikers will be able to check in with their offices; private planes will be guided to emergency landings. Chair of the Geostar Corporation, O'Neill has recently written the book *The Technology Edge: Opportunities for America in World Competition*.

O'Neill's telescopic vision can be matched only by that of our readers, whose powers of prophecy were enlisted for the "Great UFO Contest." We received an overwhelming response (some 4,000 entries) to our question, posed in the October 1985 issue: If aliens decided to visit us, where would they be most likely to land? One entrant claims aliens will drop by Albany County, Wyoming, home of the endangered Wyoming toad. His reasoning: The extraterrestrial survival depends on a chemical compound excreted by that toad. Our panel of experts settled on... Well, if you turn to "Alien Landing" (page 114), a report by Owen Dewey, you'll find out who won.

The ongoing search for extraterrestrial life is just one manifestation of our need to explore. Pulitzer prize-winner Daniel J. Boorstin, the subject of this month's Inevolve (page 102), has spent most of his life

thinking about man's ceaseless quest for new worlds to conquer. Boorstin is the eminent Librarian of Congress and author of *The Discoveries*, a book that celebrates "the imaginative thrusts of the great discoverers" throughout the ages. A poly math, Boorstin has pursued such diverse interests as bird-watching (with James Watson, of DNA fame), studying biochemistry (teaching at the Sorbonne), and exploring the mysteries of the pyramids.

Horror stories allow us to explore the shadowy part of our own natures—and from a relatively safe place: a comfortable couch or that worn but cozy wingback chair. According to Clive Barker, the powerful, new writer whose story "The Book of Blood" starts on page 54, "If you hold the nesty things of boy you can't see, really. And horror fiction is all about seeing clearly. A lot of my characters live dull lives. They live in a dimensionless reality, trapped in a singularity of vision. The supernatural events that interrupt their lives may kill them, but their lives are transformed because they see the possibility of the wonderful, the awful, the terrible. I often think of that line: 'We are not hypocrites in our sleep.' And when we're writing good horror fiction, we're dreaming."

Barker's last book, *Books of Blood* Volume One, will be released by the Berkley Publishing Group in June. Our story is the introductory one in the volume and the first magazine publication of any of Barker's work in the United States. **DD**

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LETTERS

COMMUNICATIONS

Buffaloed Again

It seems that every living creature on this magical planet swings to its own rhythm, and as writer Jim Nallman showed when he played music for a herd of buffalo [Earth, February 1986], the American bison certainly has an ear for good music. I have spent hundreds of hours watching the Teton and Yellowstone herds—magnificent animals in danger of extinction.

The Fish and Game Department of Montana, along with the big ranchers, has once again begun to slaughter the bison if an animal wanders out of Yellowstone Park: it's far game. This practice, called herd management, is absolutely degrading. Our parks and refuges are a place for animals to live out their lives safely and in honor. Long live the buffalo!

Dennis Miller
 Bethesda, CA

Cellular Visions

Dr. Jorge Yunis has developed a wonderful scientific tool that can help us better prepare for or prevent certain physical conditions [The Cell Sear, February 1986]. The future of humankind depends on the work of such brilliant scientists as Dr. Yunis.

The fact that chromosomal analysis can be used for such unethical practices as child selection is a problem that menialists itself with almost every new scientific development. It's the responsibility of each of us to see that these developments are ethically applied. Somehow I sense more good than evil can come from knowledge.

Sandra Fox
 Moraga, CA

Faithful Zombies

Wade Davis's story ["Inside Zombic Magic," February 1986] was informative, but in my opinion it failed to make a crucial point. In all of the recent reports, a careless link has been drawn between the administration of zombie potion and the religion of voodoo. Poisons, dolls, and spells automatically come to mind when an American thinks of voodoo. Actually, voodoo is a down-to-earth belief that provides the oppressed Haitian peasant with the type of strength that any faith brings, as well as

with a tie to his African heritage.

Voodoo secret societies are responsible for administering the potion. This is done to punish someone, as was implied in Davis's article. The manufacture of the potion, however, has little to do with the voodoo faith.

Charles N. Wstrom
 Chicago

Oil Trashers

I have witnessed what I can only describe as oil in formation at the bottom of the Santa Fe trash dump in Mexico City ["Meteorite Oil," Continuum, February 1986]. Oozing from the bottom layers of the gargantuan city dump is a black, highly combustible, oily substance. The locals use the ooze as fuel. The advance of the dump assures the "trash mongers" of a constant fuel supply that they can collect in buckets. This might be something for the geologists to explore.

Charles N. Muzal
 Lomas de Chapultepec, Mexico

Rosink Remembered

Please accept our appreciation for Omni Publications' contribution to the Judith A. Resnik Memorial Fund. Omni Publications' interest in helping us remember the extraordinary woman is commendable.

All of us are proud of Judy Resnik's accomplishments. In her brief life she exemplified the scholarship, dedication, and tenacity that we hope today's students will emulate. Through the Judith A. Resnik Memorial Fund, we are attempting to perpetuate her tradition of excellence.

Conrad C. Ott
 Superintendent of Schools
 Akron

Editor's Note: Contributions can be sent to Judith A. Resnik Memorial Fund, 70 North Broadway, Akron, OH 44308.

Classification

The photo-caption for the October 1985 Exploitations column on vampires referred to the late Boris Lugovsk's close association with this topic. Any other connotation was not intended. □

DIALOGUE

FORUM

Exploration has always been central to the human experience. Once we crossed mountain ranges and oceans in search of knowledge, today we journey into space and study the distant stars. Orms asked the following experts to comment on the state of exploration as we mark the anniversary of a quarter century of manned spaceflight.

Twenty-five years ago this month, Alan B. Shepard, Jr., became the first American in space. I am all awed that this country committed itself to a manned lunar landing within a decade, based on a 15-minute suborbital flight. Even more awesome is that we reached this goal on schedule.

Many people concluded that everything worth doing in space was accomplished during that first ten years. After such a phenomenal start—withdrawing to near-Earth orbit for the next 15 years had the appearance of a major retreat—and near-Earth orbit lacked the charm and imagination of continued exploration into the universe. Unfortunately, the primary motivation in those early years was competition with the Soviets, and as in any race, the audience left just as the winner lapped the field.

Despite the comparatively limited resources available, NASA has done a commendable job of stretching, building a solid space infrastructure with shuttles and a space station and promoting the commercial applications of space.

It is time, however, to look at where we want to be at the end of the next 25 years. Instead of contemplating our navels in near-Earth orbit, we should be reaching for other planets. The biggest tragedy of the Challenger accident would be the failure to accept that challenge.

The world's statesmen could rationalize the cost of going to planet Mars, for example, as a small investment in the future of planet Earth. Planning and implementing an international mission such as this would do more for world peace than all the defense budgets combined—at a very small percentage of the cost.

World peace would be the ultimate spinoff from space exploration.

Donald K. Slayton
Houston

Now is an appropriate time to reflect on how far our space program has come since its inception—and how far it can go.

We must use space to enhance scientific research, to communicate throughout the world, and to pursue commercial aspects of flight. These goals can be maintained only by continuing substantial support for basic research and development, building up math and science education for our young people so they are prepared for a technological future, and developing an appropriate space infrastructure.

Space represents the modern frontier for extending humanity's research into the unknown. Our commitment to manned programs must remain strong even in the face of adversity and tragedy. This is our history and the legacy of all who fly.

Senator John Glenn
Washington, DC

And the rocket's red glare... Little did Francis Scott Key realize that his words would be pertinent today. The Space Age, which sometimes seems to have been with us forever, began just a quarter of a century ago, on April 12, 1961, when Yuri Gagarin made his historic voyage in a Vostok space capsule. Yet the true measure of the accomplishments of the age can perhaps be best appreciated by noting that just 20 years later, to the day, John Young and Robert Crippen flew the first reusable spacecraft, Columbia, into Earth orbit.

Columbia was soon followed by Challenger, Discovery and Atlantis, all named after famous sailing ships that made historic voyages of exploration. Man has a unique ability to design and use machines to increase his reach and discover the underlying secrets of nature. This is especially true in the space program.

The space program has always had, and will continue to have, two concomitant elements: manned spacecraft and unmanned satellites. Unfortunately, the differences between these two have often become blurred.

Manned spacecraft are more than just people riding in a machine. There is a symbiosis that underlies the type of exploration. Manned spaceflights are more

flexible than unmanned missions. Their participants can reprogram and interact with onboard systems, and they can experiment with new types of sensors. Participants also have the advantage of seeing— firsthand—a panorama of the earth, and they are able to react to this in a selective and interpretive manner.

Unmanned satellites, on the other hand, carry preordained, reliable sensors and conduct longer-duration, fixed-purpose missions. Control is by computer, with only so many possibilities for reprogramming from Earth. These craft relay back a limited view of our planet, and their sensors cannot discriminate as well as an astronaut can.

Exploring space by means of both manned and unmanned systems provides a synergistic effect that transcends the results obtainable from either system alone. Man is unique in his ability to recognize patterns in a vast quantity of data and then to extract that which is new and previously unknown. Machines can then be used to exploit those discoveries.

The recent tragic loss of the Challenger and its crew of seven modern day discoverers in no way changes the fundamental role of man in space. Just as the piggy can see farther than anyone when standing on the shoulders of a giant, so will future space explorers see beyond today's limited horizons by building upon the knowledge we have painstakingly won. Now is not the time to demote the giant and let all that effort go for naught.

As we investigate every aspect of the Challenger disaster so that it may never happen again, we should reflect on the words of Theodore Roosevelt: It is not the critic who counts. The credit belongs to the man who is actually in the arena.

Who, if the tribulation beat him while doing greatly, so that his place shall never be with these cold and timid souls who know neither victory nor defeat.

Paul Scully-Power
Myrtle, CT

Editors note: In October 1994 Paul Scully-Power was a crew member on shuttle mission STS-61 and became the first oceanographer to fly in space. **DD**

KILLER LAKE

EARTH

By Owen Davies

Wedged between the Central African Republic and the Bight of Benue, Cameroon is a nervous place where 9 million Moslems, Christians, and animists vie for power. It is usually peaceful, but in the summer of 1984 a Moslem faction attempted a coup. So when 37 people died mysteriously a few weeks later, it was a good bet they'd been done in. Yet when American scientists investigated, they found no sign of foul play. Instead, the researchers declared they had uncovered one of the strangest natural disasters of all time.

It began early on the morning of August 18. Priest Kwabey Abeo and several of his parishioners drove past Lake Monoun. Glancing through the fog, which was brown and unusually thick, the group saw what seemed to be a young man asleep on his motorcycle. When Kwabey and one of the parishioners went to investigate, they found that the man was dead. But before they could return to the van, they had succumbed as well.

By 6:30 A.M. Dr. Emmanuel M. Njock Bato had arrived on the scene. He waited until after the fog dissipated, around 10:30 A.M., and then made his way to the lake. Standing near the shore, he saw a ring of death. The plants, which had the chlorophyll bleached from their leaves, were destroyed up to 20 feet above the waterline, suggesting a tidal wave. And still more shocking, 37 people lay dead along the shore.

The first of the people died at about half past midnight, and people continued to die until about seven. Njock, now a postdoctoral student at the Tulane School of Public Health and Tropical Medicine reports, "There were reddish blisters on their exposed skin, and on all the bodies there was much foamy mucus mixed with blood around the mouth and nose.

What struck me most," he adds, "was how quickly the bodies began to putrefy. The temperature that day had not exceeded seventy-seven degrees Fahrenheit, yet the bodies all began to putrefy by three-fifths in the afternoon.

"Many of my colleagues came to the area soon after that," Njock adds, "but there were no autopsies. They were all afraid

There the water stood for several months. No one could find evidence of poison in the area, but neither could they come up with a natural explanation for the deaths. Suspicion soon focused on the former head of the secret police, who owned the plantation closest to the lake. A search of his plantation turned up a few pesticides abandoned years earlier by French colonists. But officials dropped the investigation after realizing that the Cameroon government itself did all the spraying in the area, the suggestion that pesticides were at fault would implicate them.

Finally the Cameroon government went to University of Rhode Island volcanologist Harald Sigurdsson, and some six months after the accident Sigurdsson and geologist Joseph Devine arrived in Cameroon.

What they found, according to Devine, was a calm, mile-long lake shaped like a bowl to the east. Most of it was shallow, but on the east end, where the cloud had appeared, the floor sank abruptly to a flat bottomed volcanic crater about 300 feet deep.

"At first we thought there might have been a recent volcanic eruption," Devine

says. "There have been cases in Iceland and Papua New Guinea, for instance, of volcanic carbon dioxide becoming trapped in a depression and suffocating people. We couldn't find any evidence to support that notion in this case, though there were no hot areas usually associated with volcanic activity, and there was very little of the expected sulfur or halogens.

What the team did find, Devine asserts, was carbon dioxide gas dissolved in the water. There was so much of it, in fact, that water samples from the lake bottom formed like warm soda. Subsequent chemical studies showed that the gas was literally seeping out from the lake floor.

According to Devine, it has long been thought that carbon dioxide produced by volcanic lavas stays trapped at the bottom. But in Monoun, he suggests, the water was violating this tenet of nature, literally turning over and rushing the carbon dioxide to the top. When the water turned over, the carbon dioxide suddenly escaped, Devine suggests. "Those who crossed its path simply suffocated to death."

Devine, now a professor at Brown University, concedes that his explanation is flawed. "If it were just carbon dioxide released by a volcano, you wouldn't expect it to show up a five-meter tidal wave," he says. "And we don't know what triggered it. Tounes reported feeling a slight earthquake the day before, but the only seismograph in the area was out of order, so we could never confirm that."

Devine's explanation is also being questioned by Duke University ecologist Daniel Livingston, an expert on the lakes of Cameroon. The gases that might have killed these people—carbon dioxide, methane, or hydrogen sulfide—would not have caused blistering," he says. "And nothing else found in the lake would cause that reaction. It's too bad there were no autopsies. A few pictures of those bumps would answer a lot of questions.

"Unique events are hard to deal with," Livingston concludes. "No one is going to sit next to the lake until it happens again. Unless it occurs somewhere else, and we can get there quickly, we may never know what happened at Monoun." □



What really happened at Lake Monoun?

ASTEROID CROPS

SPACE

By Freeman Dyson

Suppose we go out and settle on a convenient asteroid with our life spaceship. What do we do when we get there? How do we make a living? What can we expect to export in order to pay for necessary imports? If space colonization makes any sense at all, these questions must have sensible answers. Unfortunately, we cannot hope to answer questions of economics until the asteroids have been explored. At present we know almost nothing about the chemical composition of asteroids and the physical conditions we shall find on them. No human instrument has ever touched an asteroid.

In this connection it is interesting to compare the economics of asteroid settlement with the economics of early colonies in North America. The early American colonies knew almost as little about America as we know about asteroids, and their economic expectations almost always proved to be wrong. The first settlers in Virginia intended to mine gold and instead grew rich by exporting tobacco. The Pilgrims in Massachusetts intended to live mainly by fishing and instead became farmers and fur traders. It seems that the most important prerequisite for economic survival is flexibility. Colonists should never believe economic forecasts and should be ready to switch to other means of livelihood when the forecasts are wrong.

In the circle of my own friends I have seen an example of colonization that may throw some light on the economic problems of asteroid settlers. Two friends, a young man and his wife, established themselves on an uninhabited island in the North Pacific. They built a comfortable house and had no difficulty in growing enough food for the table. The husband, a skilled blacksmith, built a sawmill and other useful pieces of machinery.

In most respects their colony was economically self-sufficient. But there were a few essential items that they could not produce for themselves and needed to import. Diesel fuel was the most essential. They needed to sail down to Vancouver, Canada, once or twice a year with a large tank and fill it up with diesel fuel for their engines. The question then arose: What was

the most convenient cash crop that they could produce for export? They had to find something that could be easily grown on their island, was easily transported in their boat, and easily sold for a high price in Vancouver. Being law-abiding citizens, they had no wish to become smugglers. What, then, would be the most convenient legal high-value cash crop for a small North Pacific island to export?

The answer to this question was not obvious. Only after a number of false starts did my friends find the answer: pedigree Rhodeian Redback pups. The dogs were easy to breed on the island. They did not need to be fenced since there was no danger of inbreeding, or crossbreeding. They fed mostly on leftovers from the farm. And the pups could be sold to dog fanciers in Vancouver for a couple of hundred dollars each.

Rhodeian Redback pups will not always be the answer, but the economic problems of asteroid colonies will be solved in a similar fashion by finding cash crops that conveniently exploit local opportunities. It seems likely that the cash crops for

asteroid colonies will often be products of specialized plant and animal breeding. Every asteroid colony must begin with a unique plant and animal-breeding program aimed at establishing an ecology adapted to local conditions. As a result most colonies will possess varieties of plants and animals that are rare or nonexistent elsewhere. Just as with the North Pacific island, the isolation of an asteroid provides an ideal environment for maintaining pure-bred pedigrees. Every colony is likely to need not only a competent blacksmith but also an expert in genetic engineering.

The next 100 years will be a period of transition between the metal and silicon technology of today and the enzyme-and-nerve technology of tomorrow. The enzyme-and-nerve technology will be the result of combining the tools of genetic engineering and artificial intelligence. We cannot hope to predict the forms in which a mature enzyme-and-nerve technology would express itself, but when I think of the space technology of tomorrow I think of three concrete images. First is the Martian potato, a succulent plant that was deep underground. Its roots penetrate layers of subterranean ice, while its shoots gather carbon dioxide and sunlight on the surface under the protection of a self-generated greenhouse. Second is the comet creeper, a warm-blooded vine that spreads like a weed over the surfaces of comets and keeps itself warm with superinsulating fur as soft as sable. Third is the intelligent space butterfly, with solar sails for wings, a creature truly of home in space, acting as our agent in exploration and reconnaissance. It could carry both pollen and information from world to world, just as terrestrial insects carry pollen from flower to flower. It is easy to dream of other inhabitants of the celestial zoo with which the universe could be peopled. The Martian potato, the comet creeper, and the space butterfly are merely symbols intended like the pictures in a medieval bestiary to edify rather than to enlighten. □



Comet creeper: an extraterrestrial export?

Freeman Dyson is professor of physics at the Institute for Advanced Studies and the author of *Weapons and Hope* (Harper & Row).

ENDANGERED BUSHMEN

LIFE

By Jim Naughton

A Coke bottle carelessly tossed from the cockpit of an airplane lands amidst a settlement of Bushmen in the Kalahari Desert. Fascinated by the object, which is unlike anything they have ever known, the Bushmen use the bottle first as a tool, later as a musical instrument. Everyone covets the bottle and before long it breeds jealousy and violence. The leader of the tribe vows that his people must be rid of this disruptive "gift" from the gods and begins a trek to the edge of the earth, where he will hurl the bottle into the abyss.

That's how modern civilization was shown to intrude on the lives of a primal people in the surprise hit film *The Gods Must Be Crazy*. In reality, though, the Bushmen peoples of Africa face a plight far more serious than the turbulence caused by a Coke bottle. They are quite literally being threatened with extinction.

The most endangered group of Bushmen are the Ju'wasi, who call themselves the well-named people. Like other Bushmen, the Ju'wasi roamed the Kalahari Basin in Namibia and Botswana, where they supported themselves by hunting and gathering, raising cattle, and cultivating some crops. Then in 1970 the Ju'wasi in Namibia were placed on a government reservation called Bushmanland.

Today the Namibian government wants to turn the most fertile portion of Bushmanland into a nature reserve, in part to cash in on the growing African tourist market. Under the new designation, the Ju'wasi will be allowed only to live on the land, not to farm it or graze the small herds of livestock on which they depend for food. They will also be encouraged to dress in skins and wander around with bows and arrows, presumably for the entertainment of tourists hungry for an authentic encounter with "real" natives.

"To call the nature park a deathblow is not just a figure of speech," explains ethnographic filmmaker John Marshall, whose film *Nai, The Story of a Kung Woman* details the Bushmen's gradual descent from self-sufficiency to economic helplessness. "It is not a metaphor for social disintegration or collapsing values,"

he says. "Depriving the Bushmen of the land will mean [the end of] their lives."

Ironically, proponents of the nature reserve see it as a way to protect the roughly 2,000 Ju'wasi living in Bushmanland, arguing that the reserve will allow the tribe to practice hunting and gathering, their traditional way of life. But Claire Ritchie, coordinator of the Kung San Foundation, which is devoted to helping the Bushmen, contends that it is a "myth to think that had we not come along they'd be happily hunting and gathering right now. No people want to stay hunt/gatherers. When the opportunity comes for Bushmen to have cattle, they want them."

Land-hungry politicians, however, are not the only ones who have encouraged the notion that Bushmen are "genetically incapable" of doing anything but hunting and gathering. Anthropologists are also responsible. "We were so fascinated with them as hunt/gatherers," says Marshall, "that we turned our backs on the vast majority of Bushmen who practiced a mixed subsistence—the ones who raised livestock, grew some crops, and were



A people on the edge of extinction

forced to work for whites.

Over the years all the Bushmen have seen their traditional territories shrink in size forcing them onto smaller and smaller reserves. Many of them have crowded into rural slums around various governmental outposts and army bases. There the South African army began recruiting the uneducated and politically naive Bushmen to fight against SWAPO (the South West African People's Organization). Today Bushmen have the highest percentage of military service of any ethnic group in the world. Their comparatively huge army salaries—20 times the average per capita income—provide the extra income to keep entire villages alive.

By 1980, when Ritchie visited the Ju'wasi, the situation had done its damage. Most Bushmen had stopped hunting and gathering and were just hanging around the settlement getting drunk and living on welfare, she says.

The proposed nature park would make life even more difficult for the tribe. "No single person in southern Africa can survive by subsistence alone," explains Marshall. "You have to have some family member working for money. But it's also true that no one can survive on a cash income alone." In this way the Bushmen are still dependent on the land.

At this writing, the nature park is being opposed by Andreas Spangina, the new Namibian minister of nature conservation. But even if the proposal is abandoned, the Ju'wasi may find themselves in a tenuous position. If majority rule comes to Namibia the Bushmen may be punished for having fought SWAPO. Some anthropologists believe that the new government would understand the economic necessity and political ignorance that led young Bushmen to fight. But under either apartheid or majority rule, the once-independent people appear destined to be pawns in someone else's game. **DD**

Editors Note: The Kung San Foundation welcomes contributors to aid in the Bushmen's struggle for self-determination. The Foundation can be contacted by writing to the Kung San Foundation, Cultural Survival, 11 DeWitt Avenue, Cambridge, MA 02138.

BEEPER PSYCH

MIND

By Judith Hooper

In October 1944, when he was ten years old, Mihály Csikszentmihalyi, his mother and the rest of his family took the very last train out of Budapest before the city was cut off from food supplies and bombed to smithereens. "What amazed me was that all our relatives denied the obvious," he recalls. "They kept thinking that everything would turn out for the best. Within a few months they were all dead, either from starvation or from the bombing."

Now a psychologist at the University of Chicago, Csikszentmihalyi has ever since been studying the rational underside of behavior. He has been particularly fascinated with peoples' day-to-day thoughts, the stream of consciousness that William James described as "a ever flowing flowing through a man's conscious waking hours. And if that great turn-of-the-century psychologist had possessed a computer, some electronic beepers, and several thousand willing research subjects, he might have been able to tell us more about what filled those waking hours.

For the past several years Csikszentmihalyi has been doing just that. He wants to know: What do people really think about during the day? What is flowing through their stream of consciousness as they are sitting down in front of *Weeks Company* and eating a TV dinner?

To find out, he has been recruiting people giving them notebooks and beepers, and having a computer signal them at random times during the day—whereupon they jot down what they were doing and how they felt when they were doing it. The result is what Csikszentmihalyi calls a "natural sampling of everyday life": a week's worth of snapshots, or samplings of quotidian consciousness.

Csikszentmihalyi's "systematic phenomenology," as he dubs his method, has caught on with a number of psychologists in the United States and abroad who have contributed to the world's first introspective data bank—which now includes several thousand subjects and hundreds of thousands of diary entries. "Once the numbers are in the computer, you can come back and ask any question you like," Csikszentmihalyi explains. "You can ask

How do people feel when they are watching TV with their families, as opposed to watching TV alone? Is eating in the morning the same as eating in the afternoon?"

As a result, anyone with questions about Italian teenagers, Dutch schizophrenics, people with multiple personalities, children with learning disabilities, the elderly, anorexic bulimics, or TV addicts can find answers in Csikszentmihalyi's computer.

"The method is not quick and easy," he notes. "It's not two hundred people taking the same test in the same room all at the same time. But it has yielded some intriguing insights.

So what is going on in people's heads most of the time?

"One of the most surprising things we found is the importance of unstructured solitude in people's lives," says Csikszentmihalyi. "If you look at anorexic, bulimic, heavy TV viewers, children who are under-achieving in school, anyone with any sort of problem, they're here as long as they're with other people. But when they're alone with nothing to do, they feel terrible. Their moods plummet. This is when they get into

these pathological behaviors: binge eating, purging, and so on. So it looks as if the ability to tolerate solitude is a very good index of mental health.

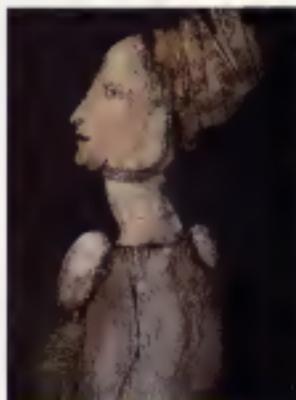
As James recognized, *mood* is also the essence of the stream of consciousness, and unlike a multiple-choice test or a psychiatric interview that takes half an hour, beeper psychology can plot the ebb and flow of these mental tides.

We found that the mood swings of adolescents are at least twice as rapid as those of adults," Csikszentmihalyi says. "Adolescents go from a high or low point to a middle point every twenty minutes, while the adult takes over an hour."

Equally surprising were the results when it was tried on people with mental disorders. When a protégé of Csikszentmihalyi tested a person with 21 personalities, five of the most dominant ones obligingly "came out" during one week's beeper exercise and the person wrote his notes under their various aliases. "It was as if two different people filled out the notebook," says Csikszentmihalyi. "And the personality the clinician thought was the strongest turned out to be weakest in describing himself."

Using the same technique, a Dutch psychiatrist discovered something curious about schizophrenics: They're called chronic schizophrenics, but they show their emotional disorders only at very specific times, reports Csikszentmihalyi. "Each person seems to have a period in midmorning or early afternoon when he really begins to appear out. Most psychiatrists assume that if you're schizophrenic, you're schizophrenic all the time. But four times out of five you can't tell a schizophrenic's entry as from a normal person's."

Although this might seem the most obvious subject for psychology (the "science of the soul") to contemplate, in fact it is the last thing the psychologist seems to care about. "Psychologists with their rating scales look at nurturance," aggressiveness, and so on. But they are not concerned with what goes on in consciousness," Csikszentmihalyi notes with some amazement. "I think psychology should study the subjective inner life of a person. After all, that is the essence of existence!" **DD**



What lies in our minds? The beeper knows.

PAINKILLER OR PARALYZER?

BODY

By James Kifield

The play began like dozens of others for tailback Kurt Waldrop: Uncoiling from the backfield, the young Texas Christian football player sprang right for a power sweep in that last yard up the field. Waldrop is now forever altered. A neck-snapping tackle left the young athlete paralyzed.

Until recently surgeons and medical researchers offered little hope of stemming the numbing tide of paralytics that will engulf 20,000 young Americans in 1993. Damage to the spinal cord or central nervous system has been considered the ultimate medical dead end.

Studies that began last year, however, should yield the definitive answer on a revolutionary new drug treatment. If the tests are successful, many future victims of spinal cord injury will never have to sit in a wheelchair or face lives changed by an ill-fated football play or high dive.

Dr. Alan Faden and Dr. John Halsetry—two researchers for the Walter Reed Army Institute of Research—used deductive reasoning to come up with the treatment. "We suspected that the accident that causes

the spinal cord injury is not usually responsible for most of the damage," says Faden, who is currently head of neurology at the San Francisco Veterans Administration Hospital. "One result of injury is the loss of blood flow to the cord. The loss leads to the death of cells but also triggers the release of other substances that kill cells," he explains. "We theorized that these secondary substances caused much of the irreversibility of the damage. So blood flow is a critical factor in spinal injury."

Faden and Halsetry knew that morphine causes a drop in a patient's blood pressure. It made sense that endorphins, the body's morphine-like substances that act as natural painkillers, would produce a similar effect and might be responsible for stalling the blood flow. To test their theory, the researchers began a series of experiments with rats that were suffering from shock, which also impedes blood flow. By neutralizing the endorphins with injections of the opiate-blocking drug naloxone, the two hoped to better understand the role of endorphins in trauma and shock.

After a dose of naloxone, rats made what

even the researchers term "an unbelievably dramatic recovery." During shock their blood pressures had dropped to less than half of normal, and the rats were nearly dead. Five seconds after a naloxone injection they began to walk and eat. At least 40 subsequent studies—using animals ranging from rats to primates—identified the same phenomenon. Opiate blockers rapidly and dramatically improve blood flow and thus prevent the effects of shock.

After the initial tests the doctors knew they had discovered the first drug capable of reversing the drop in blood pressure that inevitably follows injury to an animal's spinal cord. Even more exciting to the research team, however, was the realization that they were one step closer to linking endorphins—substances generally accepted as benevolent painkillers—to a direct role in spinal cord damage and subsequent paralysis.

Next came an exhaustive series of spinal injury tests on different species of animals. The endorphin biography that emerged from the various laboratories formed an altogether different medical composite than that of a simple pain reliever.

"We found that if you injure the spinal cord and then administered naloxone, blood pressure returned to normal, as we know it would. Then we followed the recovery of the animals. Those that got naloxone were walking nearly normally. The animals that did not get naloxone had severe spastic reaction and could barely take a step. They were paralyzed," Faden says. "It was the first successful demonstration that naloxone directly improved recovery in animals' spinal cord injuries by blocking the endorphins."

Unfortunately, naloxone also neutralized the pain-relieving effects of the endorphins, which led Faden and Halsetry to search for a second opiate blocker. What they found was another body substance—thyrotropin-releasing hormone (TRH)—that acted in most respects as a natural antagonist to the endorphins but had no effect on the endorphins' pain-relieving properties.

Theoretically, TRH seemed the perfect antidote to the endorphins. Not only did subsequent tests show an even higher



The underside of the body is upper. Endorphins may contribute to paralysis.

THE ARTS

By Matthew Kell

At age fifteen, Eslay Blackwood Jr. wrote a cello piece based on an aene scale unfamiliar to most Western ears. Instead of using the 12 "half tones" in the traditional Western scale, young Blackwood called on a 24-note scale of "quarter tones." His inspiration was an article on music in the *Encyclopaedia Britannica*. The exercise was mostly playing around, he now acknowledges.

But since 1977 Blackwood—composer, professional pianist, and professor of music at the University of Chicago—has immersed himself in the alien microtonal world, systematically investigating a whole series of scales in theory and practice. The results include his *Twelve Studies for Electronic Music Media*, a unique microtonal sampler ranging from a 13-tone piece to a new and aural 24-note work. The studies and the 525 pages of notes he has compiled for a book go far in establishing Blackwood as a pioneer in this hitherto little-explored territory of music.

Microtonality—dividing the octave into more than the traditional 12 intervals—is nothing new. The ancient Greeks used microtones, and Asian music has used them for centuries. But in Western music microtonality has always been at the fringes. It has been considered diffuse, disorganized, a dead end—primarily a playground for left-field composers. And before recent advances in electronic technology in depth systematic study of microtonal music was not really possible.

Renaissance and early baroque theorists discussed 19-, 31-, and 55-note tunings as well as a 53-note tuning relating to ancient Pythagorean proportions. Around 1900 theorists developed 95-tone and even 613-tone scales. In practice, composer Ben Johnston has created 53-tone works and Harry Partch worked extensively with a 43-note system. But work with quarter tones has been most popular. Such twentieth century composers as George Enescu, Charles Ives, Alvin Haba, Ernest Bloch, Bela Bartok, and Pierre Boulez have all used 24-tone scales.

Much of this music has required specially refined, redesigned, and newly invented instruments. The few microtonal instruments

that have existed have been difficult to play and designed for specific tunings or even specific works. So microtonality remained an obscure curiosity—until recently.

In 1963 Karlheinz Stockhausen composed a microtonal study using primitive electronic equipment. But two decades would pass before the technology needed for a serious microtonal investigation was introduced: the logarithmic calculator and a musical instrument called the Scala-tron. The Hewlett-Packard calculator made possible the swift numerical analysis involved in a microtonal study. Concurrently, Moog's dual-keyboard music synthesizer achieved accurate tunings in any designated range of intervals. Suddenly tools were available both to examine microtonal theory and to play the music.

Microtonalists interested in exploring the capabilities of its new instrument found in Eslay Blackwood the person to use those tools: a composer with an analytical mind, highly developed mathematical skills, deep understanding of musical harmony, and prodigious talent at the keyboard. Since the Scala-tron's keyboard arrangement doesn't

change when a composer switches from one microtonal tuning to another, it takes a pianist with exceptional mental and digital dexterity to play a microtonal piece on this piano-like device.

With one of the 15 existing Scala-trons in his office, Blackwood studied the theoretical relationships and musical possibilities of every microtonal tuning from the 13- to the 24-note scale. His aim: to create playable compositions in each tuning to illustrate structural and musical possibilities—the traditional purpose of studies. He intended to establish and broaden the theoretical mapping of each tuning from 13- to 24-tone and to devise comprehensible notation systems. He realized that a thorough study of chord progressions and harmony would provide future composers with a charted path. Each composer would no longer have to dive headlong into an unknown single of notes.

Half of the tunings—13, 14, 15, 16, 18 and 23—were virtually virgin territory. "In fact," Blackwood says, "reviewers of my grant proposal said, 'This is off the mark. There's a consensus among theorists that the thirteen-, sixteen-, and twenty-three-note tunings are of no musical use.' Well, there was a consensus to that effect. The only trouble was, they were all wrong."

What do the microtonal studies sound like? Few people know what to expect. Even musically literate listeners anticipate hearing nothing more than random dissonance. But one listener who heard Blackwood's compositions wrote to him: "I was astonished at the melodic quality and emotional range of the pieces, which quite overcame the unfamiliarity of the scales."

A primary element of the studies is unexpectedness. Blackwood works with notes and chords not normally found in Western music. Each new phrase challenges the mind to recalibrate its sensibilities and adjust to music that at first sounds out of kilter. "But it isn't merely an 'interesting intellectual exercise to be tolerated once then avoided.' The studies are a delightful rewarding surprise."

Public reaction has been favorable. Ironically, the most negative reaction to the studies came from certain segments of



Microtonal music: released from obscurity?

NEW MOONS

STARS

By Ron Schultz

For most people, discovering a new celestial object is a once-in-a-lifetime feat, but for Stephen Synnott it has become something of a habit. Synnott, a spacecraft navigator at NASA's Optical Navigation Facility at the Jet Propulsion Laboratory (JPL), still recalls his first find. Three years ago, as he was flashing through various images beamed back from Jupiter by *Voyager 1*, he stared at his video screen and realized that he had found a new moon. "I thought, My God, I'm the only person in the world who knows there's another satellite out there," he recalls. "Nobody else knows." His discovery recently received the name *Thebe*. Now he is in a similar situation, only this time there are seven moons to name.

When *Voyager 1* swung by Uranus this past winter, it discovered ten new moons. Because Synnott discovered most of them as colleagues at JPL now refer to him as the *Voyager* project's "Rock Hunter."

Trained in orbital mechanics, Synnott had to make sure *Voyager* got to where it was supposed to be when it was supposed to be there. The first step was finding out all

he could about the motion of the spacecraft and the objects it was going to approach. "It's like leading the pass receiver in a football game," Synnott explains. "We basically have to track the motion of our receiver and know not only how he's moving now but how he's going to move when we can't see him." With the *Voyager* spacecraft it was not an easy task since his receiver was 2 billion miles away. He also had to be able to tell the spacecraft to fly at specific angles and then open the shutter so that the target moon would be in view when the camera started taking pictures. (To see how well Synnott did his job, look at the pictorial "Moons of Uranus" on page 52.)

But there was more to the photo session than locating the subject. The lighting was abysmal, requiring exposures of up to 10 seconds. And the camera was moving at 49,000 miles an hour. The challenge was a little like trying to get a sharp picture—without a flash—of a car racing by on a starlit night. What helped JPL accomplish this technical feat is a process called target motion compensation. Once *Voyager* was within range of its target, the process

constantly corrected the view of the spacecraft as it moved, always presenting a consistent angle of view.

Synnott made his discoveries while guiding *Voyager* to perform the feat. To navigate the spacecraft, Synnott had to refer to fixed objects as reference points. He used stars of the ninth or tenth magnitude just a little fainter than can be seen by the human eye. He located them by using very sophisticated computer programs to sift through reams of optical and radio measurements sent back to Earth. The process subtracts the noise of interference and shows him where he's guiding lights are. In the process of filtering out the "noise," it can also turn up previously unknown objects, like moons, in the planetary system the spacecraft is approaching.

Using the information Synnott discovered the new moons—seven of them in a period of 20 days. He was able to fix their locations and then predict where they should be when *Voyager* aimed its lens and began taking photographs.

His first lunar discovery, temporarily called 1985 U1, has also been his largest. It measures about 160 kilometers in diameter and orbits about 53,000 miles from Uranus. It is an extremely dark object, with an albedo or level of light reflection of about 5 percent—a reflectivity less than that of a lump of coal. The smallest of his new discoveries is a tiny satellite measuring about 30 miles across.

The next task is to give these satellites permanent names. Officially that is done by the International Astronomical Union (IAU), an organization of the world's leading astronomers. Among its other duties, the IAU sets the world standards for astronomical measurements and is in charge of naming newfound sky objects.

There is a well-prescribed protocol for naming astronomical objects, but the nature of the *Voyager* discoveries was to change that somewhat. At one time a moon had to have a determined orbit in order to qualify for a name. Because the flyby of *Voyager* was so swift, the objects could be photographed, but their orbits could not always be plotted. This was the topic of much controversy at the last IAU General Assem-

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Seven new moons have been found orbiting Uranus and beyond the rings of Uranus. What shall we call them?



CONTINUUM

CHALLENGER AND THE SOVIETS

There is a kinship, perhaps stronger than blood, that links men and women who share the same dangers. This kinship cuts cleanly across the barriers of politics and nationality, as evidenced by the Seventh International Man in Space Symposium, in Houston, Texas.

The Soviets sent a delegation to this conference—the first Soviet space scientists to visit the United States since the space-shuttle tragedy in January. Among the delegates was Dr. Oleg Atkov, the cosmonaut/physician who currently shares the duration record for a single spaceflight—237 days aboard the Soviet space station Salyut 7. After the opening remarks Dr. Atkov asked the moderator if he might briefly address the gathering.

Sharon Christa McAuliffe, began the Russian cosmonaut, looking out over an audience that included many American astronauts, "after being chosen for the crew of Challenger, said, 'My head is still in the clouds.' She never returned to Earth. No one from the Challenger crew will ever return to Earth, ever again.

"This tragedy has caused us great anguish, both in our souls and in our hearts. It is impossible to accept these losses we empty have no right. Allow me, in the name of the Soviet delegation, from my cosmonaut colleagues and my crew, to express deep sympathy to the families and friends of my departed colleagues. Let our joint work serve as a memorial to them. This work shall bring the peoples of the earth peace and happiness."

They were simple words but heartfelt. Atkov had briefly drawn aside the iron curtain of professionalism and politics to let us glimpse the sorrow of Russian cosmonauts at the loss of seven American space travelers. After a few moments of silence, the audience exploded in emotional applause.

Later Atkov stood outside the conference room, surrounded by a tight knot of people discussing the feasibility of a space rescue if a shuttle were crippled in orbit, it's doubtful whether NASA could ready another shuttle in time to save the crew. The Soviet Soyuz spacecraft also takes time to prepare for flight. In an emergency our only hope might be each other. The United States and the Soviet Union agreed an agreement in 1972 to lend such assistance, but it has long since lapsed. The group agreed that today an international rescue might depend on the prevailing politics at the time of the emergency.

Could one side rescue the other? "Yes," said Dr. Atkov. "We have

the hardware." During the Apollo/Soyuz last program, the United States and the Soviet Union developed a docking adapter that would link the countries' spacecraft. If that adapter is now obsolete, space travelers can be transferred from the shuttle to Salyut (or from Salyut to the shuttle) EVA—through open space using space suits. Yet space missions are extensively rehearsed in advance. A lack of training might doom a complex rescue effort. Should the United States and the Soviet Union train together for such a contingency?

It was a hard question for Atkov. There were political ramifications if he answered simply yes or no. The American press was listening, and not far away stood a chain-smoking Russian delegate whom many of the Western attendees guessed was the "political officer" sent to shepherd the Soviet scientists.

After pacing back and forth for a few tense moments, Atkov found the diplomatically correct phrasing for what he wanted to say. "The more we do in space together," he told the group, "the more both sides will benefit."

Back inside the conference room, Atkov found himself on an international panel of astronauts and cosmonauts, shoulder to shoulder with U.S. Senator Harrison Schmidt. The panel optimistically discussed the details of a joint American/Soviet manned mission to Mars, as if the spaceship had already been built and there remained nothing left to do but pick the crew.

Crew selection, they all agreed, is critical to the success of the mission. How do you ensure that a small group of people—eight to ten men and women—work together effectively in close quarters for the 18 months required to visit the red planet and return? Most of the panel commented that besides being qualified, the crew members must already be good friends.

Atkov disagreed. Friendship is not necessary for success. "We have a saying in Russia," he explained, "that these people must eat a pound of salt together." The Mars crew should we ever clear the political barriers that prevent it from leaving, will share many meals, many experiences, many dangers.

"But it is not essential that they be good friends," Atkov continued. "What is essential is that they respect one another as men and women, as professional space scientists, without regard to politics or religion or who is the capitalist and who is the communist." —DONNA CHESHIRE AND NICK ENGLER



CONTINUUM

MORE THRILLING THAN SEX

If a night of passionate overmaking is for you life's greatest thrill, you're in the minority. According to Stanford University pharmacologist Avram Goldstein, sex produces physical sensations described as "thrilling" for only about 70 percent of the 750 people he surveyed, while other thrills ranked much higher.

For the purposes of his research, Goldstein defined a thrill as a special feeling—like a tingling sensation or a chill—that accompanies a sudden change in mood or emotion. Some of the biggest thrillers, his research subjects claimed, are great beauty in art or nature and stirring scenes in movies, plays, ballets, or books. Rated even lower than sex as thrill producers are perfumes, sports events, and fast on the fast watching parades. The biggest thrill of all? Musical passages, which reportedly produce thrills in

96 percent of the survey's respondents.

A specialist in brain chemistry, Goldstein conducted the study to learn more about the interplay between music and psychological responses. In a now-classic experiment, he found that some people who are stirred by music frequently report thrills each time they hear a particular passage played. But when Goldstein gave some volunteers naloxone, a drug that blocks endogenous opioid peptides—certain opiate-like substances in the brain—it seemed to take the tingles and chills out of music for some listeners.

"On the basis of what we know about morphine and related drugs, which probably act on the same receptors in the brain as the endogenous opiate peptides, it's reasonable to believe that opiate peptides are in part responsible for what we subjectively call thrills," notes Emory University pharmacology professor Stephen Houtman. "And it is very

possible, as Goldstein's research suggests, that music is one of the things that brings those peptides into play."—Sherry Baker

HEART PATCH

Even before they're perfected, artificial hearts may be obsolete. In two years, doctors at the University of Pennsylvania will be able to build a spare heart from the patient's own flesh. Ahead: they can patch a damaged heart like a tire.

Surgeon Larry Stevenson got the idea seven years ago. When the heart goes bad, why not use another muscle to repair it? He chose the latissimus dorsi, a back muscle the same size and shape as the one that forms the heart's main pumping chamber. A small piece can replace damaged tissue. Wrap the whole "lat" on a conical form and you have a biopump that can take over for a failing heart. A pacemaker keyed to the patient's own rhythm makes sure the patch or pump beats when the heart does.

Making it work was not easy. The heart pumps 70 times a minute as long as you live. Other muscles collapse after a few minutes at that pace, as would-be heart builders had already found out. In the end, Stevenson tried an old idea. "Physiologists found it twenty years ago but never put it to practical use," the surgeon says. "Before implanting skeletal muscle, we stimulate it with electrical pulses like those of the cardiac nerve. The muscle itself changes,



New approach to heart surgery: Just patch it like a tire.

and its fatigue resistance goes way up."

It seems to work. Already the patch has helped save a woman with a heart tumor and a man whose heart was badly scarred.

So far the artificial ventricle has been tested only in dogs, working reliably for up to a year. It won't ever replace the human heart completely, Stevenson says. The heart pumps five to seven liters of blood per minute, while a human-size biopump will move only about two liters. But that alone could save 50,000 lives per year.

"Half the people with congestive heart failure die within a year of diagnosis, according to Dr. Ray Chiu, who devised the pacer. Stevenson uses. "The rest are in the emergency room every few weeks because their hearts are pumping only three or four liters per minute if we can give them an extra two liters, we'll be doing them a great service."

—Owen Davies



Does this look like fun to you? Maybe so, but brain-ops studies show that you're better off going to a nice concert or ballet.

ORGASMIC CAREER WOMEN

Does a woman's career with her husband's sexuality? It was a question people kept asking psychologist Constance Avery-Clark, so she undertook the first-ever study of the sexuality of dual-career couples.

The results? Men married to career women do just fine—and their wives reach orgasm easily.

Avery-Clark analyzed the files on 218 couples (not necessarily typical of the general population) who underwent therapy at the Masters and Johnson Institute in St. Louis between 1979 and 1985.

She looked for differences in the frequency of various types of sexual problems in three different types of couples: those in which the wife was not employed, worked at a job primarily to bring in money, or had a career, an evolving form of employment that she regarded as a major source of

satisfaction in her life.

Avery-Clark found that indeed, the wife's employment status did correlate with significant differences in sexual problems. Husbands married to women who worked had a lower, not higher, rate of impotence than the husbands of housewives. Thirty-six percent of the men married to housewives had trouble getting or sustaining an erection, as compared with 22 percent of the men married to career women and 16 percent of those married to job women.

What's more, career women had orgasms more easily than other the job women or the housewives. Only 17 percent of the career women complained of orgasmic dysfunction, compared with 29 percent of the job women and 25 percent of the housewives. Twenty-two percent of the career women, however, complained of inhibited sexual desire—they had trouble getting in the mood in the first

place—while only 11 percent of the job and nonworking women complained of this problem.

Dual-career couples, this preliminary analysis suggests, have more fun, less often. Avery-Clark is still analyzing the data for other factors that may be relevant: the husband's work status, for example, and whether the couple has children.

"The reaction I've gotten so far is fascinating," Avery-Clark says. "People don't pay attention to the data on orgasms. They don't pay attention to the data on impotence. They only pay attention to the information on inhibited sexual desire, which gets interpreted as 'Career women are less interested in sex.'" —Loish Wallach

HEMORRHOID PISTOL

Hemorrhoids are one of the most embarrassing of the medical afflictions that plague men. But quick relief for this painful condition, in the guise of a pistol-like device that

fires a beam of infrared light, is said to have arrived on the scene.

"This should become the first-line method for treatment of hemorrhoids," says rectal surgeon John O'Connor of George Washington University in Washington, D.C., a pioneer in use of the infrared technique, "because it is effective and inexpensive, it is done on an outpatient basis, and in comparison with other procedures the treatment is painless."

To use the device, O'Connor explains, it's narrow, foot-long barrel (or light guide) is gently pressed against the hemorrhoid and the trigger is squeezed, causing a quick burst of intense infrared light that shrinks the hemorrhoid, leaving a small scar in its place. The entire procedure occurs in the doctor's office, lasts a maximum of 15 minutes and permits the patient to return to work the same day. Cost starts at \$150 and ranges up to \$400 if several visits are needed.

The new technique, known as infrared coagulation, helps patients avoid \$2,000 surgery, O'Connor says, and it does away with the discomfort of widely used rubber-band ligation—constriction of the hemorrhoid to dry it up. Already several hundred doctors in the United States are treating patients with the new device.

"Anyone familiar with rectal surgery and the other non-surgical procedures for treatment of hemorrhoids," O'Connor says, "can learn to use it right away."

—Eric Nehara



What percent falls in the reticent camp of career women? A new study indicates that despite popular belief, dual-career couples have a very good time together—provided they can get in the mood.



CONTINUUM



Diver Applies Hycote paint to a hull underwater. The resulting coat is so hard that barnacles purportedly can't penetrate it.

WET PAINT

If you want to paint your boat, don't bother to haul it out of the water and put it in dry dock. An Australian inventor has come up with a way to paint it while the hull is still in the water.

"People just don't believe it till they see it," says Bill Henderson, chairman of Underwater Technology, the Perth company that recently showed off the system at a conference in Houston. A can of paint, a power brush, and a few sheets of metal were submerged in a fish tank. People tried it out and were "amazed," he says. When the paint stuck firmly to the metal in a hard gloss and the unseal paint stayed in the pot all day without dispersing. After six hours the water was still clear.

The two-part epoxy resin paint was developed by a Perth chemist, Barry Rogers, 14 years ago to paint concrete swimming pools without having to empty them. But it wasn't until last

year that a suitable, computerized way of applying it was developed, mixing and delivering the ingredients at the right temperature.

Underwater paints had been developed before, but they didn't set very hard and "had to be applied in big dollops with a furry mitt," Rogers says. The secret is in the chemical structure of the paint, called Hycote, which produces a reaction that eliminates all air and moisture between the surface to be treated and the paint. "It's the first that is durable, inhibits rust, and resists fouling," he claims.

Best of all, the resulting coat is so hard and polished that barnacles can't penetrate it, and even big ones can be brushed off with the palm of the hand. "A ship traveling fifteen knots will clean itself," Rogers says. This is a leap forward in its own right because the toxins in self-polishing paints now used to keep hulls clear are being banned around the world as threaten-

ing to the environment.

The paint is already being used on barges and will soon be applied to docks in Perth. But how about using it for the Australian yacht defending the America's Cup off Perth next year? No good, says Rogers. Racing yachts need a roughened surface like a sharkskin to produce the air bubbles on which they slip through the water at high speeds. But it would be "boast" for family yachts, he says, and on bigger ships it will dramatically increase fuel efficiency. —Anthony Livingside

"One humiliating thing about science is that it is gradually filling our homes with appliances smarter than we are."

—Anonymous

"No storms casually together hurled/Could ere produce so beautiful a world."

—John Dryden

HOSPITAL PETS

When an eighty-five-year-old surgery patient was recently visited in the hospital by her rather large Doberman, the old woman perked right up, and so did her dog.

The touching reunion took place in the so-called pet room, an innovation in hospital visitation recently instituted at the Swedish-American Hospital in Rockford, Illinois.

The pet room, actually a converted bathroom now sporting animal decorations and a dog bowl, was opened at the suggestion of nurse Vickie Fuhus, who had

already snuck one pet pooch into Swedish-American to visit its hospitalized master.

A visit by a pet, Fuhus says, boosts the morale of its owner—patient, possibly enhancing medical recovery. "All some patients have," she says, "is their animal. Just seeing that the animal is okay and being taken care of has a positive effect."

As of this writing about ten pets, all of them dogs, have successfully visited in the pet room, according to hospital spokesperson Jan Hagenlocher. And in the future the hospital will entertain the possibility of visits from exotic pets. "If we get an elephant," she cautions, "of course we'll have a problem because the room isn't large enough. We might have to use the back parking lot!"

—Eric Mahars

"The primary obligation of intelligence is to distrust itself."

—Stanislaw Lem



A timely visit from one of our pet can perk up a hospital patient.

BLUE LOBSTERS

For 12 years, Anthony D'Agostino has pursued the wily blue lobster—with varying degrees of success—up and down the Atlantic seaboard. Finding one is a 1-in-30 million proposition, which is why he relies upon the generosity of donors.

D'Agostino needs these mutant decapods because he runs a genetic study called the Blue Lobster Project at the Osburn Laboratories of Marine Sciences at the New York Aquarium in Brooklyn. He launched the project in the early Seventies in the hope that somehow he could introduce new genes to a genetic pool of lobsters, which generally come in an unattractive shade of mottled brown.

Ever since, he's sought animals that come in orange, red, yellow, and especially blue, acting on the theory that by cross breeding mutant strains, he could eventually

develop a hardy, fast-growing species of the animal that would be of immense value to the lobster farmers of the future. If he can, it would be a tremendous shot in the arm for the nation's infant aquaculture industry.

Blue lobsters may be hard to come by, but the D'Agostino project is now so well known among North Atlantic lobstermen that he was recently given one rare blue, a yellow, and three reds bagged by a pair of Nova Scotia fishermen.

"No, we don't pay for them," explains D'Agostino. "Most lobstermen know how important the research is and what it means to them. All of the lobsters we get [the rare colors] are of genetic value. Selective breeding could provide a storehouse of information about their heredity, brood stocks, and disease control."

Most of D'Agostino's lobsters, some 300 now live in an integrated hatchery at Montauk, New York. How blue are the scientist's ten-legged prizes? "Royal blue," he says. "True blue."

—George Nobbe

"Dreams are real while they last. Can we say more of life?"

—Havelock Ellis

COPYCAT SUICIDES

Marilyn Monroe committed suicide on August 6, 1962. Freddie Prinze, on January 29, 1977. Their deaths and those of other celebrities, a researcher says, have been followed by significant nationwide jumps in suicides



Marilyn Monroe: Her suicide, like the suicides of many other celebrities, helped spark a national surge in self-destruction.

Less celebrated people's suicides, though, had no such impact, says the researcher, sociologist Ira Wiseman of Eastern Michigan University, who has statistically analyzed how the suicides of Monroe, Prinze, and 45 others (all of which made the front page of *The New York Times*) affected the national suicide rate.

"When celebrities kill themselves," Wiseman says, "the number of suicides during the next month increases. On the average, one hundred sixteen more people than expected kill themselves."

Thus, in the month following Prinze's death there were 2,315 suicides nationwide—116 more than would have otherwise occurred.

But sociologist Steven Stack, of Alabama's Auburn University, who has analyzed the impact of more than 100 suicides that were covered on TV network news, found that while the suicides of famous people did indeed give rise to significant in-

creases in the nation's suicide rate, the suicides of everyday people (such as distraught Vietnam veterans whose deaths received TV play) prompted even greater increases. The implication of this being that national media exposure of a suicide, rather than the victim's celebrity status itself, has the most adverse impact.

"The copycat behavior," Stack says, "is seen essentially among people who are already suicidal. Some of them identify with celebrities, others with plain folks."

And, he says, most of the copycats are male.

"It may be that males are more impulsive than females," he speculates, "or much more lethal in their suicidal behavior." —Eric Mishers

"Nobody ever forgots where he buried the hatchet."

—Kin Hubbard

"The artist is a member of the insured classes, who cannot pay for his leisure."

—Cyril Connolly



Most lobsters come in a drab shade of mottled brown.



CONTINUUM



Buckminster Fuller felt that domes made up of linked hexagons or pentagons reflected a universal formula for integrity. Now scientists have created a molecule with precisely the same structure.

BUCKMINSTER-FULLERENE

Buckminster Fuller was always convinced that the shape of his domes—spheres made up of linked hexagons or pentagons—reflected a sort of universal formula for structural integrity and strength. Now a cooperative effort by British and American chemists has produced an elegantly beautiful molecule that is shaped exactly like one of Fuller's famous domes.

Called buckminsterfullerene ("Fuller," explains University of Sussex chemist Harry Kroto, "was a hero of mine"), the molecule was produced by evaporating solid graphite with a high-pulse laser, then cooling the vapor by expansion—a process developed by Rick Smalley of Houston's Rice University. When Kroto, Smalley, and their colleagues analyzed the resulting fragments, they found that some of the flat flakes of carbon atoms produced by the laser blast—

flakes that looked like the hexagonal links of a chicken-wire fence—appear to have been converted to pentagonal figurations, which then joined and curled up on themselves to form a beautifully stable, fullerene-like sphere composed of 60 carbon atoms.

The new molecule, says Kroto, should have some interesting properties. It should conduct electricity at low temperatures and, if linked synthetically with fluorine, could be a superb lubricant. Since soot particles appear to be shaped very much like buckminsterfullerene, Kroto thinks that a thorough understanding of the new molecule could lead to a solution of the problem of soot formation in diesel engines.—Bill Lewnes

"Nothing in physics seems as hopeful to me as the idea that it is possible for a theory to have a degree of symmetry which is hidden from us in ordinary life."

—Steven Weinberg

THE BRAIN AND IMMUNITY

Forget hypnosis, imaging, deep relaxation, and the power of positive thinking. Soon you may be able to get your mind to rev up your immune system the easy way, with drugs that act directly on the brain.

Dr. Bernard Rancoux of the Medical School of Tours, France, has found that at least one major component of the immune system is regulated by the brain's neocortex and that each of the brain's hemispheres plays a different, specialized role in the process.

Rancoux stumbled on the brain-immunity link while experimenting with methylol, a sulfur compound that stimulates the immune system. The drug had a curious side effect: "It acts as a mood relaxant in animals and humans," he explains. "The only possible explanation was that it was working through the central nervous system." A search through

neurological literature strengthened the hypothesis. There are numerous clinical reports of lowered immune response in head-injured patients who have lost function in the neocortex, the part of the brain responsible for complex perceptual and motor skills, thought, and imagination.

Rancoux brought out the sacrificial mice. Chunks of either the left or the right side of the rodents' cortices were removed. Happily for the mice, their gross behavior—eating, drinking, mating and moving—was unchanged, but the surgery did affect a group of immune cells called T cells.

The total number of T cells in the spleen and lymph nodes, where foreign matter collects, diminished in the mice that were missing a piece of the left hemisphere. Removal of right cortical material had the opposite effect: T cell activity was actually stimulated. Immunofluorescent restored normal immunity to the mice who had left brain surgery and made them more mellow as well.

"The left cortex increases cellular immune response," Rancoux concludes. "The right cortex controls what the left is doing, repressing excessive or undue immune activity." To Rancoux this makes philosophical sense: "The central part of the brain is the piece that controls our knowledge of the external world," he says. "It always believed the immune system is also a way to know the world, to discard what is dangerous and to keep what is useful."—Leah Wallace

FISH AND CHIPS

British scientists have come up with a high-tech twist to their national dish, fish and chips. Instead of cooking their catch, they now toss it back into the ocean along with a microchip.

It's a new way of monitoring the movements and habits of cod and plaice in the fish-rich North Sea. Individual fish are fitted with acoustic tags, no bigger than the eraser on a pencil, which transmit sonar signals to a tracking vessel. Powered by tiny mercury cells, they have a range of only 400 yards and a life span of less than a week.

But they're providing information about the humble cod and plaice that no one knew before. Scientists can establish their migratory patterns and work out their growth rate and need for food, researchers even discovered that the fish's heart skips beating for a while

when it's threatened by the noise of a trawler overhead.

And they've finally solved a centuries-old mystery of the sea: Where does the plaice, a flatfish, disappear to every day?

"Fishermen have always believed the plaice was a bottom-living fish," explained one British government expert. "They could never understand why their bottom trawlers came up empty so often."

"But thanks to the sonar tags, we've discovered that migrating plaice spend fifty percent of their time halfway between the surface and the seabed. They hitch a ride on a favorable tide then dive to the bottom again." —John Cooke

The wise man looks into space and does not regard the small as too little, nor the great as too big, for he knows that there is no limit to dimensions.

—Lao-tzu



Where do North Sea cod hang out when they're not being cooked by fishermen? Acoustic tags are now revealing their secrets.



Burns are routinely treated with creams and ointments, but doctors in Russia are using alternating currents of hot and cold air.

AIR FOR BURNS

Using himself as a test case, a Soviet engineer has devised a way to treat severe burns without the dangerous aid of creams or ointments. Indeed, Grigori Antonenko of Odessa dry-cures even the worst third-degree burns simply by applying alternating currents of hot and cold air.

Antonenko had fallen victim to an industrial accident, which left him badly burned over 80 percent of his body.

Because the use of creams greatly increases the risk of serious infection in cases of extensive burns—the warm, moist environment created by the creams is like a living nursery for opportunistic bacteria—doctors decided to leave Antonenko Vaseline-free. By chance his bed was in the direct path of a draft from the room's temperature-control system. Somehow, the engineer noticed, the air current was making his burns feel better. Intrigued, Antonenko

later developed an apparatus in which a burn patient could be enclosed in a pressure chamber while dry blowers caressed his wounds with hot and cold air currents. Once perfected, the device was used successfully to cure a Russian worker who had suffered third-degree burns over 70 percent of his body. Because the dry-cure is painless and greatly reduces the risk of infection, Soviet physicians are predicting that in severe burn cases it may become the treatment of choice.

—Bill Lawton

"The logic comes from the accusation of the insignificant."

—Max Apple

"Reality is often inaccurate."

—Douglas Adams

"Starting at Gilemeash and reading forward, I find no evidence that consciousness has ever been a comfortable experience."

—Merilyn Robinson



CONTINUUM



Sabotaged customer yelling into his Scream Muffler. The device saved a family of screamers from being evicted from their apartment.

SCREAM MUFFLER

Although the stress-releasing benefit of letting loose with a loud scream is widely recognized, polite society still frowns upon such behavior—at least when exhibited outside of sports arenas or the therapist's office.

Now, though, a new invention permits the loathing individual to scream at the top of his lungs yet escape detection by nearby people in the office, home, train, or on the street.

Scream Muffler, a grapefruit-size, silver-colored sphere, opens up to an inside of contoured acoustical foam that fits over one's screaming mouth. The sound-absorbing sphere is guaranteed to muffle even the most raucous and piercing screams, lowering volume to the undisturbive level of polite conversation.

"While this is a novelty item and the concept is funny," thirty-five-year-old Diane Berkowitz, Scream Muffler's inventor, says, "it does really

work. I tested all the different acoustic foams available before I found one that muffles screams effectively."

So far, Berkowitz claims, she has sold 10,000 of her invention to customers who include therapists, executive boards of major corporations, and a family of screamers that was afraid of being thrown out of its apartment. The device costs \$10, from Screamers Incorporated in Watertown, Massachusetts.

"The price," Berkowitz says, "is quite a bargain compared with the cost of tranquilizers or alcohol."

—Eric Mishara

"I am tired of this thing called science. We have spent millions in that sort of thing for the last few years, and it is time it should be stopped."

—Senator Simon Carrison, 1901

"My friend, all theory is gray and the golden tree of life is green."

—Johann Wolfgang von Goethe

SCIENCE-FICTION QUIZ NO. 12

While everyone cheers for the hero and heroine, no rousing science-fiction tale is complete without a villain. Described below are five of the nastiest. Can you identify them and the stories in which they appeared?

1. For more than 50 years he schemed against the "Sky-lark," but in the end he was on the right side.
2. The only Star Trek villain to be in both the TV series and one of the movies.
3. He ruled a great planet, but his schemes for conquering the universe were eventually thwarted by an ex-football player, his girlfriend, and a clever scientist.
4. Mix the Oedipus myth with Sebastian's Scaramouche and you have a forceful villain who manages to be forgiven at the very end.
5. He arose from the same culture as the Doctor but used his training and great knowledge either to conquer

or destroy the universe, as his whim dictated.

—Ben Bove

ANSWERS

1. Why? (Reverend) Smeagol
2. The Master, from the Dr. Who series
3. Emperor Ming of Mongo
4. Captain Jack of the Star
5. Raymond from East Gordon, by Alex
6. Emperor Ming of Mongo
7. Khan Noonan Singh
8. Smith's Daytime series
9. Dr. Doom, Iron E. [Doc]
10. Mantic (Blackstar)

"Deep within the void most scientists do not want to believe the first of Genesis."

—Sir Fred Hoyle

"Every man with a belly full of the classics is an enemy of the human race."

—Henry Miller

"To be able to fill [someone] intelligently is the last product of civilization."

—Arnold Toynbee



The ruler of a great planet, this villain schemed to conquer the universe but was ultimately thwarted by an ex-football player.



The antenna searches the heavens for alien life, thanks to a new breed of activist

MISSIONARY POWER

BY RICHARD WOJ. KOMIR

Sitting like angels, two white-suited astronauts float above the skeletal, gaping cargo bay. Tethered to the spaceship by spiderweb strands, they assemble a pyramid of glittering aluminum tubes in a slow-motion ballet, all the while gliding across the earth's titanic face.

The scene unfolds on a huge video screen in a darkened room in Cambridge, Massachusetts, as 17 space enthusiasts watch intently. MIT astrophysical engineer Robert W. Weir, who helped design the experiment in space construction, explains what is happening on the screen. "The Bu output of that guy on the bottom corresponds to feet jiggling, according to our instruments," he says. "And the output of the guy on the top is equivalent to a slow dip."

If Weir seems oblivious to the eerie poetry of humans in space, those in the audience seem even more blasé. "How heavy is the structure?" asks one intrepid young man with neatly brushed brown hair and a yuppie designer sweater. "Who's so mass?" asks a man with jeans, a plaid lumberjack shirt, and a beard. "Does the guy in the cargo bay have his foot in a rebar?" or is he floating free?"

These viewers, members of a pro-space

PHOTOGRAPHS BY DAN MCCOY



group called the L-5 Society appreciate the glowing sponsor, the blue-and-white Earth as seen by God. But with technical back grounds in fields from computers and astronautics to aircraft design, they are too serious about extraterrestrial development to concentrate merely on aesthetics.

This meeting of the Boston chapter of the L-5 Society illustrates trends taking hold across the United States. Back in the fabled Sergeant Pepper days of the Seventies, officials of the national L-5 Society testified before Congress wearing Star Trek uniforms and waving plastic ray guns. But today the Boston group meets in MIT's Artificial Intelligence Laboratory courtesy of the lab's head, Marvin Minsky, a member of L-5's board of governors. And there are nearly 50 pro-space organizations boasting similar respectability. With an aggregate budget of \$30.5 million, these groups sponsor real research, including the search for extraterrestrial intelligence and the development of new spacecraft and orbiting colonies. And they have significant political clout, with the ability to influence a congressional vote or funnel large sums of money to various NASA programs. Now for instance, some groups are spearheading a fund-raising drive to replace the shuttle Challenger.

Today, according to writer Rudy Bell, the movement's unofficial sociologist, space enthusiasts have formed all sorts of groups for all sorts of reasons. The World Space

Foundation, for example, is developing the solar-sail propulsion system. The Independent Space Research Group is building the orbiting amateur space telescope. The American Space Foundation is lobbying for a manned U.S. space station. To encourage female involvement in space, there's a group known as the Hypatia Cluster. And the International Association of Astronomical Artists was formed especially for artists interested in depicting outer space.

With a collective membership of 300,000, the groups reflect a growing public bullishness on space development. As Alan Wasser, a board member of the L-5 Society, puts it, "Most of us believe that our species must experience the habitat of space."

If the pro-space groups have an ancestor, it is the German Society for Space Travel of the Twenties and Thirties. A magnet for German scientists, engineers, and ordinary citizens, a mix of zealots and the notion of flying through space, the society accommodated the young and zealous Wernher von Braun. Years later, after Von Braun had masterminded Germany's V-2 rocket program, the gaspbo arrested him and charged him with using his military work as a front for his real interest—space travel.

Following the war, the U.S. government imported Von Braun to aid the American race for space. He very presence in this country acted like a "spacophile" gene spliced into the nation's collective chromosomes. The

space took. Space, after all, is a frontier and frontiers have always galvanized our national will.

It was Von Braun's rocketry genius that opened the new wild west, located straight up. In the late Forties he created the country's big booster rockets. During the Fifties, serving as a tireless promoter of spaceflight, he wrote popular articles and lectured nationwide. Some scientists dismissed his notion of humans traveling in space as fantasy. But on October 4, 1957, the Soviet Union launched Sputnik 1. Spirited to action, the U.S. government unleashed Von Braun. On January 31, 1958, he and his group sent up Explorer 1, the first U.S. space satellite. In the Sixties they developed the huge Saturn boosters, the first-stage rockets that carried spacecraft heavenward for years. Boosters in place, it was only a matter of time before the advent of the manned "night shift" missions—Mercury Gemini and Apollo—culminating when Neil Armstrong stepped onto the moon in July 1969.

We had become a spacelaring species. But for the average civilian, space was still the preserve of military men, test pilots and heroes. Then, in 1974, harking back to his own youthful romance with the German Society for Space Travel, Von Braun founded the National Space Institute to encourage public support of the U.S. space program. Von Braun's group was too closely tied to NASA and the aerospace companies to give



"Imagery, Congressman Sledge: this passenger section was personally designed by Senator William Proxmire."

members the sense that they themselves could leave for the stars anytime soon. But the group was a start, and before long new organizations sprang up.

In 1973, for instance, enthusiasts started the L-5 Society named for the point where the earth's and moon's gravities cancel, making it ideal for a space-colony site. And in 1976 the American Society of Aerospace Education, later to merge into the Aerospace Education Association of America, emerged as a forum for aerospace teachers. That group was followed, in 1978, by the Planetary Society and the Progressive Space Forum, which worked for international cooperation in space. Write Now was created in 1980 to prod citizens into writing space-advocacy letters to congressional representatives. And in 1984 aerospace professionals formed the American Interstellar Society to encourage space entrepreneurship.

One activist reaching for the stars today is Todd Hawley. Five years ago, as an economics major at George Washington University, he picked up a copy of *The High Frontier*, the landmark book by Princeton University physicist Gerard K. O'Neill. Published in the early Seventies, the book offered a heady vision of huge, self-supporting colonies floating in space, complete with farms, forests, and soil recycled here that fell only late in the artificial night.

Not long after Hawley learned that the Princeton physicist said we could live in space. He read an article in *Cosmos* by Rudy Bell ("Space Achieve," February 1981) listing some of the new pro-space groups springing up. "I began dating groups, joined one, and went down to watch the shuttle launch," says Hawley. "Then I started my own group at George Washington University."

It didn't take Hawley long to merge his own group with other student-founded space groups at Princeton and MIT, creating a new national campus organization, Students for the Exploration and Development of Space (SEDS). "SEDS began as a protest for space funding," Hawley now says. "We were raised since birth as part of a spacefaring race, and it's in our vested interest to see that space develops." SEDS films and lectures give members on campuses throughout the United States and in five other countries, including the Peoples Republic of China, a sense of opportunities in space. "We talk about space law as well as rocket design," says Hawley. "Our members are not just engineers and techies."

SEDS has recruited the career of Hawley himself. Today, instead of being an economist, he is director of special projects for the Young Astronaut Council, a new organization that teaches elementary-school children about off-Earth voyaging. Already, says Hawley, they roster a 250,000-strong

But educational organizations are just the tip of the space-activist iceberg. Other groups, comprising mostly professional engineers and scientists, are developing new technologies for the human future in space.

At the Pasadena headquarters of the World Space Foundation, for instance, en-

gineers are refining a huge, shimmering kite-like structure called the solar sail. NASA initiated the sail, which is pushed through the solar system by photons from the sun, like a sailboat catching the wind. When NASA later abandoned the project, engineers at enthusiastic over-fueled solar sailing set up the World Space Foundation to develop the new technology privately. They hope to shuttle their prototype into orbit for a trial cruise shortly.

Meanwhile, in Princeton, New Jersey, the Space Studies Institute (SSI) is developing technologies needed to realize Gerard O'Neill's vision of orbiting space habitats. Because it is O'Neill's argument that large-scale construction in space will be economic only with materials found in space itself, SSI focuses on exploring the moon and asteroids. "Don't forget when the Pilgrims came to the New World they didn't bring lumber and bricks; they just brought axes and shovels," says Gregg Marynek, SSI's executive vice president.

◀ Back in the
funky Sergeant Pepper
days of the
Seventies, L-5 members testified
before Congress
wearing their Star Trek
uniforms and
waving plastic ray guns. ▶

In its Princeton workshop, SSI has a high-tech peashooter. Press a switch and pellets shoot out of a tube, accelerate down a black tube who toward a hanging target. A full-scale version of the electromagnetic "mass driver" mounted on the moon, would launch lunar rocks and soil into space, shooting them into what amounts to an orbiting catchers' net. Crews would use the soil to construct colonies housing as many as about 10,000 settlers.

Working in space with lunar soil requires other technologies as well. Rockwell International, an SSI subcontractor, has already developed techniques for extracting oxygen from lunar soil. Moon dirt is about 40 percent oxygen, a key component of rocket fuel, says Marynek. And oxygen is the gas of life in space.

SSI is also trying to transform the moon's rock and dirt into construction materials. Working under NASA contracts, corporations like Grumman have already produced "beam builders" that turn spools of aluminum ribbon into construction beams. Since aluminum's thermal properties are not really ideal for space, SSI has begun modifying beam builders to process lunar soil instead.

According to Marynek, lunar materials might even be used to supply Earth with energy. SSI has determined, he says, that engineers can convert moon dirt into virtually all components of the solar-power satellite, which changes sunlight into microwaves, the microwaves can then be beamed to Earth and converted cheaply to electricity.

Space groups today often try in such grand aims. And compared to such groups five years ago, they have the clout to make their dreams come true. For example, the largest group, the 100,000-member Planetary Society, founded by Carl Sagan and NASA's Bruce Murray, recently began conducting the world's most powerful receiver for detecting signals from alien civilizations.

On September 29, 1985, at Harvard University's Oak Ridge Observatory in suburban Harvard, Massachusetts, movie producer Steven Spielberg, with his infant son cradled in one arm, threw the switch that turned on META, the Megachannel Extraterrestrial Assay computer. Spielberg had donated \$100,000 to the Planetary Society project, which uses a specially programmed computer to monitor an 8.4-million-channel radio receiver (for more on the project, see Stars, March 1986.) Previously the world's most powerful SETI (Search for Extraterrestrial Intelligence) project, also operated by the Planetary Society, used only a 131,000-channel receiver. But even that equipment could accomplish in one minute a search that would have taken 1,000 years using the equipment of Project Gamma—the first SETI receiver, operated by Cornell astronomer Frank Drake in 1960.

While its META receiver hunts the millions of radio signals raining in from the cosmos, searching for one that is clearly artificial, the Planetary Society is busily flying some political fan, too. "Our major thrust now is promoting international cooperation in interplanetary science," says executive director Louis Friedman, a planetary scientist himself. As an example, he cites a society-sponsored U.S.-Soviet conference on manned flight to Mars, held last year in Austria. The society also recently helped U.S. scientists attend a SETI conference in the Soviet Union.

Other pro-space organizations are also dabbling in politics. "Not long ago a New York City congressman, Ted Weiss, was voting against every NASA budget," says L-5's Alan Weiser, who lives in Manhattan. "Every time he held a town meeting, though, our members stood up and argued that his votes against U.S. exploration and development of space were counter to the nation's and humanity's best interests."

Astonished, Weiss began to explain his vote. He had thought nobody in his district cared about space, but he knew there was decided opposition to a superconic transport (SST) project. And, although the SST project had been scrapped years ago, the NASA budget still retained a portion of SST funding. Weiss said he had voted against NASA to cut out that remnant SST funding. Finally he began to vote yea for NASA. "That

was our finest hour," says Wassler.

Nationally, L-5's finest political hour came in 1979-1981, when the organization led the opposition to a U.N. treaty on space development. "It had one phrase, the common heritage of mankind, which sounded wonderful but would have put severe limits on the use of space resources, particularly by private businesses," says Elsa Sisti Wynn, founder of L-5's Buffalo, New York, chapter. In effect, the innocuous-sounding language would have socialized outer space, setting up an international bureaucracy and making joint, intergovernmental undertakings by all the treaty's signatories virtually the only way to exploit extraterrestrial resources. In accordance with L-5's objections, the U.S. voted against the treaty.

The single space organization that has thus far wielded heavyweight political clout is High Frontier, founded by U.S. Army Lieutenant General Daniel Graham. It was Graham, former director of the Defense Intelligence Agency and a former adviser to Ronald Reagan, who first interested the President in the orbiting antimissile system. Partly as a result of High Frontier's continual lobbying, the country is now committed to spending billions on the Strategic Defense Initiative (SDI), nicknamed star wars.

Over the last few years, disputes over SDI gave the pro-space movement its own inter-ethnic star wars. While space groups like High Frontier are passionate advocates of

space weaponry, others—the Stop Star Wars Initiative, for instance—oppose it.

For most space activists, though, the issue has lost its lightning and thunder. That may be because most citizens debate SDI in terms of its effect on the chances for nuclear war, its price tag, its workability. But activists regard SDI from a perspective all their own: Will it slow or speed the development of space?

Most are perfectly willing to share the void with a floating arsenal, if only they can get up there themselves, and soon. "It's changing the space program in some ways for the better, and we're not necessarily for or against it," says SS's Maryniak. "Were in favor of any space R&D, but we're not militarily oriented," says Glen P. Wilson, executive director of the National Space Institute in Washington, DC.

"Today fictionalism is waning in the pro-space movement at large. In the works right now, for instance, is a merger between the National Space Institute (NSI), the movement's graybeard, and the L-5 Society, once the pro-space movement's Yippies. "Our interests have converged," says Wilson. "There's lots more to do in space than colonies and settlements, and they've come to see that. A space station is the next logical step, for instance. When they started out it was, 'Build a colony right now! They certainly have matured.'"

Cutting across the categories, the activ-

ists explain, is a single urge: moving humanity into space. Even High Frontier, with its military roots, has more in mind for space than a zero-general. "We'll be pushing for a Free World Space Academy," says Dan Graham, whose students can earn degrees in such subjects as space engineering, space mathematics, and space law. The academy would be for the entire free world, he adds. "It would top all the great enthusiasm for space I've found among young people in America, Europe, and Japan."

Indeed, it's that unbridled enthusiasm, paired with an almost mystical yearning to leave the earth, that seems to be the key. "Nobody gets without having a personal vision of what he'd like to see happen in space," says Gary Olson of L-5. "Now, by NASA's amo schedule, I'll be eighty by the time they set up their first moon base; that doesn't please me."

Jim Bowers, a San Diego specialist in computer-based communications and an activist in several pro-space organizations, believes the space groups express a pent-up urge. "I think humanity is in its late adolescence, exploring our home's resources in preparation to going out to earn our own way," he says. "Earth created humans to extend life off the earth."

The desire to hitch up the rocket wagons and begin the trek to a new frontier seems to be infecting the general public as well. When the shuttle *Challenger* exploded in

continues on page 100



"Once, just once, I would like to see you make a decision and stick to it."

FICTION

*Every body is a
book of blood. Wherever we're
opened, we're red.*

THE BOOK OF BLOOD

BY OLIVE BARKER

The dead have highways.

They run, intersecting lines of ghost
trains, of dream canyons, across the
wasteland behind our lives, bearing an
endless traffic of departed souls. Their
dreams and terrors can be heard in the
broken places of the world, through cracks
made by acts of cruelty, violence, and
depravity. Their light, the wandering
dead, can be glimpsed when the heart
is close to burning and a light that should
be hidden comes plainly into view.

They have signposts, these high-
ways and sidings and lay-bys. They
have landmarks and intersections.

It is at these intersections, where the
crowds of dead mingle and cross, that
the forbidden highway is most likely to
split through into our world. The traffic is
heavy at the crossroads, and the voices
of the dead are at their most shrill. Here
the barriers that separate one reality
from the next are worse than with the
passage of measurable feet.

Such an intersection on the highway
of the dead was located at Number
Sixty-five, Tollington Place. Just a two-
fronted, mock-Georgian detached
house, Number Sixty-five was un-
remarkable in every other way. An old, for-
gettable house, stripped of the cheap

grandeur it had once had down to, it had
stood empty for a decade or more.

It was not rising damp that dove ten-
ants from Number Sixty-five. It was not
the rot in the ceiling, or the subsidence
that had opened a crack in the front of
the house that ran from doorstep to
eaves. It was the noise of passage.
In the upper story the din of that traffic
never ceased. It cracked the plaster on
the walls, and it warped the beams. It
rattled the windows. It called the mind,
too Number Sixty-five, Tollington Place,
was a haunted house, and no one could
possess it by day without assuredly sit-
ting in. At some time in its history a hor-
ror had been committed in that house.

No one knew when or what. But even to
the untrained observer the oppressive
atmosphere of the house, particularly the
top story, was unmistakable. There was
a memory and a promise of blood in the
air of Number Sixty-five, a scent that in-
gaged in the senses and turned the
strongest stomach.

The building and its environs were
shunned by vermin, by birds, even by
flies. No wood lice crawled in its kitchen,
no starling had nested in its attic. With-
out violence had been done there, a
had opened the house up, as surely as

PAINTING BY ETIENNE SANDORFI



a knife slit a tibia belly, and through that out the wound in the world, the dead passed out and had their say

That was the rumor anyway

It was the third week of the investigation at Sixty-five, Tollington Place. Three weeks of unprecedented success in the realm of the paranormal.

Using a newtowner to the business, a twenty-year-old called Simon McNeal, as a medium, the Essex University Parapsychology Unit had recorded all but incontrovertible evidence of life after death.

In the top room of the house, a claustrophobic corridor of a room, the McNeal boy had apparently summoned the dead and at his request they had left copious evidence of their visits, writing in a hundred different hands on the pale ochre walls. They wrote it seemed, whatever came into their heads. Their names, of course, and their birth and death dates. Fragments of memories and well-wishes to their living descendants, strange elliptical phrases that hinted at their present torments and mourned their lost joys. Some of the hands were square and ugly, some delicate and feminine. There were obscene drawings and half-finished jokes alongside lines of romantic poetry. A body drawn rose. A game of roughts and crosses. A shopping list.

The famous had come to this wailing well—Mussolini was there, Lennon and Jane Fonda—and nobodies, forgotten people who had signed their names beside the greats. It was a roll call of the dead, and it was growing day by day as though word of mouth was spreading amongst the lost tribes and seducing them out of silence to sign this banian room with their scored presence.

After a lifetime's work in the field of psychic research, Doctor Florescu was well accustomed to the hard facts of failure. It had been almost comfortable setting back into a certainty that the evidence would never materialize itself. Now she was faced with a sudden, spectacular success, and she felt both elated and confused.

She sat, as she had sat for three incredible weeks, in the main room on the middle floor, as light of slats down from the writing room, and listened to the clatter of notes from upstairs with a sort of awe, scarcely daring to believe that she was allowed to be present at this miracle.

There had been riddles before, tantalizing hints of voices from another world, but this was the first time that promise had insisted on being heard.

Upstairs the notes stopped. Mary looked at her watch: it was exactly six-seventeen PM.

For some reason best known to the writers, the contact never lasted much after six. She would wait till half past and then go up. What would it have been today? Who would have come to that sordid little room and left their mark?

"Shall I set up the cameras?" Peg Fuller, her assistant, asked.

"Please," she murmured, distracted by expectation.

"Wonder what we'll get today?"

"We'll leave him ten minutes."

"Sure."

Upstairs, McNeal slumped in the corner of the room and watched the October sun through the tiny window. He felt a little still in all alone in that damn place, but he still smiled to himself, for with *beats* came that melted even the most academic heart. Especially Doctor Florescu's. Oh yes, the woman was infatuated with his smile, his eyes, the lost look he put on for her.

It was a fine game.

Indeed, at first that was all it had been—a game. Now Simon knew they were playing for bigger stakes, what had begun as a sort of lie-detection test had turned into a very serious contest, McNeal versus the Truth. The truth was simple. He was a cheat. He painted all his 'ghouls' onto the wall with tiny strands of lead he scooped under his tongue. He banged and thrashed and shouted with-

◆The sky
was Prussian blue, the highway
wide and windy,
the dead pressed on every side
She fought through
them, while their gauping, idiot
faces looked
at her and hated her invasion ◆

out any provocation other than the sheer mischief of it. And the unknown names he wrote—ha, he laughed to think of it—the names he found in telephone directories.

Yes, it was indeed a fine game.

She promised him so much, she tempted him with fame, encouraging every lie that he invented. Promises of wealth, of applauded appearances on the television, of an education he had never known before. As long as he produced the ghosts.

He smiled the smile again. She called him her go-between, an innocent carrier of messages. She'd be up the stairs soon—her eyes on her body, his voice close to tears with her palpable excitement at another series of screwed names and numbers.

He lied it when she looked at his nakedness, or all but nakedness. All his sessions were carried out with him dressed only in a pair of briefs, to preclude any hidden aids. A ridiculous precaution. All he needed were the leads under his tongue and enough energy to fling himself around for half an hour, belching his head off.

He was sweating. The groove of his breastbone was slick with it, his hair plastered to his pale forehead. Today had been

hard work. He was looking forward to getting out of the room, slucing himself down, and basking in admiration awhile. The go-between put his hand down his briefs and played with himself shy.

Somewhere in the room a fly or flies maybe, were trapped. It was late in the season for flies, but he could hear them somewhere close. They buzzed and fretted against the window or around the light bulb. He heard their tiny fly voices, but he didn't question them. He was too engrossed in his thoughts of the game and in the simple delight of sucking himself.

Now they buzzed, those harmless insect voices, buzzed and sang and complained. Now they complained.

Mary Florescu drummed the table with her fingers. Her wedding ring was loose today, she felt it moving with the rhythm of her tapping. Sometimes it was tight and sometimes loose, one of those small mysteries that she'd never analyzed properly but simply accepted. In fact today it was very loose, almost ready to fall off.

She thought of Alexis' face. Alexis' dear face. She thought of it through a hole made of her wedding ring, as it down a tunnel. Was that what his death had been like, being carried away and yet tethered away down a tunnel to the dark? She thrust the ring deeper onto her hand. Through the tip of her index finger and thumb she could almost taste the sour metal as she touched it. It was a curious sensation, an illusion of some kind.

To wash the bitterness away she thought of the boy. His face came easily so very easily, splashing into her consciousness with his smile and his unmistakable physique, still unmanly. He was like a girl really—the pureness of him, the sweet clarity of his skin, the innocence.

Her fingers were still on the ring, and the sourness she had tasted grew. She looked up. Fuller was organizing the equipment. Around her balding head a nimbus of pale green light shimmered and wove—

She suddenly felt guilty.

Fuller was nothing and heard nothing. His head was bowed to his business, engrossed. Mary stared at him still, seeing the halo on him, feeling new sensations waking in her, coursing through her.

The air seemed suddenly alive. The very molecules of oxygen, hydrogen, nitrogen pointed against her in an intimate embrace. The nimbus around Fuller's head was spreading, tracing fellow radarian in every object in the room. The unnatural sense in her fingertips was spreading too. She could see the color of her breath as she exhaled, it a pinky orange glow in the bubbling air. She could hear quite clearly the voice of the desk she sat at, the low whine of its solid presence.

The world was opening up, throwing her senses into an ecstasy, coaxing them into a wild confusion of functions. She was capable suddenly, of knowing the world as a system, not of politics or religions but as a system of senses, a system that spread out from the living flesh to the inert wood of her desk.

to the stale gold of her wedding ring.
And further. Beyond wood, beyond gold
The crack that led to the highway opened
In her head she heard voices that came from
no living mouth.

She looked up, or rather some force thrust
her head back violently, and she found her-
self staring up at the ceiling. It was covered
with worms. No, that was absurd! It seemed
to be alive, though, maggoty with life—pulling,
dancing.

She could see the boy through the ceiling.
He was sitting on the floor, with his jutting
member in his hand. His head was thrown
back like hers. He was as lost in his ecstasy
as she was. Her new sight saw the throbbing
light in and around his body—traced the
position that was seated in his gut and he
heard molten with pleasure.

It saw another sight, the lo in him, the ab-
sence of power where she'd thought there
had been something wonderful. He had no
talent to commune with ghosts nor had ever
had, she saw this plainly. He was a little liar,
a boy liar, a sweet, white boy liar without the
compassion or the wisdom to understand
what he had dared to do.

Now it was done. The lies were told, the
tricks played, and the people on the high-
way were sick beyond death of being mis-
represented and mocked. And now they
were buzzing at the crack in the wall, de-
manding satisfaction.

That crack she had opened, she had un-
knowingly impaled and fumbled at, unlock-

ing it by slow degrees. Her desire for the boy
had done that. Her endless thoughts of him,
her frustration, her heat and her disgust at
her heat had pulled the crack wider. Of all
the powers that made the system manifest,
love, and its companion, passion, and their
companion, loss, were the most potent. Here
she was, an embodiment of all three. Loving
and wanting and wanting acutely the impos-
sibility of the former two. Wrapped up in an
agony of feeling that she had denied herself
believing she loved the boy simply as her
go-between.

It wasn't true! It wasn't true! She wanted
him, wanted him now, deep inside her. Ex-
cept that now it was too late. The traffic could
be denied no longer. It demanded, yes, it
demanded access to the little inkeeper.

She was helpless to prevent it. All she
could do was utter a tiny gasp of horror as
she saw the highway open out before her
and understood that this was no common
intersection they stood at.

Fuller heard the sound
"Doctor?" He looked up from his tinkering,
and his face—washed with a blue light
she could see from the corner of her eye—
bore an expression of inquiry.

"Did you say something?" he asked.
She thought, with a lisp of her stomach,
of how this was bound to end.

The other faces of the dead were quite
clear in front of her. She could see the pro-
fundity of their suffering, and she could sym-
pathize with their ache to be heard.

She saw plainly that the highways that
crossed at Tolington Place were not com-
mon thoroughfares. She was not staring at
the happy idling traffic of the ordinary road.
No, that had opened onto a route walked
only by the victims and the perpetrators of
violence. The men, the women, the children
who had died enduring all the pains nerves
had wit to muster, with their minds bandied
by the circumstances of their deaths. Elo-
quent beyond words, their eyes spoke their
agonies, their ghost bodies still bearing the
wounds that had killed them. She could also
see mingling freely with the innocents their
daughters and sons. These mon-
sters, frenzied, mush-minded bloodletters
peeked through into the world, nonsense
creatures, unspoken, forbidden moles of
our species, chattering and howling their
Jabberwocky.

Now the boy above her sensed them. She
saw him turn a little in the silent room, know-
ing that the voices he heard were no fly
voices, the complaints were not insect com-
plaints. He was aware suddenly that he had
lived in a tiny corner of the world, and that
the rest of it, the Third, Fourth, and Fifth
worlds, were pressing at his living back, hun-
gry and irrevocable.

The sight of his panic was also a small
and a taste to her. Yes, she realized him
as she had always longed to, but it was not a
less that maimed their senses—it was his
growing panic it killed her up. Her empathy
was total. The fearful glance was harsh as
such as his—their dry throats rasped the
same small word.

"Please—
That the child learns
Please—
That was care and gifts
Please—
That even the dead, surely, even the dead
must know and obey
Please—"

Today there would be no such mercy
given, she knew for certain. These ghosts
had departed on the highway a growing
age, bearing the wounds they had died with
and the inmates they had outraged with.
They had endured his levity and insolence
his idiosyncrasies, the laborations that had made
a game of their odors. They wanted to
speak the truth.

Fuller was peering at her more closely, his
face now swimming in a sea of pulsing, or-
ange light. She felt his hands on her skin.
They tasted of vinegar.

"Are you all right, Doctor Florescu?" he
said, his breath like iron.

She shook her head.

No, she was not all right, nothing was right.
The crack was gaping wider every second.
Through it she could see another sky,
the slate heavens that loomed over the high-
way. And it overwhelmed the mere reality of
the house.

"Please," she said, her eyes rolling up to
the fading substance of the ceiling.

"Wider, Wider—"

The brittle world she inhabited was
struggling to breaking point.

CONTINUED ON PAGE 94



"Frankly, I'm fed up with brilliant, independent thinkers
I'm looking for a good, old-fashioned yes-man"



"They're back"

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THE OTHER SIDE

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OPENS NATIONWIDE MAY 23rd

Coming soon: a small space-relay device that may someday save your life



GEOSTAR

BY GERARD K. O'NEILL

On the coast of Maine waves leech the deck of a racing sailboat. The skipper strains to see through wind-driven spray. A ball sounds, he glances down at a water-proof display and reads: "Submerged rocks 200 yards ahead. Safe passage 20 degrees starboard or 30 degrees to port." He glances at the manual, then spins the wheel to the right. A half-minute later he spots tell-tale waves breaking, indicating the rocks that he has now safely passed.

A tractor trailer rolls along a main highway. A lone sounder and the driver looks at a terminal above his dashboard. It says, "Please key F if running a full load. N if not." He keys N, and seconds later another message appears: "Load available 20 miles ahead, 10 miles north of interstate. Please key OK for pickup directions."

PHOTOGRAPH BY
PETE TURNER



These messages, one warning a sailor of hidden danger, the other alerting a trucker to a commercial opportunity, are actually alike in several ways. The messages combine the services of precise positioning, directional guidance, and communications. Within two years such messages may be commonplace, relayed through devices barely larger than a pocket calculator. They will be generated by a newly emerging technology, the Geostar Satellite System, which I patented in 1982.

Geostar transmits data between portable, "go anywhere" terminals. It is not intended to compete with conventional voice or data systems, which transmit information continuously. Instead, it concentrates on what it does best: sending short bursts of information, with accurate positioning and database services added by computers at Geostar Central in Princeton, New Jersey. The combination of two-way communication and precise positioning makes Geostar particularly useful to the transportation industry and to emergency services, like police and fire departments, ambulances, and tow-truck operators. It can guide cars and trucks to a street address, instructing them to "turn right 1/4 miles ahead of Washington Street traffic light," for example.

Inexpensive lightweight radios, called "transceivers," send and receive digital messages through special satellites to Geostar Central. Once in mass production, transceivers will cost only a few hundred

dollars. The transceiver user never has to switch radio-frequency channels—all transceivers listen to broadcast signals from the Geostar satellites on the same channel. Just one return channel is used for the transmissions from the transceivers to the satellites (We plan to launch the satellites through Amerspac, a privately owned company).

The Geostar satellites, 22,000 miles above the earth, are no more than relays, relaying Geostar Central's outbound signals to the transceivers. The reply signals, inbound, are sent on to the central station. Computers, programs, and databases—all the "smarts" of the system—are at Geostar Central, where they can be maintained and updated easily.

The system can perform seven distinct functions: It can relay information on the user's location, to an accuracy of one to seven meters, and provide directional guidance for aircraft, boats, and cars. It can warn sailors and pilots of collision hazards and can report positions of police cars, taxis, ambulances, and other vehicles to their dispatch headquarters. Geostar also sends and stores messages, including calls for help, with the exact location of the emergency calculated automatically. Finally, it can access other database services.

The system will also help to solve crimes, including car theft. When a Geostar-equipped car is broken into, the central computer will locate the nearest police car, guide the police to the scene of the theft, and call upon its data bank to display for the

officers on route the description and license-plate number of the stolen vehicle, as well as its owner's name.

Although the Geostar system uses only two channels, one for incoming messages and the other for outgoing ones, neither channel is a party line. The reason is that each transceiver and the equipment at Geostar Central can select specific messages to or from that transceiver. Every transceiver has its own unique digital code, a "fingerprint," as individual as a phone number. Every message sent or received includes the fingerprint and only the transceiver addressed by the code will display the signal. For stations in which false alarms must be eliminated—reports of crimes or other emergencies—the system is programmed to demand a backup. Geostar Central interrogates the user for a personal code number, like the number required to draw money from a bank's automated teller.

Most people are startled to hear that a hand-held device powered by paraffin cells can send messages directly to a satellite more than 20,000 miles high. The trick lies in a combination of short-burst, high-power digital signals from the transceivers and a technique called "spread spectrum," developed originally for military communications. With "spread spectrum" a message can be sent, received, and decoded with high fidelity, even though the message signal is far weaker than electrical static or any jamming signals that may be broadcast to block it.

Geostar Central finds the position of each transceiver by measuring the time required for signal transmission, adding information from its computer memory and carrying out a computation. The process begins with a timing marker signal that's sent out many times per second. Relayed through a satellite, the signal reaches the user transceiver. Then a transceiver replies with a message or a request for positioning. Geostar's positioning capability depends on two satellites in orbit at different locations, each of which is equipped to receive the transceiver signals and pass them on to Geostar Central.

At the ground station, the computer receives two identical reply signals, relayed through the two different satellites. The computer then has two arrival times and the time the original marker signal was transmitted. Using those three pieces of information and referring to a stored digital map of terrain heights, the computer calculates the position of the transceiver. For afloat, Geostar receives an altimeter reading with each response in place of a terrain height. The computer stores any message sent, then transmits a brief acknowledgment coded with the transceiver's "fingerprint." The process takes about six tenths of a second. Once the message is safely stored, Geostar Central transmits it to the addressee.

There are, of course, potential Geostar customers whose locations would be previously recorded. To satisfy insurance rules, banks and jewelry stores, for example, must use burglar-alarm systems that respond to interrogations every 90 seconds. Geostar



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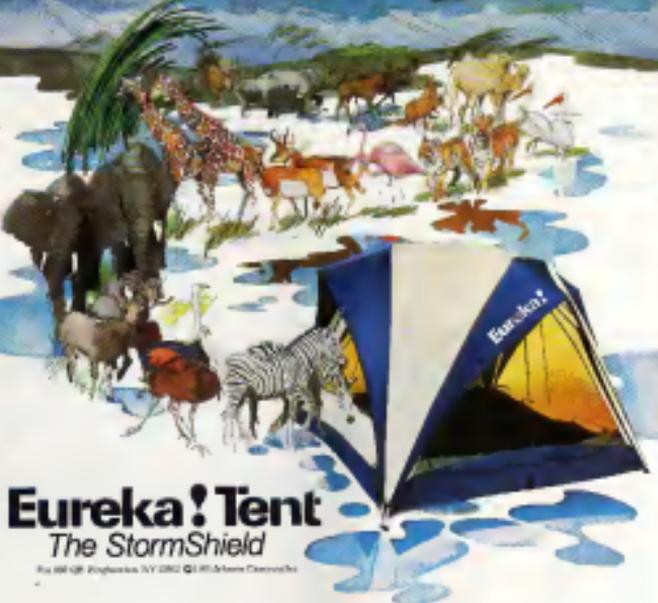
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schedules its accuracy by comparing the response times of each transceiver with those of transceivers in known locations. Using those reference "benchmarks," the Geostar computer can give accurate positions for transceivers without knowing the exact location of the satellites or the changing delays of radio signals through the ionosphere.

Eventually there may be millions of transceivers. They can all share the same radio channel because after responding to interrogation each transceiver will turn its transmitter off. For an aircraft, finding its way to a safe landing in fog, the time lapse between responses may be less than a second. For a long-haul truck on the highway, the normal interval can be several hours, though the trucking company's dispatch office can request an unscheduled update at any time. An efficient use of time, coupled with the system's ability to send a message in a fraction of a second, will make it possible to transmit a large number of messages or positions every hour. As a result, the charges for each individual message can be quite low. It will be possible to send a message anywhere in the country for about 25 cents, the cost of a local telephone call.

For the user Geostar acts like a private line to the addressee. Because Geostar Central's memory stores digital codes of the addressee who are called frequently (the way modern telephones store frequently called numbers), the sender need not re-

member the individual codes. The letters H and O are enough to direct a message home or to the office and friends can be addressed by their first names or a single letter.

High on a mountain a young hiker eased her pack down. She glances at a small device clipped to her pack, touches a key and the message "You OK?—Home" appears on the display along with the time when the message was sent. She keys it, "Fine. Weather great. Staying extra day." Less than a second later her message appears at a home computer.

To prevent criminals or a company's competitors from learning anything useful by peering into the Geostar signals, privacy is essential, and the Geostar Corporation plans to guard its customers' privacy. No one will have his position reported to another without his making the request by a combination of keystrokes. And messages will be "scrambled" in the outbound transmissions so that only the transceiver addressed will receive an intelligible signal.

A single-engine plane with a family aboard cruises above a solid cloud deck at night, heading home. The engine misfires a beat, picks up, then misfires again. The pilot presses two red keys on the instrument panel. Within seconds a display spells out: "Unlighted grass airstrip 2,000 feet long, in glide slope for next 4 minutes. Nearest weather 500 feet overcast. Press emergency keys for approach guidance."

Geostar has many applications to aviation: the system originally was designed to improve the safety of flying. Its invention followed a tragedy in 1978 in the skies over San Diego: when an airliner overtook and collided with a small aircraft. Both plunged to the ground, and more than 150 people were killed. The mid-air collision occurred in "positive control" airspace under the direct supervision of the federal air traffic control system. Both planes had complete instrument equipment and pilots in both had logged thousands of flight hours. It was appalled by the circumstances of the accident and resolved to find a better way to locate aircraft, predict their paths, and warn them of probable collisions. The result was Geostar.

Geostar was designed to solve simply and economically what I saw as a national problem. But the solution carried with it a curious extra: The system could pay for itself without requiring federal support. Because every transceiver had its own code and every transaction required passing that code through the central computer, it would be possible to associate each message with a specific user and therefore to bill customers and generate revenues. The made it practical to develop Geostar as a commercial venture, without waiting—possibly many years—for a federal agency to adopt it.

The Geostar Corporation was formed early in 1983. As it grew potential users learned of it: trucking companies, manufacturers of

cars, boats, and security alarm systems, aviation associations, railroad companies. We made contact with government agencies and found that they, too, needed these services. As the design became simpler, the investment required for Geostar dropped, easing the challenge of financing.

Even so, challenges remained. One of the greatest hurdles was that of federal regulators. The frequencies needed were in a region that had been in heavy use for many years. A whole new service, the radio determination satellite service, had to win acceptance and be approved by the Federal Communications Commission (FCC) before Geostar could begin operating. Fortunately, the support for the Geostar concept was so strong from the aviation community, potential commercial users, and agencies of the government that the commission acted relatively quickly. The FCC has allotted the necessary frequencies and has granted experimental licenses to allow early testing.

No matter how many technical reviews confirm that Geostar will work, seeing is believing. By September of 1980 a test system was working in the south-Lake Tahoe region. During the tests electronic radio relays on mountain peaks carried out the functions of the Geostar satellites. At Geostar Central all the calculations were done by a desktop computer. And the system worked. Pedestrians were guided to within a single step of hidden markers in a field. Cars were directed to exact street addresses. In the most demanding exercise of all, an airplane was guided to a precision landing; in every case the transceiver was the same. Only the programs at Geostar Central were different.

Progress has been rapid. The first satellite relay, designed to receive signals from mobile terminals and send them to Geostar Central, has been built, and a backup is being constructed. Either one will enable limited services to begin over the continental United States in 1986. Services will include relaying messages and approximate positions from mobile terminals through Geostar's satellites to the central ground station and from there to transportation companies' dispatch headquarters. A third Geostar relay with two-way capability will take about 24 months to build. That relay, working with either of the original two, will permit the company to provide the full range of Geostar services. The spread-spectrum hardware for Geostar Central has been completed and tested successfully, and manufacturers are building the mobile terminals. Work is also in progress aimed toward a worldwide expansion of Geostar. Just six satellites could supply the entire world with Geostar service.

Geostar's first years have been exciting and risky—a ride at breakneck speed over a course with obstacles of every kind. Tough as that ride has been, it has brought the rewards of comradeship to a band of hard-working people. The goal of providing life-saving service to the public is very close. When that service begins, its applications are likely to be limitless. ☐

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FICTION

AGAINST BABYLON

*If life were like the movies, these
giant aliens would be film characters, and everything
would be okay by the final reel*

PAINTING BY MAX ERNST

Carmichael flew in from New Mexico that morning, and the first thing they told him when he put his little plane down at Burbank was that fires were burning out of control all around the Los Angeles basin. He was headed bad, they told him. It was late October, the height of the brushfire season in Southern California, and a hot, hard, dry wind was blowing out of the desert, and the last snow it had raised was the 15th of April.

BY ROBERT SILVERBERG

He phoned the district supervisor right away and the district supervisor told him "Get your ass out here on the line double fast, Mike."

"Where do you want me?"

"The worst one's just above Chatsworth. We've got planes stacked and ready to go out of Van Nuys Airport."

"I need time to pee and to phone my wife. I'll be in Van Nuys in fifteen, okay?"

He was so tired that he could feel it in his teeth. It was nine in the morning, and he had been flying since half past four, and it had been rough all the way getting pushed around by that same fierce wind out of the heart of the continent that was now threatening to fan the flames in L.A. At this moment all he wanted was home and shower and Cindy and bed. But Carmichael didn't regard fire-fighting work as optional. This time of year, the whole crazy city could go in one big fire storm. There were times he almost wished that if would. He hated this smoggy, swarty Babylon of a city, its endless tangle of freeways, the strange-looking houses, the filthy air, the thick, choking, glossy sootage everywhere, the drugs, the booze, the divorcees, the laziness, the sleek ziness, the porno shops and the naked on-counter parlors and the message joints, the weird people wearing their ward clothes and driving their weird cars and cutting their hair in weird ways. There was a cheapness, a trashiness, about everything here, he thought. Even the mansions and the fancy restaurants were that way, hollow, like sick

more suits. He sometimes felt that the trashiness bothered him more than the out-and-out evil. If you kept sight of your own values you could do battle with evil, but trashiness slipped up around you and infiltrated your soul without your even knowing it. He hoped that his sojourn in Los Angeles was not doing that to him. He came from the Valley, and what he meant by the Valley was the great San Joaquin, not behind Bakersfield, and not the little cluttered San Fernando Valley they had him. But L.A. was Cindy's city, and Cindy loved L.A. and he loved Cindy, and for Cindy's sake he had lived here seven years, up in Laurel Canyon amidst the lush, green shrubbery, and for seven Octobers in a row he had gone out to dump chemical retardants on the annual brushfires, to save the Angelenos from their own idiotic carelessness. You had to accept your responsibilities, Carmichael believed.

The phone rang seven times at the home number before he hung up. Then he tried the little studio where Cindy made her jewelry, but she didn't answer there either, and it was too early to call her at the gallery. That bothered him, not being able to say hello to her right away after his three-day absence and no likely chance for it now for another eight or ten hours. But there was nothing he could do about that.

As soon as he was aloft again he could see the line not far to the northwest, a grossy black column against the pale sky. And when he stopped from his plane a few minutes later

at Van Nuys he felt the blast of sudden heat. The temperature had been in the mid-60s at Burbank, damned well hot enough for nine in the morning, but here it was over a hundred. He heard the distant row of flames, the popping and cracking of burning unbrush, the peculiar whirling sound of dry grass catching fire.

The airport looked like a combat control. Planes were coming and going with frantic frenzy and they were frantic planes, too, antiquities of every sort, forty and fifty years old and even older, converted B-17 Flying Fortress and DC 3s and a Douglas Invader and, to Carmichael's astonishment, a Ford Trimotor from the 1930s that had been hauled, maybe, out of some movie studio's collection. Some were equipped with tanks that held fire-retardant chemicals, some were water pumps, some wore mappers with infrared and electronic scanning equipment glistering on their snouts. Hairied-looking men and women ran back and forth, shouting into CB handsets, supervising the loading process. Carmichael found his way to Operations HQ, which was full of haggard people staring into computer screens. He knew most of them from other years.

One of the dispatchers said "We've got a DC-3 waiting for you. You'll dump retardants along the air, from Ybarra Canyon eastward to Horse Flats. The flats in the Santa Susana foothills, and so far the wind's from the east, but if it shifts to northerly it's going to take out everything from Chatsworth to Granada Hills and right on down to Ventura Boulevard. And that's only the best."

"How many are there?"

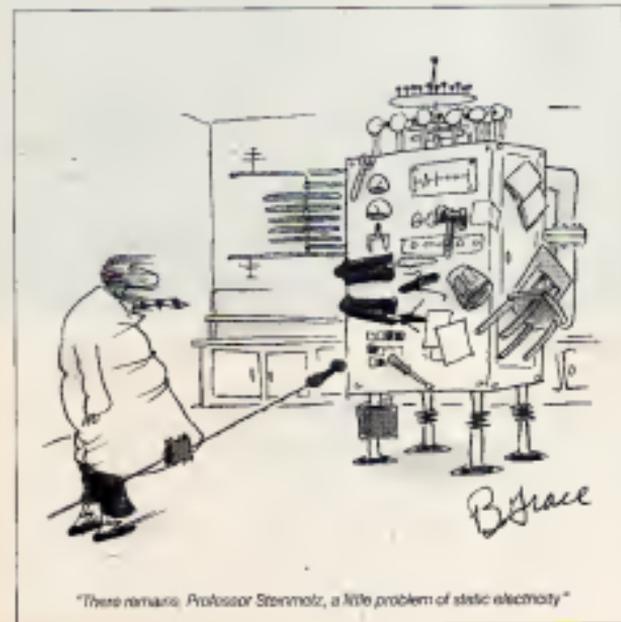
The dispatcher tapped his keyboard. The map of the San Fernando Valley that had been showing disappeared and was replaced by one of the entire Los Angeles basin. Carmichael stared. These great scatter strokes indicated fire zones, the one along the Santa Susanas, another nearly as big way off to the east in the grasslands north of the 210 freeway around Glendora or San Dimas, and a third down in eastern Orange County, back of Anaheim Hills. "Ours is the big one so far," the dispatcher said. "But these other two are only about forty miles apart and if they should join up somehow..."

"Yeah," Carmichael said. A single wall of fire running along the whole eastern rim of the basin, maybe—with Santa Ana winds blowing, carrying sparks westward across Pasadena, across downtown L.A., across Hollywood, Beverly Hills, all the way to the coast, to Venice, Santa Monica, Malibu. He shivered. Laurel Canyon would go. Everything would go. Worse than Sodom and Gomorrah, worse than the fall of Nineveh. Nothing but ashes for hundreds of miles. "Everybody scared silly of Russian nukes and a carload of dumb kids losing cigarettes can do the job just as easily," he said.

"But this wasn't cigarettes, Mike," the dispatcher said.

"No? What then, arson?"

"You haven't heard."



"There remains, Professor Stenzel, a little problem of static electricity."

"I've been in New Mexico for the last three days."

"You're the only one in the world who hasn't heard them."

"For Christ's sake, heard what?"
About the ET's, said the dispatcher wearily. They alerted the fires. Three spaceships landing at six this morning in three different corners of the L.A. basin. The heat of their engines ignited the dry grass. Carmichael did not smile. "You've got one word sense of humor, man."

The dispatcher said, "I'm not joking. Spaceships? From another world?"
With engines fifteen feet high onboard, the dispatcher at the next computer said, "They're walking around on the freeways right this minute. Fifteen feet high. Mike."
"Men from Mars?"

"Nobody knows where the hell they came from."

Jesus Christ, God, Carmichael said. Wild updrafts from the basin buffeted the plane as he took it back and gave him a few bad moments. But he moved easily and automatically to gain control, pulling the moves out of the underground territories of his nervous system. It was essential he behaved to have the moves in your fingers, your shoulders, your thighs, rather than in the conscious realms of your brain. Consciousness could get you a long way, but ultimately you had to walk out of the underground territories of you were dead.

He left the plane responding and managed a grin. DC-3s were tough old birds. He loved flying them, though the youngest of them had been manufactured before he was born. He loved flying anything. Flying wasn't what Carmichael did for a living—he didn't actually do anything for a living, not anymore—but flying was what he did. There were months when he spent more time in the air than on the ground, or so it seemed to him, because the hours he spent on the ground often slid by unnoticed, while time in the air was intensified, magnified.

He swung south over Encino and Tarzana before heading up across Canoga Park and Chatsworth into the fire zone. A fine haze of ash masked the sun. Looking down, he could see the tiny houses, the tiny swimming pools, the tiny people scurrying about despondently trying to hose down their roofs before the flames arrived. So many houses, so many people, filling every inch of space between the sea and the desert, and now it was all in jeopardy. The southbound lanes of Topanga Canyon Boulevard were as jammed with cars here in midmorning, as the Hollywood Freeway at rush hour. Where were they all going? Away from the fire, yes. Toward the coast, it seemed. Maybe some television preacher had told them there was an ark sitting out there in the Pacific, waiting to carry them to safety while God rained brimstone down on Los Angeles. Maybe there really was. In Los Angeles anything was possible.

Invaders from space walking around on the freeways even Jesus Jesus Carmichael hardly knew how to begin thinking about that.

He wondered who Cindy was, what she was thinking about it. Most likely she found it very funny. Cindy had a wonderful ability to be amused by things. There was a line of poetry she liked to quote, from that Roman, Virgil. A storm is rising, the ship has sprung a leak, there's a whirlpool to one side and sea monsters on the other and the captain turns to his men and says, "One day perhaps we'll look back and laugh even at all this." That was Cindy's way, Carmichael thought. The Santa Anos are blowing and three big brush fires are burning and invaders from space have arrived at the same time and one day perhaps we'll look back and laugh even at all this. His heart overflowed with love for her and longing. He had never known anything about poetry before he had met her. He closed his eyes a moment and brought her onto the screen of his mind. Thick cascades of jet-black hair, quick, dazzling smile, long slender tanned body all aglitter with those amazing rings and necklaces and pendants she designed and fashioned. And her eyes. No one else he knew had eyes like hers, bright with strange mischief, with that altogether original way of seeing that was the thing he most loved about her. Damn the fire, just when he'd been away three days! Damn the stupid man from Mars!

Where the hell was and circles of sub-

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urban streets ended there was a great open stretch of grassy land parched by the long summer to the color of a lions hide, and beyond that were the mountains, and between the grassland and the mountains lay the fire an enormous lateral red crest topped by a plume of foul black smoke. It seemed to already cover hundreds of acres, maybe thousands. A hundred acres of burning brush, Carmichael had heard once, creates as much heat energy as the atomic bomb they dropped on Hiroshima.

Through the crackle of radio static came the voice of the line boss, directing operations from a helicopter hovering at about four o'clock. "DC-3, who are you?"

"Carmichael."

"We're trying to contain it on three sides, Carmichael. You work on the east, Laramie Canyon, down the flank of Parker Ranch Park. Got it?"

"Got it," Carmichael said.

He flew low, less than a thousand feet. That gave him a good view of the action. Sawyers in hard hats and orange shirts chopping burning trees to make them fall toward the fire. Bulldozer crews clearing brush ahead of the blaze. Showers carving firebreaks. Helicopters pumping water into isolated torques of flame. He climbed five hundred feet to avoid a single-engine observer plane, then went up to five hundred more to avoid the smoke and turbulence of the fire itself. From that altitude he had a clear picture of

it, running like a bloody gash from west to east, wider at its western end. Just east of the fire's far tip he saw a circular zone of grassland perhaps a hundred acres in diameter that had already burned out, and precociously at the center of that zone stood something that looked like an aluminum box the size of a ten-story building, surrounded at a considerable distance by a cordon of military vehicles. He felt a wave of dizziness rock through his mind. That thing, he realized, had to be the E.T. spaceship.

It had come out of the west in the night, Carmichael thought, falling like a hemisphere sliding toward the western end of the San Fernando Valley, leaving the grass with its exhaust, and leaving a trail of flame behind it. And then it had gently set itself down over there and extinguished its own brushfire in a neat little circle about itself, not caring at all about the blaze it had kindled farther back, and God knows what kind of creatures had come forth from it to inspect Los Angeles. It figured that when the UFOs finally did make a landing out in the open, it would be in L.A. Probably they had chosen it because they had seen it so often on television—didn't all the stories say that UFO people always monitored our TV transmissions? So they saw L.A. on every other show, and they probably figured it was the capital of the world, the perfect place for the first landing. But why Carmichael wondered, had

the bastards needed to pick the height of the fire season to put their ships down here?

He thought of Cindy again, how fascinated she was by all this UFO and E.T. stuff. Those books she read, the ideas she had, the way she had looked toward the stars one night when they were clamping in Kings Canyon and talked of the beings that must live up there. "I'd love to see them," she said. "I'd love to get to know them and find out what their heads are like." Los Angeles was full of nut cases who wanted to ride in flying saucers, or claimed they already had, but it didn't sound nutty to Carmichael when Cindy talked that way. She had the Angeleno love of the exotic and the bizarre, yes, but he knew that her soul had never been touched by the crazy corruption here that she was untroubled by the prevailing craving for the weird and irrational that made him loathe the place so much. If she turned her imagination toward the stars, it was out of wonder, not out of madness. It was simply part of her nature, that curiosity that hunger for what lay outside her experience to embrace the unknowable. He had had no more belief in E.T. as than he did in the tooth fairy, but for her sake he had told her that he hoped she'd get her wish. And now the UFO people were really here. He could imagine her, eyes shining, standing at the edge of that cordon staring at the spaceship. Why he couldn't be with her now, feeling at that excitement surging through her, he pitied the wonder the image

CONTINUED ON PAGE 78

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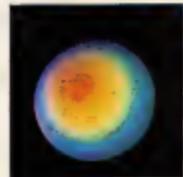
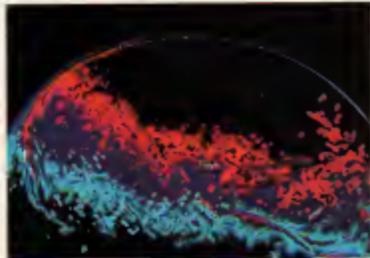
MOONS OF URANUS



A ROBOT
TOURIST TO A DISTANT
PLANET HAS
SENT BACK SHAPSHOTS OF
WORLDS THAT
DAZZLE AND BEWILDER

BY RON SCHULTZ



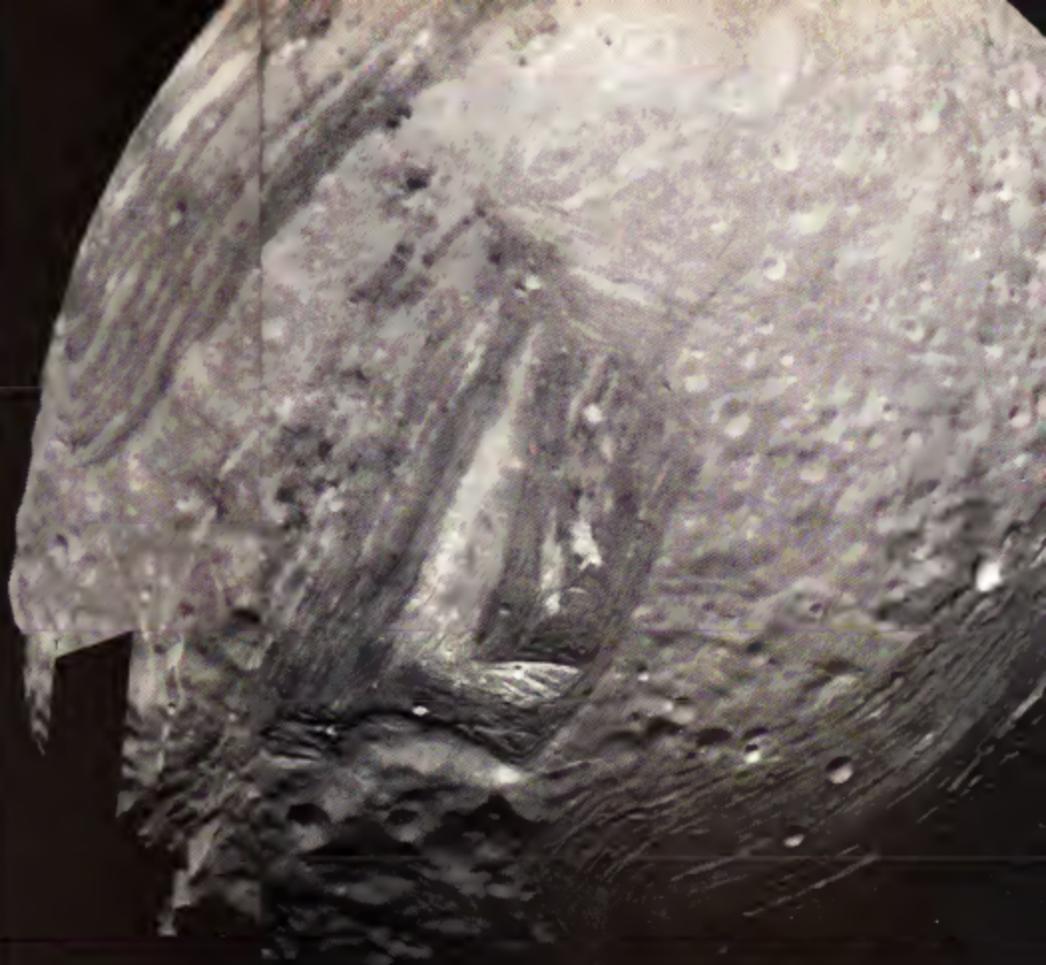


**OPENING PAGES:
THE RINGS OF THE GIANT
PLANET URANUS
(LARGE PHOTO) AND THE
HEAVILY SCARRED
TITANIA (SMALL PHOTO).
THESE PAGES: TWO
VIEWS OF URANUS (ABOVE
AND TOP); ARIEL
(ABOVE CENTER); AND
MIRANDA WITH ITS
STRANGE RECTANGULAR
PATCH (AT RIGHT).**

This year Uranus, the veiled blue-green giant of the solar system, welcomed its first visitor from Earth, the Voyager II spacecraft. Boasting its proclivity over 2 billion miles of space, the robot explorer showed us a portrait of a baffling planet: one completely covered with an ocean 5,000 miles deep, shrouded in a straggling atmosphere, and tilted so far on its axis that it almost appears to be whirling on its side.

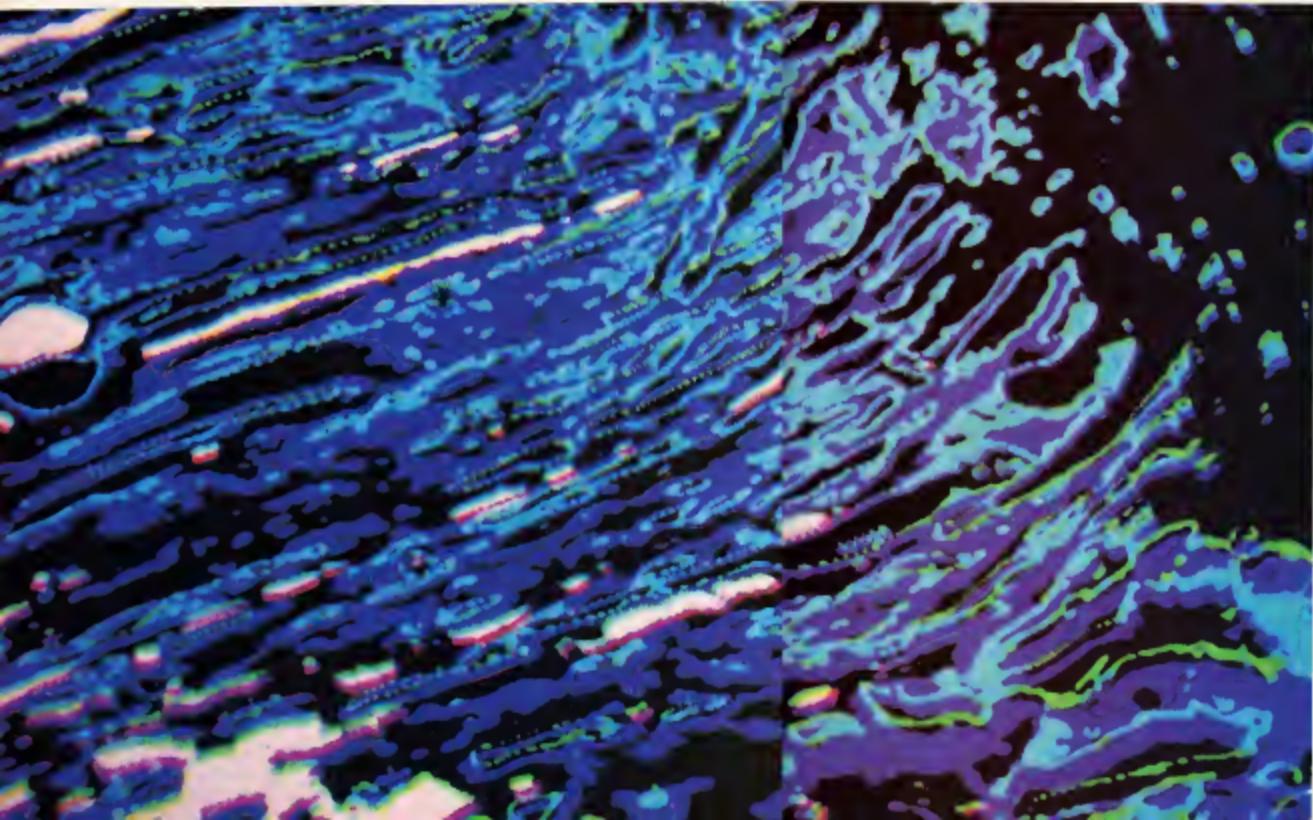
But the biggest surprise of all offered up by the ringed planet was its five moons: Oberon, Titania (named after the fairy king and queen in *A Midsummer Night's Dream*), Umbriel, Ariel, and Miranda. While from a distance these icy spheres appear to be drab uninteresting objects, up close they turned out to have dramatically distinctive geological characters.

The surface of Titania, the largest and outermost moon, is pitted





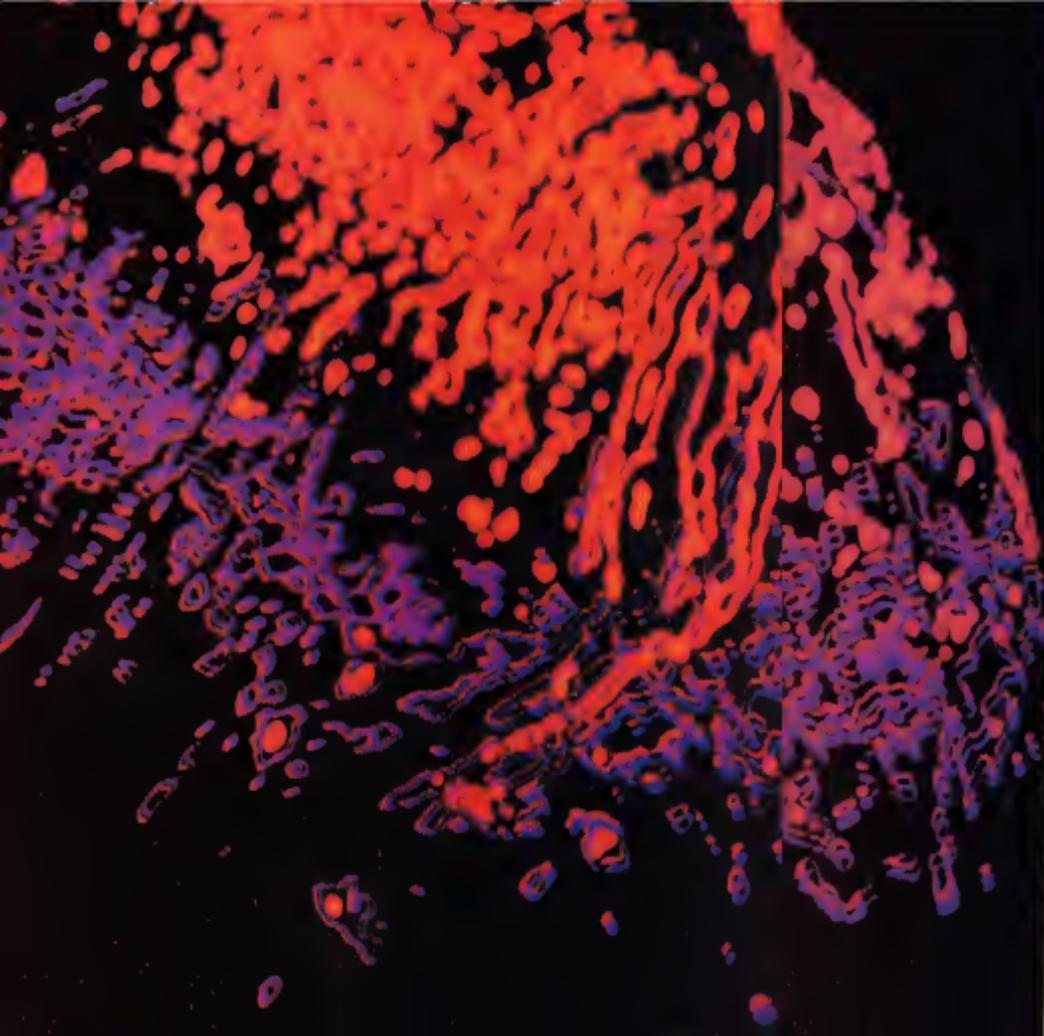
URANUS (THE TWO PHOTOS BELOW) AND ITS FIVE LARGEST MOONS. NEAR LEFT (LEFT TO RIGHT): MIRANDA, TITANIA, AND OBERON. CLOSE-UPS OF MIRANDA (FAR LEFT, LOWER LEFT).



with craters and etched with long fault valleys. These surface scars sparkle with an unknown substance, most likely frost from material that leaked out of its interior.

Oberon is pocked with large impact craters similar to those seen on Jupiter's moon Callisto. And some of its craters appear to be filled with darker material that has been the source of much speculation: Did the remnants of a dust ring settle there, or is it some icy, carbon-rich material that erupted onto the crater floor? No one is sure.

Umbriel, the darkest and oldest of the Uranian moons—named after the "dusky, melancholy spirit" in Alexander Pope's *The Rape of the Lock*—is a mostly bland, gray hulk. But its polar region has a distinctive doughnut-shaped crater at least 90 miles across. It catches the sun's rays and, like a beacon, re-



reflects back 30 percent more light than the rest of the moon's surface.

By contrast, there is Ariel, named for the fairy prankster in *The Tempest*. Its fractured topography and jumbled crust are evidence of a huge fault system.

But most enigmatic of all is Miranda, the innermost of the Uranian moons. It is a microcosm of the solar system's geology. It has the geobranched valleys of Mars, the grooved terrain of Jupiter's moon Ganymede, and faults like those seen on Mercury.

"It's all the strange places rolled into one," marvels Larry Soderbom, deputy imaging team leader at NASA's Jet Propulsion Laboratory. "If you took all the bizarre geological features and put them on one object, you'd get Miranda."

As *Voyager II* moved on toward Neptune, it left behind a mass of data that will take years to digest. As a result of its visit, our view of the solar system's third-largest planet has been changed forever. Those views of Uranus and its satellites will leave planetologists, as one expert put it, "happily bewildered" for some time to come. ☐

**THE TORMENTED
GEOSCAPE OF ARIEL
(OPPOSITE)
IS NOT NEARLY AS
SEIZURE AS
MIRANDA'S (BELOW AND
BELOW MIDDLE)
BUT IS MORE SCARRED
BY FAULTS THAN
UMBRIEL (AT BOTTOM
LEFT) AND OBERON
(AT BOTTOM RIGHT).**



January some thought it meant the end of public support for space development. But telephones in the space group headquarters began to ring immediately with an influx of new members and volunteers offering their services, says L-5's Gary Olson.

"The tragedy burned out a lot of apathy," says Olson. "Somewhere in the last twenty years, the shuttle became a symbol of our move into space, but nobody seems to have realized it until now."

In fact, immediately after the Challenger disaster, an ABC/Washington Post poll showed that 79 percent of the public said the United States should continue its shuttle program, and 72 percent believed NASA should continue including civilians. After the explosion, support for making the space program a federal spending priority actually went up.

I grew up in Tennessee, hooking mules to wagons to haul cotton to the old cotton gin, and we were progressive because we had pneumatic tires on our wagon," says best-selling science-fiction author Jerry Pournelle, a longtime pro-space organization leader and activist. "Now I'm seriously talking about holding our last L-5 meeting in a colony on the moon, but that's not good enough—everyone can develop the moon."

want a space colony. And then a colony around another sun.

This generation, says Pournelle, has a chance to become the first true spacefarers. With colonies in space, he points out, even the end of the world would not end human life. "What's most important," he says, "is that humankind has ahead of it a one-hundred-billion-year future. That future is in space."

CMNI'S PRO-SPACE DIRECTORY

Editors' note: A 325-page report called "Upward Status Report and Directory of the American Space Interest Movement, 1984-85," is available for \$20 from science writer and editor Tracy E. Bell, 71 Riverside Drive, 15GW New York, NY 10023.

The Planetary Society, 65 North Carolina Avenue, Pasadena, CA 91106 (818-793-6100)

L-5 Society, 1060 East Elm Street, Tucson, AZ 85719 (602-622-6351)

National Space Institute, West Wing Suite 203, 600 Maryland Avenue SW, Washington, DC 20004 (202-484-1111)

High Frontier, 1010 Vermont Avenue NW, Suite 1000, Washington, DC 20005 (202-737-4979)

Space Studies Institute, 285 Rosedale Road, Box 62, Princeton, NJ 08540 (609-921-0377)

Young Astronaut Council, 1015 Fifteenth Street NW, Suite 505, Washington, DC 20005 (202-662-7984)

World Space Foundation, Box Y, South Pasadena, CA 91030 (818-759-6135)

Students for the Exploration and Development of Space (SEDS), 600 Twenty-first Street NW, Washington, DC 20002 (202-676-7102)

National Space Club, 625 Fifteenth Street NW, Washington, DC 20005 (202-639-4210)

Women in Aerospace, 62125 Old Keene Mill Court, Springfield, VA 22152 (703-866-0020)

American Institute of Aeronautics and Astronautics, 1633 Broadway, New York, NY 10019 (212-561-4300)

International Association of Astronomical Artists, 209 West Yale Loop, Irvine, CA 92714 (714-551-6815)

American Society of Aerospace Pilots, 190 SW Sixth Street, Suite 24, Grants Pass, OR 97526 (503-476-6210)

Hypatia Cluster, 164 Dolores Street, San Francisco, CA 94103 (415-662-0141)

Congressional Space Caucus, 1576 Longworth HOB, U.S. House of Representatives, Washington, DC 20515 (202-225-4261)

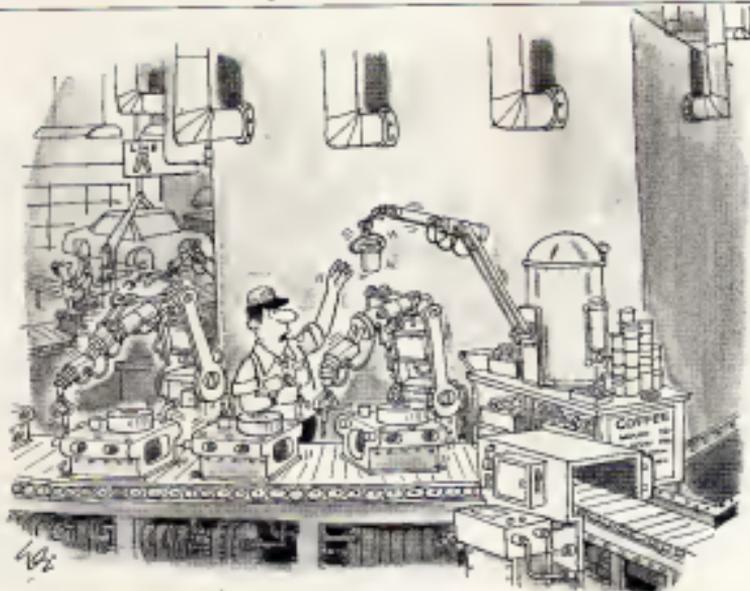
United States Space Foundation, 1525 Vapor Trail, Colorado Springs, CO 80916 (303-560-1000)

Radio Amateur Satellite Corporation, Box 27, Washington, DC 20044 (301-560-6062)

Independent Space Research Group, Box 23083, Rochester, NY 14692

American Space Foundation, Suite 200, 111 Massachusetts Avenue NW, Washington, DC 20001 (202-289-2293)

Campaign for Space, Box 1526, Cambridge, GA 31711 (312-245-6765) **DC**



"Thanks"

*Despite unpredictable risks and unimaginable consequences, manned space exploration will continue, says the author of *The Discoverers*, because it is the irresistible fate of adventuring humanity*

INTERVIEW

DANIEL J. BOORSTIN

When Challenger exploded in the face of a shocked world, the tragedy destroyed more than seven precious lives and \$2.5 billion worth of high technology. The catastrophe also shattered the illusion that space travel had become routine—that space was now hospitable to the mothers of small children and not the most hostile and alien environment humans have ever explored. As NASA's image cracked and fell apart, people pondered the future that brought down the vainglorious of the gods and even wondered if our hopes of voyaging to the distant stars might not be just dreams.

Daniel J. Boorstin, for one, dismisses such doubts. In his view there is a streak in human nature that cannot be denied, one that forever urges us to explore to the limit and beyond. "We should and will try to go as far as we can," he says. "People's humanity lies in discovering the boundlessness of our powers, which we can

never define. To fail to do all we can do is to fail to be human." Boorstin should know, for he has spent a large chunk of his life tracking about humanity's ceaseless quest for new worlds to conquer. The eminent Librarian of Congress is the historian and author of *The Discoverers*, the popular "history of man's search to know the world and himself." The book emboldens Boorstin's belief that the exploring spirit has played a decisive role in shaping human affairs and energetically celebrates "the courage, the restlessness, the heroic and imaginative thrusts of the great discoverers" throughout the ages.

His pages are crowded with the colorful true tales of the discoverers and inventors, the countless Columbuses who have ventured into terra incognita to reveal the unknown known.

A sturdy sanguine sixty-nine, Boorstin himself is an avid explorer of life, with an insatiable appetite for traveling the outer

PHOTOGRAPH BY MIKE MITCHELL



reaches of knowledge. He is, says friend and Ronald Reagan biographer Edmund Morris, 'an information machine, obsessively hungry for facts of any kind. He mines every vein of knowledge he comes across, mining them into strange new alloys of always-surprising conclusions.' Jim Lehrer of Channel 13's nightly newscast *The Mitchell/Lehrer Newshour*, says Boonin is 'as ravenous in new ideas as any man half his age. That's how he stays young. He cares about things he doesn't know about. His educational process goes on and on.'

Whether his enthusiasm is cause or effect, Boonin has excelled at every stage throughout his life. His only retreat, by his own account, is that he had to give up when he tried to write a novel, and his principal editor and wife Ruth adds, he can't dance. A short, pipe-chomping man, Boonin was born of emigrant Russian Jewish stock in Atlanta. As a young attorney, his father Samuel helped defend Leo Frank, the factory superintendent wrongly convicted of the murder of a young girl and then lynched. Daniel grew up in Tulsa, Oklahoma, where the family fled to avoid the wave of anti-Semitism that followed the notorious case. From this relatively modest launch site, the Boonin career took off on the same trajectory as an Apollo moon shot. At Harvard by age fifteen, he was an editor of the *Criticon* and won the Bowdoin prize for an essay on *Gibbon's Decline and Fall of the Roman Empire*, the book he values most. He studied biochemistry for a while, graduating summa cum laude in English history and literature. A prized double first (two first-class degrees) in law at Oxford, where he went as a Rhodes scholar, was followed by qualifying as a barrister at law in the English courts. Coming home to get his doctorate in jurisprudence at Yale, he briefly taught at Harvard and became a government lawyer in Washington. But he found that he didn't like practicing law and bodily switched to history. He spent the next 25 years as a distinguished professor of history at the University of Chicago, with trips abroad to teach at the Sorbonne and in Kyoto, Cambridge and Rome. At Chicago, where he married James Watson (of DNA fame) bed-watching, he built up an enviable record as a historian by writing many books, ending with a three-volume social history of America, *The Americans*. The third volume won a Pulitzer prize in 1975. Another Boonin classic is *The Image: A Guide to Pseudo Events in America*. The book showed how the media created a new kind of unreality and created celebrities, whom Boonin wittily defined as 'people who are well-known for their well-knownness.'

In 1969 he left Chicago for Washington to become director of the Smithsonian's National Museum of History and Technology. Fond of technology, he revolved in the places sewing machines, and other artifacts displayed there. In 1975 Boonin who calls the invention of the book 'the greatest technological advance man has ever made' was tapped by President Ford for the post of Librarian of Congress. He was confirmed after

hearings complicated by concern that he might spend government time writing his books, and since taking office he has kept his typewriter in his study at home.

Boonin clearly enjoys being leader of the 20-million-volume institution, probably the biggest library in the world (the exact size of the comparable Lenin Library in Moscow is unknown). The library which subscribes to 117,000 periodicals, has its shelves stuffed with a daily average of 7,000 books. The cultural post has helped make Boonin an insider par excellence on the Washington social scene. Typically he was seated close to Reagan at the White House dinner for Prince Charles and Lady Diana. His sociability extends beyond serving the library's interests, for Boonin loves to catalyze other minds interested in books and class. He's really the unofficial minister of culture,' says a writer who owes a million-dollar contract to Boonin's introductions. Good friends include Clare Boothe Luce, New York Times publisher John Oakes, columnist William

◆ *The triumphs
of American civilization
have all been
triumphs of community as
well as of
individuals. Columbus could
not have gotten
anywhere without his crew.* ◆

Balfre and Supreme Court Justice Byron White who in an annual ritual reads the Declaration of Independence after lunch every Fourth of July at the Boonins' country retreat on the banks of the Potomac, across from Mount Vernon.

Interviewer Anthony Lewisidge called on him at 8:30 in the morning in Washington DC. Snow was falling, and it was not a day when most people were bounding out of bed. But Boonin, who answered his door in sport coat and red bow tie had begun work at five o'clock and equipped with pipe, an old black Olympia, and a wall of reference works, was exploring the mysteries of the pyramids and Stonehenge for his current book in progress, *The Creators*. Only a fortnight after the Challenger tragedy with the pain still felt and NASA then still only slightly tormented, it seemed appropriate to ask him first to put the seemingly disastrous setback in broader perspective.

Ques: The Challenger tragedy gave pause to many who advocated that human exploration of space should proceed at full throttle. But you believe, don't you, that 'spacious

the new sea and we must sail upon it,' as President Kennedy said?

Boonin: Yes. We are not free not to. As the old Talmudic saying has it, we're not free to complete the task or to desist from it. That's the human imperative, the Prometheus imperative: if you live, if the fire is there, we must capture it. It won't burn by itself, that is our misfortune and opportunity. Sounds rather corny to put it that way, but I really think so. We are not free to desist from genetic research, space exploration, or archaeological research—which could have been possible. If we had accepted [seventeenth-century Irish prelate] Archbishop James Usher's biblical chronology of the creation of Earth, we wouldn't have bothered with archaeology or carbon dating. Orm! But juxtaposing the unprecedented Voyager pictures of Uranus with the Challenger catastrophe, some fool there may be a hint to the distant people should travel physically from Earth.

Boonin: I don't believe there is. That's what people told Columbus! They said you could prove by all existing maps it would be a fruitless expedition. The experts were more right than Columbus about the extent of Earth, as it turned out. But you have to see: The Challenger's oracles put it in the negative. Should we risk loss of life in space exploration? (I'd put it in the affirmative and say that humanity's greatest need is the need for the unnecessary. Civilization's progress is the multiplication of items, opportunities, and technologies that are unnecessary. Who can tell what their consequences might be? Ques: Isn't there a mythology of space like the mythology of the West in the eighteen hundreds, which was promoted by the ads of land speculators that painted it as a Garden of Eden?

Boonin: Actually, at that time maps placed the Great American Desert in what is now the most fertile part of the country. I don't see any reason to treat space as unique. It's an opportunity for exploration in another dimension, that's all, and it is not the kind of thing we are free to desist from. An entire society curtails people's freedom to be fully human, whether in speech, writing, painting or space exploration. Those extravaganza, perhaps especially exploration, are the sign of our humanity and its full limit.

Ques: What was the immediate effect of the shuttle explosion?

Boonin: The shuttle disaster catapulted people from anonymity to celebrity overnight. In my book *The Image* I defined celebrity as a person who is known for his 'well-knownness.' Now *well-known* is something else. The Challenger explosion also had the incidental effect of creating a sense of heroism about these people's efforts. With so many delays and the twenty-four times the shuttle had gone up, public sensitivity was dulled. People were no longer fascinated by it. The disaster dramatized the risk and the cost in human life. That may have helped to make the space program a heroic effort, not just a technological feat with dozens of people sitting at the controls.

Orin: Because they rely more on the decisions of others, are the astronauts less heroic than the great figures of the past?

Booster: I think that the emphasis on individualism that has dominated American history is simplistic. The great triumphs of American civilization have all been triumphs of community as well as individuals. Columbus couldn't have got anywhere without his crew. The pioneers generally moved west in pretty well-organized groups, each with its own contribution. The space program is a communal effort. Yet without the insistence of leaders, who dare to pursue the unknown and to take risks, it would be impossible. I am just beginning to learn about the interaction between the community and the creator. Would Gauguin have painted as he did without the conventions of his time to rebel against? The community provides a reset and medium that gives the creator something to rebel against. The community is part of the resource and the opportunity.

Orin: What will be the historical impact of the space adventure on society?

Booster: We will discover great oceans of ignorance. We know much less than we think we know about the solar system and the universe beyond.

Orin: So it will encourage humility?

Booster: Paradoxically every discovery of a new dark continent increases human arrogance and man's belief in his own powers to know. Yet, as it provides new territories of

discovery, exploration adds new territories of ignorance. But man is least more impressed with what he's newly discovered than with the new areas of ignorance. That certainly was true in the case of America. The first efforts were to make all the newly encountered things fit with the previous patterns. As I said before, even the nineteenth-century maps still had the words Great American Desert written across the body of North America. Now it took quite some time for people to discover the inaccuracy of that description. The greatest significance of the discovery of America for Western civilization was the realization that if there could be more continents than had been imagined or found on any of the respectable maps, there might also be more of anything and everything else! But humility is a little too theological a word to speak of.

Orin: One had the word hubris in mind after the shuttle disaster.

Booster: In his autobiography Benjamin Franklin listed twelve virtues, each one of which he was going to perfect in himself for one month. The thirteenth virtue was going to be humility. He would imitate Jesus and Socrates. But his afterthought was that if he did accomplish it he'd then be proud of his humility so it was self-defeating. Such "self-liquidating" ideals are, I believe, characteristic of the American experience. Our country seeks its objectives and opportunities in experience and thereby deceives its ideals,

paradoxically, in the process of accomplishing them. That's quite unlike a society that is based on dogma or apriorism.

Orin: Won't the new view of the planet as seen from space inspire social harmony and world peace because it looks so vulnerable and beautiful alone in the universe?

Booster: It's not at all clear that knowing more about each other makes people love each other more. I haven't got any simple answers. I don't like the way of putting the question because I believe in openness. I believe the one certainty in history is the unexpected. To be reminded of our inability to predict is itself a wholesome influence. We re-imprisoning ourselves in the instruments of our prophecy. Our tendency to apply the techniques of mathematical prediction, of extrapolation in science, to mankind's experience is dangerous. Science insists on the importance of quantitative techniques. Most historians of science define science's progress as the increasing application of quantitative methods to a quantitative end, and the deriving of quantitative data from experience. That view has also been borrowed by social scientists. But mine is that human experience is incommensurable with quantitative categories.

Orin: Doesn't the space adventure enlarge horizons and encourage creativity?

Booster: The creative consequences of the space enterprise, just like the consequences of Columbus's voyages, are unmeasurable.



•Living on the road,
he began to hunt for rockets and
saucers built by those
plying salvation from the stars •

ANTI-MATTER

In the fall of 1977 photographer Douglas Curran bought a secondhand yellow Fiat van. He christened it Gaele, pried out the rear seat, and fitted a small desk in the space behind the driver's seat. Then he set out from British Columbia, following secondary highways through the towns and cities of Canada and the United States. His goal: to document the twentieth-century fascination with flying saucers and godlike aliens from space.

The mythical quest Curran now says emerged from his ideas about photography itself. "The more I thought about it," he

explains, "the more I realized that photography was anachronistic: that the very act of photographing something thrust it into the past. The popular point of view is that artists are ahead of their time. But I began to realize that artists are actually behind the times. They are the garbage men of society: cultural luddites, forwarding the past while the rest of humanity moves forward in subtle but powerful ways.

Hoping to render images of man's latest yearnings and fears, Curran began to seek a symbol for the new age. Then one night, as if in answer to his prayers, he was jolted out of a dream. This dream itself seemed to fade in a mist, but he says the words in *Advance of the Landing: Folk Concepts of Outer Space* emerged:

"I don't pay much attention at the time," Curran now says, "at the phrase that would become the title of his first book (Abbeyville, 1981): 'But also it two years later I was rounding the curve of a highway in Quebec when I saw my first folk rocket. Thrust out over the trees, head in unaided flight, it



UFO QUEST

soared to strain against its metal wings, a form attempting to leap away from the gravity of Earth.

Curran was so dazzled by the apparition that he literally fell off his bicycle. This pairing metal sculpture, he knew embodied the nocturnal mumblings of his dream. Built by two local carpenters in 1950, a general store it was the spear of the collective unconscious. "I saw it as a symbol of transcendence," Curran now says, "an archetypal image of our time."

This discovery re-declared Curran's artistic ambitions. Leaving out of Gaele, he

began to hunt for rockets and saucers built by those plying salvation from the stars. These alien stars he turned out were everywhere. In Fort Cosca, California, he found an Allen Rocket (page 113 left) built by inventors Clayton Bailey who also maintains a fleet of 1947 and 1948 Studebaker rocket cars. Behind the grounds of Governor State College in Park Forest, Illinois, he discovered a concrete flying saucer (above) created by the New York sculptor Jano Hightstein. And he photographed another concrete saucer (page 112 left) in the San Bernardino hills.

Continuing on his trip, Curran also found an America dotted with flying-saucer homes. The house shown on the bottom of page 110, for instance, is located in Pensacola, Florida. But according to Curran, a whole series of identical homes were manufactured and shipped throughout Canada and the United States. In almost every instance these houses are raised above the ground and can be reached only by long winding roadways or ramps. Curran says



You approach the house in application as you would approach the altar of a god.

Passing through the rural community of St. Paul, Alberta, Curran even found a UFO landing pad built in 1967 to commemorate the Canadian centennial. In fact in 1962, the International Year of the Child, St. Paul used the pad to welcome Mother Teresa (page 111, bottom).

The tiny run Curran recalls "was driven down Main Street in a cavalcade of jeeps. A high school band played as two sergeants at arms in white pained hats greeted her on top of the pad. When Mother Teresa spoke, she said simply, "If there is wisdom in space we would go there too."

But as Curran continued his journey, he realized that saucers and landing pads were just the beginning. While some people used UFO imagery to symbolize the future, others were convinced the aliens were real.

On the road, Curran

educated youngsters in yellow marker."

Toroni, Curran learned was an unemployed bulldozer operator who traveled up the slopes of near-by Red Mountain to commune with alien gods. And in December 1977 he took Curran along. First, Curran relates, Toroni strapped an aerial traffic light to his car battery. Then he scanned the sky with binoculars. When he spotted a saucer—the shield, he claimed, for hiding UFOs—he signaled upward with the light, using Morse code.

In 1980 Curran found Toroni again, this time living in Eureka, California, with a group of bar-bagan Christians. What about UFOs? "They are part of Satan's work plan of his deception," Toroni now said. "They are not of Christ."

Though Toroni has disavowed UFOs, he was the one to tell Curran about the mercenary Roy Starford and his Project Straight International (PSI), billed as the only full-time group for "hard data" monitoring of UFOs. Starford's career inology

started in December 1964 when, at the age of sixteen, he says he received his first very distinct telepathic message from the space people. A few years later he and brother Rex had driven to California to meet the most famous of all UFO contact ops—George Adamski. They became disciples and, perhaps in response to Adamski's scientific claims, Ray grew interested in an instrumented approach to UFOs. As early as 1964, in fact, PSI members constructed a ring of lights out in the Arizona desert.

explains, "I started talking to people. One man, a newspaper editor in northern California, told me, 'There's no one around here building flying saucers, but there's the guy down in Orland who goes looking for them. Maybe you should talk to him.'"

That's what Toroni did. I found Orland, Toroni (page 111, right) in Orland, California, he says, "and when I dropped by he pulled out the family Bible, with references he believed referred to flying



to signal UFOs. (A modern version of the ring, formed around PSI headquarters in Austin, Texas, is shown on page 112, bottom right.)

By 1975 various money for PSI began to flow. And according to Starford, one of the most important results was a new device dubbed the UFO-VICTOR. Part keyboard, part video camera and part ruby laser, the machine supposedly sent pulsed messages to UFOs. The operator, who used a



tryback is still in vogue. "If it starts to rain, I'll be in a ship," was promised. When the aliens responded with a dangerous blast of light.

Despite the wonders of the UFO/VE — Dr. Curran says Stanford never published his work, never publicly demonstrated his technology and never documented the existence of a UFO. Today, with his son and funding gone and his projects in ruin, Stanford says he's going to become an artist. "I'll pursue



the UFO thing as I can. If Stanford's effort has stopped, though, Curran has found another project going full speed ahead. The master of ceremonies, Young John Shepherd (page 110 left), who has turned his grandparents' Battle, Mich. gun house into the most elaborate UFO detecting station in town.

Shepherd's interest in UFOs took hold at the age of seven. He was being a "do" when he gawked up to see unexplained lights overhead. Not long after, his family split up, and he came



to live with his grandparents in Delta. Disappointed with high school, he dropped out to soup up sound equipment for local bands. And it didn't take him long to point his son's interest toward the stars.

Today, each morning at six, Shepherd begins by broadcasting music and radio signals from a 20-foot transmitter. He also uses instruments called gravimeters to monitor any violent changes in the earth's magnetic field. The assum-

ien. Curran explains, "It's that those changes have been caused by UFOs." Radio gear wired to the gravimeters then pinpoints the data's source, sending off a message of peace.

Shepherd, who finances his project by selling stock futures, views his life as portentous: from the time he saw a UFO while being a radio to Curran's arrival at his door. There's definitely a purpose, a plan of some kind, Shepherd says. "People are being prepared."

Indeed, Curran found that preparing for the alien



landing has become a favorite pastime for saucer buffs worldwide. Each year, for instance, members of the New Age Foundation meet at Mt. Ranier, Washington, where they join hands to create a cosmic brain battery (page 113, bottom right). The energy, they say, will summon the UFOs. Constant Briccau (page 113, top), head of the Center of Cosmic Consciousness in St. Jovite, Quebec, has converted a wood-frame church to a



temple in anticipation of extraterrestrial gods. And Nordrog (page 111, top), Earth contact for the Outer Dimensional Forces (ODF) in Waco, Texas, is preparing for the arrival of starships. These will set off a sort of Armageddon, he contends—and only those trained by ODF will survive.

The most spirited group of saucer buffs preparing for the aliens, though, could be the Uranus Foundation, located in St. Capis, California.



The Uranus Foundation. Curran explains, presents members with a complete and ordered cosmography. Earth, they believe, is the garbage dump of the universe, the place where unfulfilled souls end up until they achieve enough of a karma bank balance to bail themselves out. The Uranians contend that Earth operates at a low level of consciousness, and raising that consciousness is the group's goal. Such a move, they believe, would send a cosmic yes to the Intergalactic Confederation. That's two



Of the things people ask me," Curran responds, "is how do I listen to the stuff and not die laughing. But in fact, the people in the movement are so sincere, so committed to their ideas that receiving information from them is exciting. When you talk to them, you can't help being impressed by their skills. Most people would consider Ruth Norman, for instance, beyond the pale in terms of fakiness. But she's a wonderful psychologist. She has an awesome ability to command people and influence their behavior. John Shepherd and Orlando Tocco had to master striking technical skills. I was so busy listening, so impressed that I had no time to laugh or don't to pass judgment. It was as if I were an empty vessel getting filled."

—PAMELA WEINTRAUB



spaceships—one from each planet of the Intergalactic Confederation—would then land on Planet Earth (the Uranian landing site, near Jamul, California, is shown on page 112, top) to teach man and a higher way of life."

The power for such an ambitious endeavor," Curran adds, "comes from an eighty-four-year-old widow named Ruth Norman, known to Uranians as Archangel Uziel. The incarnation of a supreme being who has

visited Earth many times before. Uziel has supposedly lived as Confucius, Socrates, Henry VIII, and even Benjamin Franklin. She is also said to have lived among higher consciousness peoples in the planets Vega, Janus, and Yuna.

The first time Curran met Norman, he awaited her with Uranus members lining the street. Suddenly an electric blue Cadillac with a glowing saucer on its roof wheeled into view. Out stepped

Uziel. Curran says, with three-tone flicks on her eyelids, hair the color of orange sherbert, and flowing purple chiffon gown.

Norman's hold over her took. Curran adds, is complete. After one meeting, I watched strong men break into tears as they realized what they had done to Uziel in past lives and how kind she was to sit them appear in her presence now.

(Uranians Brian and Mike Warfield, page 110, right dress in the costumes they

wore in previous lives, with a distant planet.)

Have groups like Uranus convinced Curran that extraterrestrials are on the way? "You can't do the work without coming face to face with that question," he says, which is not to say that I, one face to face with extraterrestrials, I'm open to the possibility, but I'm not encouraged by the likelihood.

How has Curran managed to maintain both skepticism and respect for his subjects?

Photographs from In Advance of the Landing. Folk Concepts of Outer Space, by Douglas Curran, published in 1985 by Abbeville Press. Reprinted with permission of the publisher. All photographs © Douglas Curran 1985.





*They won't choose
Devil's Tower or Disneyland. An earthbound E.T.
would prefer the city life.*

ALIEN LANDING

BY OWEN DAVIES

Well, it's over at last. We've opened the envelopes (on basis of them) and read the entries. Our judges have rendered their verdict. And the winner is . . .

Oh, second thought, perhaps we should review the rules. Remember? You were to tell us in 50 words or fewer where in the United States aliens would land and why they would choose that site. Then you were asked to list the coordinates on the OMN AMERICA map published last October, sketch the appropriate square, and send the package to us. While you were doing that, we recruited a distinguished panel of ufologists, science-fiction writers, and other seekers of alien intelligence to form a single expert answer to our question. The winner would be the person who made the same choice as our panelists and backed it with the best reasoning.

More than 4,000 readers accepted this challenge—one of the largest responses in Omni contest history. Men outnumbered women by about five to one (yet two of our three prize-winners are female). Eighteen teachers in both grammar and high school made the contest a



class project, sending in up to 50 entries per school from their classrooms. We received envelopes from Yale, Harvard, MIT, ISM, Maxwell, Omaha—and even one Indiana penitentiary.

Three answers were by far the most popular, nearly 25 percent of our contestants chose one of them. Alena, they said, would land at Cape Caravelle, where they saw the space shuttle being off; they would follow it home to Edwards Air Force Base, or they would land in the giant reactor cooler outside Winslow, Arizona, Washington, DC, come in a distant fourth.

Several other answers appeared repeatedly. Many thought that hostile—or just cautious—aliens would land at the North American Air Defense Command, near Loveland, Colorado, to neutralize any possible threat to them. Others chose Puffy, North Dakota, the geo-

graphic center of the continent, or Devil's Tower, Wyoming, for a close encounter of the indisputable kind. Several nuclear facilities were voted: Alamogordo, New Mexico; Hanford, Washington; and Three Mile Island.

Alaska was a surprise favorite. It is the home of the Alutian Language Research Center, where scientists are already trying to establish communications with other species. It's also the site of the Centers for Disease Control, where aliens could either study our exotic microbes or be inoculated against them.

A few readers chose the White Mountains of New Hampshire, where Betty and Barney Hill claimed to have been abducted by aliens in the Fifties. And finally there was Escondido, California, home of the Rebel sperm bank, whose biotechnology sleuths might make a deposit to improve the human brood.

Several imaginative answers were applause, if not the contest.

John Sprung of San Pedro, California, suggested that aliens will make their appearance in New Orleans to honor more of the Dauphin just now arriving by radio at their home planet. He calls this the Big Band theory.

PAINTINGS BY TIM WHITE

Nicholas Faust of June Lake, California holds that the aliens will visit Oshkosh, Wisconsin in late July or early August, arriving their craft in the annual Experimental Aircraft Association fly-in.

The proverbial skepticism of Missourians won their state a vote if they can be made to believe in aliens; the rest of the world should be daisy. Extraterrestrials would land in Lamar, Elizabeth Blöbrowka of St. John'sville, New York, added, because of their admiration for hometown hero Harry Truman.

George Lucas's Skywalker Ranch, north of San Francisco, would be a perfect landing site. Sondra Syles of North Wales, Pennsylvania, suggests, because onlookers would shrug off the attention as just another film shot.

What of our 12 panelists? Most of their names seem more prosaic than the Nobel award bank and New Orleans nightspots, better reasoned than Mexico craters and other geographic oddities. Here are our experts and their entries:

- Our first panelist refuses to travel by air: let alone spacecraft. Yet few are better qualified to speculate about where UFOs would land than Isaac Asimov, author of more than 300 books and countless articles on topics ranging from space to Shakespeare. An inveterate New Yorker, he selected map coordinates F-27 (New York City).

"The aliens are land-dwelling comets who are looking for other forms of high intelligence to learn from and to teach," Asimov explains. "They study the night sky for its social illumination, bolstering high technology, and land where it is brightest."

- Former *Omni* editorial director Ben Bova is now director of the National Space Institute, the Washington-based space-advocacy foundation. He has spent the last 25 years thinking about space exploration and—as a science-fiction writer—the possible nature of alien life. Like Asimov, he also chose F-27.

"I can think of three possible reasons for aliens to come here," he says. "They are seeking works of art they can send back to their home world, they are seeking new forms of entertainment, or they are seeking to convert all the inhabitants of the galaxy to their own religion. Therefore, I conclude that the aliens will land in Manhattan, Manhattan is the best place to land artworks. It is rich in entertainment possibilities. And certainly any eventuality would love to take control of the media here."

- Famed science-fiction writer Ray Bradbury foresees a landing in the American Southwest, somewhere between coordinates K-4 and H-11. He will not be able to pin it down more closely than that. He writes:

"If there is any truth in our perceptions regarding the American Indian, then it might be wise for any UFO crew to consider landing in the middle of Arizona or New Mexico. Montezuma's smoking Arizona Caste might make a serene residence for the heavenly invaders until they contacted your local philosophical chief or resident witch doctor. What would most occur might be the staff for a peasant—or perhaps jinni—novel, as the

outcasts of one world meet the outcasts of American time."

- Frank Drake, dean of the national-academy division at the University of California, Santa Cruz, is best known as the founder of SETI, the Search for Extraterrestrial Intelligence. In 1960 his Project Ozma used the National Radio Astronomy Observatory at Green Bank, West Virginia, to eavesdrop on the stars Tau Ceti and Epsilon Eridani in hopes of detecting intelligent sounds. None were heard. Fifteen years later he turned the giant radio telescope at Arecibo, Puerto Rico, to the same task but achieved the same result. And in 1974 he reversed the process, using the Arecibo antenna to send his own message to the stars.

Drake focused on a site chosen by two other panelists—the experts single most popular choice. We made the first two go back and try again and even warned against this suggestion in our contest announcement, but we just couldn't argue with the man who brought hard science to the search for



aliens. He selected map coordinates J-2—Disneyland. His explanation:

"Where to land to learn most about our humanity in one spot? Disneyland is the choice because there one finds just about everything that is special about us: An image of our past, our future, our fantasies, our belief that the world can be better and our belief that technology will make it so. Our love of fun—even hedonism—and our love of children. The rich, the poor, and the great diversity of racial and ethnic groups, something that may be a rare and remarkable phenomenon in civilizations."

- Philosophy professor Edward Regis stayed far outside the normal bounds of his field last year when he edited *Extraterrestrials—Science and Alien Intelligence*, a collection of scholarly articles. Now on a year's leave of absence from Howard University, he imagines aliens will land at coordinates H-4.

"Since aliens create their necessities from stars, they'll arrive to explore, not plunder. Wanting to escape detection while maintaining proximity to a city they'll land in the desert near Las Vegas, the area of lowest electromagnetic emissions among the spots of greatest brightness.

- Nuclear physicist Stanton Friedman has credentials that even ardent UFO skeptics can respect: degrees from the University of Chicago, 14 years of work on nuclear power plants for both ground and space applications, jobs with TRW, Aeronautics and other high-tech firms, and memberships in the American Physical Society, American Nuclear Society and British Interplanetary Society. Yet he believes so strongly in UFOs that he spent 12 years lecturing about them. Today he divides his time between ufology and his practice as a consulting physicist. He cites coordinates J-10, in New Mexico, as most likely to attract aliens.

"Any local startling civilization would keep tabs on all nearby primitives and vary close tabs on those about to venture forth into deep space. Automatic monitors would have detected atom-bomb and rocket tests, as well as radar signals, as long ago as World War II. Ingressing a complete technological and sociological evaluation of Earth," Friedman says. "The most logical place to find the explorers would be New Mexico, where the first atom-bomb tests occurred."

- Bruce Macabee is also a physicist—he specializes in laser optics—and a firm believer in the existence of UFOs. "The only single thing that led me into the study of UFOs," he says. "It just became increasingly clear that many of the explanations given for UFO sightings didn't hold water. I have seen nothing since then to indicate that I was mistaken." He selected map coordinates J-9.

"First contact would occur in the Southwest, where air craft are likely to concentrate their activities to observe our most advanced weapons technologies," he says.

Forced to pick a specific location, he chose the outskirts of Albuquerque, New Mexico, one of the largest cities in the region and near several weapons testing sites. El Paso, Texas, would be his second choice he notes, because of its proximity to White Sands Proving Ground.

- In concealing alien intelligence, it seemed reasonable to ask the thoughts of people working to create it here on Earth. As founder of the Artificial Intelligence Laboratory at the Massachusetts Institute of Technology, Marvin Minsky is one of the most prominent leaders in the field. He suggests that aliens could land any day at the map coordinates F-27—but not in New York.

"The alien impression of intelligent life on Earth is based on what they have been able to learn from our powerful radio and television broadcasts. Naturally, they long ago decided that it would be too dangerous to approach such a fearsome civilization openly. Nevertheless, they launched a discreet expedition to New Brunswick, New Jersey, for the purpose of rescuing any survivors of the ill-fated Marston expedition to Earth; the one they heard described in the *Orson Welles* broadcast," Minsky explains. "They are considering turning back in fear of being vaporized by SDI," the Strategic Defense Initiative, instigated by President Reagan to strike down incoming missiles.

- Former NASA engineer James E. Oborg,

CONTINUED ON PAGE 142

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AGAINST BABYLON

CONTINUED FROM PAGE 94

But he had work to do. Swinging the DC-3 back around toward the west, he swooped down as close as he dared to the edge of the fire and hit the release button on his dump lines. Behind him a great crimson cloud spread out, a slurry of ammonium sulfate and water, thick as paint, with a red dye mixed into it so they could tell which areas had been sprayed. The retardant clung in globs to anything and would keep it damp for hours.

Emptying his four five-hundred-gallon tanks quickly, he headed back to Van Nuys to refill. His eyes were throbbing with fatigue, and the stink of the wet charred earth below was filling through every plane of the old plane. It was not quite noon. He had been up all night. At the airport they had coffee, ready sandwiches, toots bunnies. While he was waiting for the ground crew to fill his tanks he went inside to call Cindy again, and again there was no answer at home, none at the studio. He phoned the gallery and the kid who worked there said she hadn't been in touch all morning.

"If you hear from her," Carmichael said, "tell her I'm flying the control out of Van Nuys on the Chatsworth line, and I'll be home as soon as things calm down a little. Tell her I miss her, too. And tell her that if I run into an E.T. I give it a big hug for her. You got that? Tell her just that."

Across the way in the main hall he saw a crowd gathered around someone carrying a portable television set. Carmichael shouldered his way in just as the announcer was saying, "There has been no sign yet of the occupants of the San Gabriel or Orange County speedships. But this was the horrifying sight that rebounded residents of the Porter Ranch area beheld the morning between nine and ten o'clock." The screen showed two upright tubular figures that looked like squid walking on the legs of their antennae, moving cautiously through the parking lot of a shopping center, peering this way and that out of enormous yellow, platter-shaped eyes. At least a thousand onlookers were watching them at a very distance, appearing both repelled and at the same time irresistibly drawn. Now and then the creatures paused to touch their foreheads together in some sort of communion. They moved very slowly, but Carmichael saw that they were taller than the limpets—twelve feet high, maybe fifteen. Their skins were purplish and leathery looking, with sows of luminous orange spots glowing along the sides. The camera zoomed in for a close-up; then jiggled and swerved wildly just as an enormously long elastic tongue sprang from the chest of one of the alien beings and whipped out into the crowd. For an instant the only thing visible on the screen was a view of the sky. Then Carmichael saw a shot of a stunned-looking girl of about fourteen caught around the waist by that long tongue,

being hoisted into the air and popped like a collected specimen into a narrow green sack. "Teams of the giant creatures roared the town for nearly an hour," the announcer roned. "It has definitely been confirmed that between twenty and thirty human hostages were captured before they returned to their spacecraft. Meanwhile, fire-fighting activities desperately continue under Santa Ana conditions in the vicinity of all three landing sites and—"

Carmichael shook his head. Los Angeles, he thought. The kind of people that live here, they walk right up and let the E.T.s gobble them live flat.

Maybe they think it's just a movie and everything will be okay by the last reel. And then he remembered that Cindy was the kind of people who would walk right up to one of these E.T.s. Cindy was the kind of people who lived in Los Angeles, he told himself, except that Cindy was different. Somehow.

He went outside. The DC-3 was loaded and ready.

In the forty-five minutes since he had left the fire line, the blaze seemed to have spread noticeably toward the south. This time the fire boss had him lay down the retardant from the northeast corner of Porter Ranch. When he returned to the airport, intending to call Cindy again, a man in military uniform stopped him as he crossed the tarmac and said, "You Mike Carmichael, Laurel Canyon?"

"That's right."

"I've got some troublesome news for you. Let's go inside."

"Suppose you tell me here, okay?" The officer looked at him strangely. "It's about your wife," he said. "Cynthia Carmichael? That's your wife's name?"

"Come on, Carmichael said.

"She's one of the hostages, sir."

His breath went from him as though he had been kicked.

"Where did it happen?" he demanded. "How did they get her?"

The officer gave him a strange, strained smile. "It was the shopping-center lot, Porter Ranch. Maybe you saw some of it on TV."

Carmichael nodded. The girl jerked off her feet by the immense elastic tongue, swept through the air, popped into that green pouch. And Cindy—?

"You saw the part where the creatures were moving around? And then suddenly they were grabbing people and everyone was running from them? That was when they got her. She was up front when they began grabbing, and maybe she had a chance to get away, but she waited just a little too long. She started to run. I understand, but then she stopped—she looked back at them—she may have called something out to them—and then—well, and then—"

"Then they scooped her up?"

"I have to tell you that they did."

"I see," Carmichael said stonily.

"One thing all the witnesses agreed, she didn't panic, she don't scream. She was very brave when those monsters grabbed her. How in God's name you can be brave when



"Every night I have the Atomic dream. And every morning I forget it."

something that she is holding you in ruder is something I don't understand, but I have to assure you that those who saw—"

"It makes sense to me," Carmichael said. He turned away. He shut his eyes for a moment and took deep, heavy pulls of the hot, smoky air.

Of course she had gone right out to the landing site. Of course, if there was anyone in Los Angeles who would have wanted to get to them and see them with her own eyes and perhaps try to talk to them and establish some sort of rapport with them, it was Cindy. She wouldn't have been afraid of them. She had never seemed to be afraid of anything. It wasn't hard for Carmichael to imagine her in that panicky mob in the parking lot, cod and rackets, staring at the giant aliens, smiling at them right up to the moment they seized her. In a way he felt very proud of her. But it terrified him to think that she was in her grasp.

"She's on the ship?" he asked. "The one that we have right up back here?"

"Yes."
"Have there been any messages from the hostages? Or from the aliens?"

"I can't divulge that information."
"Is there any information?"

"I'm sorry I'm not at liberty to—"
"I refuse to believe," Carmichael said, "that that ship is just sitting there, that nothing at all is being done to make contact with—"

"A command center has been established, Mr. Carmichael, and certain efforts are under way. That much I can tell you. I can tell you that Washington is involved. But beyond that, at the present point in time—"

A kid who looked like an Eagle Scout came running up. "Four planets all loaded and ready to go, Mike!"

"Yeah," Carmichael said. The fire, the fucking fire! He had almost managed to forget about it. Almost. He hesitated a moment, torn between conflicting responsibilities. Then he said to the officer, "Look, I've got to get back out on the fire line. Can you stay here a little while?"

"Well—"
"Maybe half an hour. I have to do a restaurant dump. Then I want you to take me over to that spaceship and get me through the corridor, so I can talk to those critters myself. If she's on that ship, I mean to get her off it."
"I don't see how it would be possible—"

"Well, try to see," Carmichael said. "I'll meet you right here in half an hour."

When he was alone he noticed right away that the fire was spreading. The wind was even tougher and wilder than before, and now it was blowing hard from the northeast, pushing the flames down toward the edge of Chatsworth. Already some glowing cylinders had blown across the city limits, and Carmichael saw houses alike to his left, maybe half a dozen of them. There would be more, he knew. In this lightning you come to develop an odd sense of which way the struggle is going, whether you're gaining on the blaze or it's gaining on you, and that sense told him now that the vast effort that was under way was failing, that the fire was

still on the upsurge, that whole neighborhood was going to be ashes by nightfall.

He held on tight as the DC-3 entered the fire zone. The fire was sucking air like crazy now and the turbulence was astounding. It felt as if a giant's hand had grabbed the ship by the nose. The fire boss's helicopter was tossing around like a balloon on a string.

Carmichael called in for orders and was sent over to the southwest side, close by the outermost street of houses. Fire fighters with shovels were beating on wisps of flame rising out of people's gardens down there. The skirts of dead leaves that dangled down the trunks of a row of towering palm trees were blazing. The neighborhood dogs had formed a crazed pack, running desperately back and forth.

Sweeping down to street level, Carmichael let go with a red gush of chemicals, swathing everything that looked combustible with the stuff. The shovellers looked up and waved at him, and he dipped his wings to them and headed off to the north, around the western edge of the blaze—it was edging farther to the west too, he saw, looping up into the high canyon out by the Ventura County line—and then he flew westward along the Santa Susana foothills until he could see the spaceship once more, standing isolated in its circle of blackened earth. The column of vehicles seemed to be even larger, what looked like a whole armored division deployed in concentric rings beginning half a mile or so from the ship.

He stared intently at the alien vessel as though he might be able to see through its shimmering walls to Cindy within.

He imagined her sitting at a table, or whatever the aliens used instead of tables, sitting at a table with seven or eight of the huge beings, calmly explaining Earth to them and then asking them to explain their world to her. He was altogether certain that she was safe, that no harm would come to her, that they were not torturing her or dissecting her or sending electric currents through her simply to see how she reacted. Things like that would never happen to Cindy, he knew.

The only thing he feared was that they would depart for their home star without releasing her. The terror that that thought generated in him was as powerful as any kind of fear he had ever felt.

As Carmichael approached the alien landing site he saw the guns of some of the tanks below pivoting around to point at him, and he picked up a radio voice talking him brusquely, "You're off limits, DC-3. Get back to the fire zone. This is prohibited airspace."
"Sorry," he said. "No entry intended."

But as he started to make his turn he dropped down even lower so that he could have a good look at the spaceship. If it had portholes and Cindy was looking out one of those portholes, he wanted her to know that he was nearby. That he was watching, that he was waiting for her to come back. But the ship's hull was blind-folded, entirely blank.
Cindy? Cindy?

She was always looking for the strange, the mysterious, the unfamiliar, he thought.



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The people she brought to the house, a Nevada once a bewitched Turkish tourist, a kid from New York. The music she played, the way she chanted along with it. The incense, the lights, the medication. "I'm searching," she liked to say. Trying always to find a route that would take her into something that was wholly outside herself. Trying to become something more than she was. That was how they had fallen in love in the first place, an unlikely couple, she with her braids and sandals, he with his steady no-nonsense view of the world. She had come up to him that day long ago when he was in the record shop in Studio City and God only knew what he was doing in that part of the world in the first place, and she had asked him something and they had started to talk, and they had talked and talked, talked all night, she wanting to know everything there was to know about him and when dawn came up they were still together and they had rarely been parted since. He never had really been able to understand what it was that she had wanted him for—the Valley rock, the aging flycoy—although he felt certain that she wanted him for something real, that he filled some need for her as she did for him, which could for lack of a more specific term be called love. She had always been searching for that too. Who was? And he knew that she loved him truly and well, though he couldn't quite see why. "Love is understanding," she liked to say. "Understanding is loving." Was she trying to tell the spaceship people about love right this minute? Cindy Cindy Cindy.

Back in Van Nuys a few minutes later he found that everyone at the airport seemed to know by this time that his wife was one of the hostages. The officer whom Carmichael had asked to wait for him was gone. He was not very surprised by that. He thought for a moment of trying to go over to the ship by himself, to get through the cordon and do something about getting Cindy free, but he realized that that was a dumb idea. The military was in charge and they wouldn't let him or anybody else get within a mile of that ship, and he'd only get snarled up in stuff with the television micro-viewers looking for poignant crap about the families of those who had been captured.

Then the head dispatcher came down to meet him on the field, looking almost about ready to burst with compassion, and in future weeks told Carmichael that it would be all right if he called it quits for the day and went home to await whatever might happen. But Carmichael shook him off. "I won't get her back by sitting in the living room," he said. "And this file isn't going to go out by itself either."

It took twenty minutes for the ground crew to pump the retardant slurry into the DC 3's tanks. Carmichael stood to one side drinking Coke and watching the planes come and go. People stared at him, and those who knew him waved from a distance, and three or four pilots came over and silently squeezed his arm or rapped a hand consolingly on his shoulder. The northern sky was

black with soot, shading to gray to east and west. The air was sauna hot and frighteningly dry. You could set fire to it, Carmichael thought, with a snap of your fingers. Somebody running by said that a new fire had broken out in Pasadena, near the Jet Propulsion Lab, and there was another in Griffith Park. The wind was starting to carry firebrands, then. Dodger Stadium was burning someone said. So is Santa Anita Race track, said someone else. The whole damned place is going to go, Carmichael thought. And my wife is sitting inside a spaceship from another planet.

When the plane was ready he took it up and laid down a new line of retardant, practically in the face of the fire fighters working on the outskirts of Chatsworth. They were too busy to have in order to get back to the airport he had to make a big loop behind the fire, over the Santa Susanas and down the flank of the Golden State Freeway, and this time he saw the fires burning to the east, two huge configurations marking the places where the exhaust streams of the other two spacecraft had grazed the dry grass and a bunch of smaller blazes strung out on a line from Burbank or Glendale deep into Orange County. His hands were shaking as he touched down at Van Nuys. He had gone without sleep now for thirty two hours, and he could feel himself starting to pass into that blank, white fatigue that lies somewhere beyond ordinary fatigue.

The head dispatcher was waiting for him again as he left his plane. "All right, Carmichael said at once. "I give in. I'll knock off for five or six hours and grab some sleep, and then you can call me back to—"

"No. That isn't it."

"That isn't what?"

"What I came out here to tell you, Mike. They've released some of the hostages."

"Cindy?"

"I think so. There's an Air Force car here to take you to Sylmar. That's where they've got the command center set up. They said to find you as soon as you come off your last dump mission and send you over here so you can talk with your wife."

"So she's free," Carmichael said. "Oh Jesus, she's free!"

"You go on alone, Mike. We'll look after the fire without you for a while, okay?"

The Air Force car looked like a general's limo, long and low and sleek, with a scoured-jawed driver in front and a couple of very tough-looking young officers to sit with him in back. They said hardly anything, and they looked as weary as Carmichael felt. "How is my wife?" he asked, and one of them said:

"We understand that she hasn't been harmed." The way he said it was stiff and strange. Carmichael shrugged. The kid has seen too many old movies, he told himself.

The whole city seemed to be on fire now. When the air-conditioned limo there was only the faintest whiff of smoke, but the sky to the east was lemming, with streaks of red bursting like meteors through the blackness. Carmichael asked the Air Force man about that, but all he got was a clipped: "It looks pretty

bad, we understand." Somewhere along the San Diego Freeway between Mission Hills and Sylmar, Carmichael fell asleep, and the next thing he knew they were waking him gently and leading him into a vast, bleak, hangarlike building near the rear door. The place was a maze of cables and screens with military personnel operating what looked like a thousand computers and ten thousand telephones. He let himself be stuffed along, moving mechanically and barely able to focus his eyes, to an inner office where a gray-haired colonel greeted him in his best this-is-the-tense-part-of-the-movie style and said: "This may be the most difficult job you've ever had to handle, Mr. Carmichael."

Carmichael scowled. Everybody was Hollywood in this damned town, he thought.

"They told me the hostages were being freed," he said. "When's my wife?"

The colonel pointed to a television screen. "We're going to let you talk to her right now."

"Are you saying I don't get to see her?"

"Not immediately."

Her face was glowing. There was a calm joy in her eyes verging on ecstasy. He had seen her look like that before, but this was different. She had seen the beatific vision, this time.

"Why not? Is she all right?"

"As far as we know, yes."

"You mean she hasn't been released? They told me the hostages were being freed?"

"Al, but there have been let go," said the colonel. "Two people, according to the aliens, were injured as they were captured and are undergoing medical treatment aboard the ship. They'll be released shortly. The third is your wife, Mr. Carmichael. She is unwilling to leave the ship."

"It was like hitting an air pocket."

"Unwilling—?"

"She claims to have volunteered to make the journey to the home world of the aliens. She says she's going to serve as our ambassador, our special emissary. Mr. Carmichael, does your wife have any history of mental imbalance?"

Glaug, Carmichael said. "She's very sane. Believe me."

"You are aware that she showed no display of fear when the aliens seized her in the shopping center incident this morning?"

"I know, yes. That doesn't mean she's crazy. She's unusual. She has unusual ideas. But she's not crazy. Neither am I, incidentally. He put his hands to his face for a mo-

ment and pressed his fingertips lightly against his eyes.

"All right," he said. "Let me talk to her."

"Do you think you can persuade her to leave that ship?"

"I'm sure as hell going to try."

"You are not yourself sympathetic to what she's doing, are you?" the colonel asked.

Carmichael looked up. "Yes. I am sympathetic. She's an intelligent woman doing something that she thinks is important and doing it of her own free will. Why the hell shouldn't I be sympathetic? But I'm going to try to talk her out of it, you bet. I love her. I want her. Somebody else can be the god-damned ambassador to Betelgeuse. Let me talk to her, will you?"

The colonel gestured, and the big television screen came to life. For a moment, mysterious colored patterns flashed across it in a disturbing, random way, then Carmichael caught glimpses of shadowy catwalks, intricate metal structures creaking and rattling at peculiar angles, and then for an instant one of the aliens appeared on the screen. Yellow pterid eyes looked complacently back at him. Carmichael left although he was awake now.

The aliens took vanished and Cindy came into view. The moment he saw her, Carmichael knew that he had lost her.

Her face was glowing. There was a calm joy in her eyes verging on ecstasy. He had seen her look something like that on many occasions, but this was different. This was beyond anything she had attained before. She had seen the beatific vision, this time.

"Cindy?"

"Hello, Mike."

"Can you tell me what's been happening in there, Cindy?"

"It's incredible. The contact, the communication."

"Sure, he thought, if anyone could make contact with the space people it would be Cindy. She had a certain kind of magic about her, the gift of being able to open any door."

She said: "They speak mind to mind, you know, no barriers at all. They've come in peace to get to know us, to join in harmony with us, to welcome us into the colorful world of words."

He motioned his lips. "What have they done to you, Cindy? Have they brainwashed you or something?"

"No. No, nothing like that. They haven't done a thing to me, Mike! We've just talked."

"They've showed me how to touch my mind to theirs. That ain't brainwashing. I'm call me I, me, Cindy. I'm okay. Do I look as though I'm being harmed? They aren't dangerous. Believe me."

They've set fire to half the city with their exhaust trails, you know.

That grieves them. It was an accident. They didn't understand how dry the hills were. If they had some way of extinguishing the flames, they would, but the fires are too big even for them. They ask us to forgive them. They want everyone to know how sorry they are. She paused a moment. Then she

said, very gently, "Mike, will you come onboard? I want you to experience them as I'm experiencing them."

"I can't do that, Cindy."

"Of course you can! Anyone can! You just open your mind, they touch you and—"

"I know I don't want to. Come out of there and come home, Cindy. Please, Please. It's been three days—four, now—I want to hug you. I want to hold you—"

"You can hold me as tight as you like. They'll let you onboard. We can go to their world together. You know that I'm going to go with them to their world, don't you?"

"You aren't. Not really."

She nodded gravely. She seemed terribly serious. "They'll be leaving in a few weeks, as soon as they've had a chance to exchange gifts with Earth. I've seen images of their planet—like movies, only they do it with their minds—Mike, you can't imagine how beautiful it is! How eager they are to have me come!"

Sweat rolled out of his hair into his eyes, making him blink, but he did not dare wipe away for fear she would think he was crying.

"I don't want to go to their planet, Cindy. And I don't want you to go either."

She was silent for a time. Then she smiled delicately and said, "I know, Mike."

He clutched his hair and let go and clutched them again. "I can't go there."

"No. You can't. I understand that. Los Angeles is alien enough for you. I think, you

need to be in your Valley, in your own real world, not running off to some far star. I won't try to coax you."

"But you're going to go anyway?" He asked, and it was not really a question.

"You already know what I'm going to do." "Yes."

"I'm sorry. But not really."

"Do you love me?" he said, and regretted saying it all at once.

She smiled sadly. "You know I do. And you know I don't want to leave you. But once they touched my mind with theirs, once I saw what kind of beings they are—do you know what I mean? I don't have to explain, do I? You always know what I mean."

"Cindy—"
"Oh, Mike, I do love you so much."
"And I love you, babe. And I wish you'd come out of that goddamned ship."

"You won't ask that. Because you love me right? Just as I won't ask you again to come onboard with me, because I really love you. Do you understand that, Mike?"

He wanted to reach into the screen and grab her.

"I understand, yes," he made himself say.

"I love you, Mike."
"I love you, Cindy."

They tell me the round-trip takes forty-eight of our years, but it will only seem like a few weeks to me. Oh, Mike! Good-bye, Mike! God bless Mike! She blew kisses to him. He saw his favorite rings on her fingers: the three little strange star sapphires ones that

she had made when she first began to design jewelry. He searched his mind for some new way to reason with her, some line of argument that would work, and could find none. He felt a vast emptiness beginning to expand within him, as though he was being made hollow by some whirling blade. Her face was shining. She seemed like a stranger to him suddenly. She seemed like a Los Angeles person, one of those, lost in fantasies and dreams, and it was as though he had never known her, or as though he had pretended she was something other than she was. No, No, that isn't right. She's not one of those, she's Cindy. Following her own star, as always. Suddenly he was unable to look at the screen any longer, and he turned away, bringing his lip, making a shoving gesture with his left hand. The Air Force man in the coats wore the awkward expressions of people who had inadvertently eavesdropped on someone's most intimate moments and were trying to pretend they had heard nothing.

"She isn't crazy, Colonel," Carmichael said valiantly. "I don't want anyone believing she's some kind of nut."

"Of course not, Mr. Carmichael."

"But she's not going to leave that spaceship. You heard her. She's staying aboard, going back with them to wherever the hell they came from. I can't do anything about that. You see that, don't you? Nothing I could do, short of going aboard that ship and dragging her off physically, would get her out of there. And I wouldn't ever do that."

Naturally not. In any case, you understand that it would be impossible for us to permit you to go onboard, even for the sake of attempting to remove her."

"That's all right," Carmichael said. "I wouldn't dream of it. To remove her or even just to open her for the top. I don't want to go to that place. Let her go. That's what she was meant to do in this world. Not me. Not me, Colonel. That's simply not my thing." He took a deep breath. He thought he might be trembling. "Colonel, do you mind if I got the hell out of here? Maybe I would feel better if I went back out there and dumped some man-gunk on that fire. I think that might help. That's what I think, Colonel. All right? Would you send me back to Van Nuys, Colonel?"

He went up one last time in the DC-3. They wanted him to dump the retardants along the western face of the line, but instead he went to the east, where the spaceship was, and flew in a wide circle around it. A radio voice warned him to move out of the area, and he said that he would.

As he circled, a hatch opened in the spaceship's side and one of the aliens appeared, looking gigantic even from Carmichael's altitude. The huge, purplish thing stepped from the ship, extended its tentacles, seemed to be sniffing the smoky air.

Carmichael thought vaguely of flying down low and dropping his whole load of retardants on the creature, downing it in gunk getting down with the aliens for having taken Cindy from him. He shook his head. That's crazy, he told himself. Cindy would feel sick if she knew he had ever considered any such



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thing. But that's what I'm like, he thought. Just an ordinary, ugly, vengeful Eintracht. And that's why I'm not going to go to that other planet, and that's why she is.

He swung around past the spaceship and headed straight across. Grizaba Hills and Northridge into Van Nuys Airport. When he was on the ground he sat at the controls of his plane a long while, not moving at all. Finally one of the dispatchers came out and called up to him: "Mike, are you okay?"

"Yeah, I'm fine."

"How come you came back without dropping your load?"

Carmichael peered at his gauges. "Did I do that? I guess I did that. Didn't I?"

"You're not okay, are you?"

"I forgot to dump, I guess. No, I didn't forget. I just didn't feel like doing it."

"Mike, come on out of that plane."

"I didn't feel like doing it," Carmichael said again. "Why the hell bother? The crazy city—thank's nothing left in it that I would want to save anyway." His control deserted him at last, and rage swept through him like fat racing up the slopes of a dry canyon.

He understood what also was doing, and he respected it, but he didn't have to like it. He didn't like it at all. He had lost Cindy, and he felt somehow that he had lost his war with Los Angeles as well. "Fuck it," he said. "Let it burn. This crazy city I always hated. It deserves what it gets. The only reason I stayed here was for her. She was all that mattered. But she's going away now. Let the fucking place burn."

The dispatcher piped at him in amazement: "Mike—"

Carmichael moved his head slowly from side to side as though trying to shake a monstrous headache from it. Then he frowned. "No that's wrong," he said. "You've got to do the job anyway, right? No matter how you feel. You have to put the fires out. You have to save what you can. Listen, I'm not going to fly one last loop today, you hear? And then I'll go home and get some sleep. Okay? Okay?" He had the plane in motion, going down the short runway. Dinty felt relieved that he had not requested clearance. A little Cessna, spottier plane, moved desperately out of the way, and then he was done. The sky was black and red. The fire was completely uncontained now, and maybe uncontrollable. But you had to keep trying, he thought. You had to save what you could. He gunned and went forward, flying calmly into the inferno in the foothills, until the wild thermals caught his wings from below and lifted him, and tossed him like a toy skimming over the top and sent him hurtling toward the waiting hills to the north.

Thus saith the Lord, Behold, I will raise up against Babylon, and against them that dwell in the midst of them that sit up against me a destroying wind.

And will send into Babylon fanners, that shall fan her, and shall empty her land. For in the day of trouble they shall be against her round about.

Jeremiah 51:1-10:00

INTERVIEW

CONTINUED FROM PAGE 101

gnable now. Every advance in knowledge has its self-correcting or self-liquidating consequence. Every advance should expose new areas of ignorance. Sometimes a new formula or scientific dogma appears as the most prominent thing in the foreground. But behind it looms vast new areas of darkness. Those are the most promising areas.

Greer: Would you personally accept a ride on the shuttle?

Booster: Is this an invitation? I don't know. It takes different kinds of courage to do different kinds of things. I don't know whether I have that kind of courage. I have never confronted it. I don't like to look down from a precipice. I'd probably take it. I don't think this is likely to happen! But why not? Why not? One of my favorite movies comes from a wonderful passage in one of Shaw's plays. The serpent says to Eve in the Garden of Eden, "When you and Adam talk I hear you say 'why?' But I dream things that never were, and I say 'why not?'" I think that's a better question: "Why not?"

I don't think there is a certain type of person who is a discoverer or a creator. The Discoverers dramatize the accidentalness and unpredictability of the types of people who would be discoverers. You couldn't tell if it would be a respectable William Harvey (English physician who demonstrated the function of the heart and circulation of the blood) or a half-mad scientist Paracelsus (Swiss physician and alchemist) who would add something.

Greer: Many scientists toil off after accomplishing great things, but you are still going strong after five decades of hard work. How do you explain it?

Booster: Well, trying to match an accomplishment is a problem of success for everybody. As Goethe observed, "Why is it that when a man accomplishes one remarkable thing, the world conspires to prevent him from accomplishing another?" People are hungry for what the discoverer or creator provides them—but they are also envious.

But one doesn't deserve praise nor is one entitled to feel virtuous, for working at what one wants to do, any more than for failing in love. If you're lucky enough to love your work, why should you be pressed for doing what you can't help doing?

The problem in writing is having something to say. Writer's block is basically thinker's block. If you haven't anything to say, of course it's going to be harder to write it.

Greer: What's the difference between a discoverer and a creator?

Booster: The Discoverers were about the search for what is out there, everything outside of humanity's consciousness—the world, society, the continents, and so on. The Creators is what we make of what's out there. It's all about the arts. The Discoverers stressed that one of the great obstacles to human progress was not ignorance but the illusion of knowledge. The counterpart in the

Creators is the mystery of what's out there for the discoverer is the mystery of what one has created. And the creator never really knows what he or she has created.

Greer: Have you had any surprises so far?

Booster: One unexpected thing I found was that the very idea of creation is novel and does not exist everywhere in the world. The great Greek philosophers didn't believe there could be anything new. Plato and Aristotle both believed that whatever you were making was only a reaching for some ideal existing from eternity. Yet they were wonderfully creative.

The history of creation is in part the history of humans' increasing awareness of our creative powers. But we can be aware of our powers without ever being aware of the consequences. The epigraph of my book, *The Genius of American Politics* is the emptiness of the Holy of Holies in the ancient temple of Solomon. That is in some ways the symbol of my view of history. You're not trying to assemble a jigsaw puzzle as some historians and politicians seem to think. Rather you're searching for the boundaries of your ignorance, trying to discover what it is you really don't know.

Greer: What is the last sentence in your typewriter this morning?

Booster: And the last signs of many awareness of himself remain the most enduring." In his chapter called "The Cities of the Dead," I'm dealing with the beginnings of architecture and with mankind's struggle against his own reluctance to try, or even accept the new.

Man's first creators started with his efforts to overcome or deny the transience of his life, to reassure himself that he and his works are permanent. The pyramids, the Mayan temples, or Stonehenge would be a very good example of that.

These very first efforts are those to which we now turn for understanding, whether about the Egyptians, the early Central Americans, or Paleolithic people. Ritual, dance, and music are many attempts to reassure himself of the regularity of experience, that the cycles are going to continue to come. The arts originate in man's efforts to overcome his uneasiness about the transience of his life and the unreliability of nature.

Greer: Do you believe that there are cycles of invention, scientific discovery, and creativity in human history?

Booster: I don't believe in the decline of human nature—no more heroes, no more creations, no more great people. Opportunities change, but I see no reason to believe that all of a sudden after thousands of years on Earth human intelligence and ingenuity will disappear. Invention isn't always heroic by the way. Sometimes it is just happy. The great inventions of modern times were not necessary, were no more useful than what preceded them. There was no need for television, no cinema from his public saying, "We need television!" When the automobile was desired it was a much less efficient mode of transportation than the horse, because there were no roads.

A taste of Italian night life



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So there is a kind of reciprocal relation between what humans try and what they need and what they think they need and so on. It's not a simple linear movement along the path of biological or even spiritual needs.

Ortiz: Is it sacrilege to suggest that we might eventually have a pill to make people more creative?

Boorstin: The Creator will emphasize that creativity is on what I call the "terrible verge"—that is, its resources stem from the unfamiliar. Anything increasing human sensitivity and receptivity to the unfamiliar should promote the chances of creation. Since creativity by its nature is unpredictable, a society that encourages creativity must be hospitable to the unpredictable. That, indeed, is quite a conundrum!

Much of great literature has been produced in oppressed societies. The novels of Tolstoy, Dostoyevski, and Turgenev are all products of the czarist regime. That oppressive society granted Count Tolstoy the leisure to work as he did. But a free society like that of America increases the probability of the unpredictable. Efforts to keep peoples' thoughts channeled, as in the Soviet Union and other totalitarian societies, will ultimately fail. The mind cannot be imprisoned.

Ortiz: By allowing communication to escape control and censorship, do you think that personal computers will help depense oppression in Russia?

Boorstin: Computers make you energy dependent, unlike when you write a letter or a

manuscript. Authorities could withhold either the machine itself or parts needed for repairs. Certainly broadcasting and other electronic media have caused an important shift by promoting the sale of the undelivered audience. With printed books you have a certain number of copies that can be holed or rescued. But with radio and television you never know who's listening or watching. **Ortiz:** We shouldn't, you say, be too skeptical of the advantages of a new invention, since we can't immediately know what these inventions are. **Boorstin:** I agree. We never know the uses of it or the consequences of it. When some people first saw that Henry Ford was going to lighten all the horses, he replied that if everyone had an automobile there wouldn't be any more horses.

That's true for great works of art, too. How could Shakespeare have imagined *Kiss Me Kate*? And the creators of *Kiss Me Kate* also could not have known what they had created, because there'll be another symbolic by-product of it.

Ortiz: Our quest for knowledge has led us into enormous difficulties with the unfortunate discovery of the atomic bomb. Is there any solution to that dilemma?

Boorstin: It would be hard to imagine any of man's inventions that could not have "unintended" by-products. What about fire? Few things are more destructive than fire. Maybe that was unfortunate. Maybe all civilization was a mistake, as some philosophers have

suggested. But why not at all free to ask that question?

Ortiz: But don't we have to advance in line with what we find out about nature so that the power we gain to destroy doesn't outrun our wisdom?

Boorstin: Most efforts to civilize humans have been based on an arrogance, an assumption that man knows more than he really does, know about his nature and his powers. That was true when people tried to suggest the techniques of immunization, which many opposed and which produced deaths in the case of smallpox vaccination. Many who were against it said, "Who are we to interfere with the works of Providence?" The same story is often repeated. It's a parable of people refusing to accept the consequences of knowledge and ingenuity. And we can't refuse. We must continue to play with and to try to test these consequences, and within the limits of prudence and decency to render them as undamaging and as fruitful as possible.

When I was at the National Museum of History and Technology one of our first exhibits was entitled "Do It the Hard Way" from an essay by Rube Goldberg. The motto is perhaps a name for civilization—finding more complicated ways to do simpler tasks, to satisfy simple needs. The point is, man is not free not to elaborate his technology. He must pursue the path that he sees but has never followed.

Ortiz: You've written that technology's supreme law is convergence—the tendency for everything to become more like everything else. Do you think the culture of the future will be more and more homogeneous, the same everywhere?

Boorstin: Now technologies tend to erase distinctions of place and time. When you see something broadcast on television, you can't know whether it is taped or live, someone has to tell you. The Creator points out that culture and knowledge grow on the boundary between something and something else. When you reduce this element to sameness, you disintegrate the opportunities for art and new knowledge.

Ortiz: You feel the amateur historian has an advantage, don't you?

Boorstin: I probably wouldn't have written most of my books if I had been properly trained as a historian. But I didn't know what the rules were, and I didn't know where the highway was. And the highway usually becomes a rut for any profession. So I had to do what interested me.

Ortiz: Isn't it rather forbidding to come in from the outside?

Boorstin: Ah, but my notion is that there is no outside. There is only an inside, and it's for everybody. You're speaking like a professional when you say "coming from the outside." I have never felt I was trespassing on anybody's territory by writing history. A professional usually aims at possessing a monopoly and a jargon, and is concerned with keeping out competitors, whether lawyers, doctors, historians, sociologists, you name 'em—not librarians, of course! **DD**



MOUNTAIN WARRIOR

EXPLORATIONS

By Jane Goodall

Half-hidden in the damp forest vegetation, she stands near a huge silverback male gorilla, who accepts, even welcomes, her proximity. Her face radiates love for this animal, just one of a group of gorillas for whom her heart knows no bounds. This is how I and thousands of others will remember Dian Fossey. It is also how she wanted to be remembered, for it was a fascination for the gorillas and a desire to learn about them that first lured her into the forbidding, mist-swathed Virunga volcanoes of the African country of Rwanda. It was love and respect for them that kept her there most of her life, battling the cold, the months of rain, the venal clinging raffles, and all the very real dangers of that wild place. And it was her dedication to the well-being of the gorillas and hatred of those who harmed them that led to her untimely death.

I first met Dian in 1966, when she came to see me at my camp in Tanzania to discuss field methods. She was interested, of course, in the chimpanzees I was studying, but it was clear that the visit was no more than a necessary interlude. She was

impatient to start work with her own chosen ape, the gorilla. After this initial two-week encounter, we were to meet infrequently over the years, usually for brief periods in which we exchanged a few ideas, then hopped off in different directions: she to lecture in the States and I to return to Africa, or the other way around.

I cannot say I ever came to know Dian well. I doubt that many people did. She was a complex person with startling abruptness as she swung from one mood to another. What most distinguished her, though, was her courage. Her refusal to give way to threats by native poachers who resented her protection of the gorillas and her stamina in facing the charge of an angry silverback have become legendary. Her courage went beyond the Robert Hinde, a professor with whom both Dian and I studied at Cambridge University, told me recently that Dian had a tent of rafts on Onea when he visited her in a hotel room she spent most of the time glued to a wall away from the window. Yet she lived and worked in the mountains, crossing steep gorges and clambering precipitous cliffs,

fighting her paralyzing fear so she could stay with the gorilla.

It was this persistence, this determination to stay in the field despite all difficulties, discomforts, and dangers that led, I believe, to her most significant contribution to science. She compiled careful case histories of individual gorillas that in some instances spanned nearly 20 years. Such meticulous research is needed in order to understand the unique personality and idiosyncrasies of individual gorillas. Because of her research we have a much better understanding of rarely observed but critical events in gorilla life. We have a clearer sense of how gorillas interact with neighboring social groups, why and when occasional brutal infanticides occur, and what precipitates conflicts among adult gorillas.

Dian also shared her work with many students. But her standards for field research were high, so high, in fact, that most of her relationships with students soured when they failed to meet her expectations. She once limped around with an untreated broken leg because it was not convenient for her to leave her research. "This is what fieldwork is all about," she wrote to David Menard, the illustrator who worked with her on gorillas in the Meru. "You simply dive yourself to exhaustion and dive others in the same manner. The gorillas deserve as much—oh, so much more."

During our last visit, Dian and I discussed problems that arise with students in the field. At that time she was at Cornell University in New York, putting the finishing touches on her book. As we walked through Cornell's Sapsucker Woods on a cold but sunny spring morning, we stopped to watch a woodpecker, then a squirrel. Although a far cry from the wild mountains of Rwanda, it was a link to nature Dian craved. "It helps to keep me sane," she said.

She was very depressed then. Her furts had almost run out. Unless her book was a success she was not sure how she would get back to Rwanda. "Yet she had to return. 'There is no future for me in the country,' she said. 'I sensed a desperate plea in her voice: 'I have to get back to the gorillas.'"

Asked to that feeling of desperation was



To serve them all her days, the late Dian Fossey with the gorillas she studied and protected.

the knowledge that even if she did return to Rwanda she would be handicapped by ill health in the high altitude of her camp. She was suffering from emphysema. Moreover, her old dog Cinde had recently died. Back at her apartment I caught her gazing—her eyes wet with tears—at the spot on a rug where Cinde could always be found. Under she wails, commenting on my acquisition of a new dog. "No one should live without an animal, though there are times when I wonder if the hurt one gets from losing them is worth it at all."

Animals were more than just companions to Dian. They were what touched her most deeply. Years ago, when she returned to England for a visit, she met Robert Hinde at the airport. She was enthralled and could hardly contain her excitement. She had, she told him, touched a gorilla for the first time in an itinerary that she hated: the poachers who intentionally or unintentionally so often caused her gorillas to suffer horrible deaths? Time and again her study animals were caught in cruel snares. Some had been set for other animals; the gorillas had been captured by accident! Other times the poachers were after the apes themselves for the magical properties thought to be in various parts of their bodies, or for selling to tourists. Gorilla-hunt as a hobby is very popular.

Right or wrong, Dian attacked the poaching problem in her own, often highly unorthodox, way. At first she terrorized poachers by sprang out at them, her face grotesquely disguised by a Halloween mask. Later she enlisted dedicated Rwandan game guards to patrol the mountains. During the last few months of her life, when she was unable to follow the gorillas because of her health, she wrote to tell me that she spent almost all of her time "running patrols, which I'm really good at, and is my main source of satisfaction now."

She had been able to return to Rwanda because Gorilla in the Mist had been a huge success and the fund she had set up in honor of Digs, one of her most beloved apes, who had been murdered by poachers, was bringing in substantial support. If either of these efforts had been less successful, she might not have been able to return to Africa, and she would not have died in that homely way, backed to death with a machete as she lay alone in her cabin at night. Even so she had spent her last months where she most wanted to be: near the magnificent animals to whom she had devoted her life.

What was Dian's greatest contribution? Was it her scientific mapping of gorilla lives in the midst of their mountain home? Or was it her "active" conservation of their lives and habitat? If Dian had never gone to work in Rwanda there would be far fewer mountain gorillas than there are today. Without her protection it is quite possible that the last of them would have been killed long ago. Her grace among the graves of so many of them, gives testament to the power of dedication, love, and courage. Let us hope that it also serves to make her cause our own. **CD**

BLOOD

CONTINUED FROM PAGE 48

Suddenly it broke like a dam, and the black waters poured through, inundating the room.

Fuller knew something was amiss (it was in the color of his aura, the sudden fear), but he didn't understand what was happening. She left his spine ripple. She could see his brain whir!

"What's going on?" he said. The pathos of the inquiry made her want to laugh!

Upstairs, the water jug in the writing room shattered.

Fuller let her go and ran toward the door. It began to rattle and shake even as he approached it, as though all the imbalances of hell were beeping on the other side. The handle turned and turned and turned. The paint blistered. The key glowed red hot.

Fuller looked back at the doctor, who was still fixed in that grotesque position, head back, eyes wide.

He reached for the handle, but the door opened before he could touch it. The hallway beyond had disappeared altogether. Where the familiar interior had stood the vista of the highway stretched to the horizon. The sight killed Fuller in a moment. His mind had no strength to take the panorama in—it could not control the overload that ran through his every nerve. His heart stopped; a revolution overturned the order of his system, his bladder leaked, his bowels leaked, his limbs shook and collapsed. As he sank to the floor his face began to blister like the door and his corpse rattle like the handle. He was inert, stiff already, as if for his indignity as wood or steel.

Somewhere to the east his soul joined the wounded highway, on its route to the intersection where just a moment previously he had died.

Mary Fitzcarril knew she was alone. Above her the marvelous boy, her beautiful, cheating child, was writhing and screaming as the dead set their vegetal hands on his flesh. She knew their intention. She could see it in their eyes—there was nothing new about it. Every history had that particular moment in its tradition. He was to be used to record their testaments. He was to be their page, their book, the vessel for their autobiographies. A book of blood. A book made of blood. A book written in blood. She thought of the grimaces that had been made of dead human skin. She'd seen them, touched them. She thought of the tattoos she'd seen. Break-show exhibits, some of them, others just shortless laborers in the street with a message to their mothers, pricked sores that back it. It was not unknown, to write a book of blood.

But on such skin, on such gleaming skin—on God. That was the crime. He screamed as the torturing need as of broken jug glass flipped against his flesh, plovering it up. She felt his agonies as if they had been hers, and they were not so terrible.

Yet he screamed. And thought and poured obscenities out of his attackers. They look

no notice. They swarmed around him, dead to any plea or prayer, and worked on him with all the enthusiasm of cicadas forced into silence for too long. Mary leered as his voice wailed with its complaints, and she fought against the weight of fear in her limbs. Somehow, she felt, she must get up to the room. It didn't matter what was beyond the door or on the stairs—he needed her, and that was enough.

She stood up and felt her hair swell up from her head, falling like the snakes hair of the Gorgon Medusa. Reality swam—there was scarcely a floor to be seen beneath her. The boards of the house were ghost wood, and beyond them a seething dark raged and yowled at her. She looked to the door, feeling all the time a lethargy that was so hard to fight off.

Clearly they didn't want her up there. Maybe, she thought, they even fear me a little. The idea gave her resolution, why else was they bothering to intimidate her unless her very presence, having once opened this hole in the world, was now a threat to them?

The blistered door was open. Beyond it the reality of the house had succumbed completely to the howling chaos of the highway. She stepped through, concentrating on the way her feet still touched solid floor even though her eyes could no longer see. The sky above her was Prussian blue, the high way was wide and empty, the dead pressed on every side. She fought through them as though a crowd of living people, while their gaping, idiot faces looked at her and hated her invasion.

The "Pleaser" was gone. Now she said nothing, just gritted her teeth and narrowed her eyes against the highway, kicking her feet forward to find the reality of the stars that she knew were there. She tripped as she touched them, and a howl went up from the crowd. She couldn't tell if they were laughing at her clumsiness or sounding a warning at how far she had got.

First step. Second step. Third step. Though she was torn at from every side she was winning against the crowd. Ahead she could see through the door of the room to where her little fat was sprawled, surrounded by his attackers.

The boy's brows were around his ankles. The scene resembled a rape. He screamed no longer, but his eyes wailed wild with terror and pain. At least he was still alive. The natural resilience of his young mind half accepted the spectacle that had opened in front of him.

Suddenly his head jerked around, and he looked straight through the door at her. In this extremely he had dropped up a true talent, a skill that was a fraction of Mary's but enough to make contact with her. Their eyes met. In a sea of blue darkness, surrounded on every side with a civilization they neither knew nor understood, their living hearts met and married.

"I'm sorry," he said, stantly. It was infinitely petty. "I'm sorry, I'm sorry." He looked away, his gaze writhed from hers.

She was certain she must be blind at the

top of the stark, her feet stiff breathing air as far as her eyes could tell, the faces of the travelers above, below, and on every side of her. But she could see—very faintly—the outline of the door, and the boards and beams of the room where Simon lay. He was one mass of blood now, from head to foot. She could see the marks, the hieroglyphics of agony on every inch of his torso, his face, and his limbs.

One moment he seemed to flash into focus, and she could see him in the empty room, with the sun through the window and the shattered jug at his side. Then her concentration would falter, and instead she'd see the invisible world made visible, and he'd be hanging in the air while they wrote on him from every side, plucking out the hair on his head and body to clear the page, writing in his empties, writing on his eyelids, writing on his genitals, in the creases of his buttocks, on the soles of his feet.

Only the wounds were in common between the two sights. Whether she saw him bare or with authors or aliens in the room, he was bleeding and bleeding.

She had reached the door now. Her trembling hand stretched to touch the solid reality of the handle, but even with all the concentration she could muster it would not come clear. There was barely a ghost image for her to focus on, though it was sufficient. She grasped the handle, turned it, and flung the door of the writing room open.

He was there, in front of her. No more than

two or three yards of possessed air separated them. Their eyes met again, and an eloquent look, common to the living and the dead worlds, passed between them. There was compassion in that look, and love. The tears fell away, the lips were dust. In place of the boy's manipulative smiles was a true sweetness—answered in her face.

And the dead, fearful of this look, turned their heads away. Their faces lightened, as though the skin were being stretched over the bone, their flesh darkening to a bronze, their voices becoming wistful with the anticipation of defeat. She reached to touch him, no longer hearing to fight against the hordes of the dead. They were falling away from their quarry on every side, like dying flies dropping from a window.

She touched him, lightly on the face. The touch was a benediction. Tears filled his eyes, and ran down his scarred cheek, mingling with the blood.

The dead had no voices now, nor even mouths. They were lost along the highway, their malice damned.

Plane by plane the room began to reestablish itself. The floorboards became visible under his sobbing body, every nail, every stained plank. The windows came clearly into view—and outside the twilight street was echoing with the clamor of children. The highway had disappeared from living human sight, entirely its travelers had turned their backs to the dark and gone away into oblivion, leaving only their signs and their tra-

versants in the concrete world.

On the middle landing of Number Seventy-five the smoking, bleached body of Reg Fuller was casually trodden by the travelers' feet, as they passed over the intersection. At length Fuller's own soul came by in the throng and glombed down at the flesh he had once occupied, before the crowd pressed him on toward his judgment.

Upstairs, in the darkening room, Mary Fioretti knelt, beside the McNeil boy and stroked his blood-plastered head. She didn't want to leave the house for assistance until she was certain his tormentors would not come back.

There was no sound now but the whine of a jet finding its way through the stratosphere to morning. Even the boy's breathing was hushed and regular. No nimbus of light surrounded him. Every sense was in place. Sight. Sound. Touch.

Touch. She touched him now as she had never previously dared, brushing her fingertips, oh so lightly, over his body, running her fingers across the raised skin like a blind woman reading Braille. There were minute words on every millimeter of his body, written in a multitude of hands. Even though the blood she could discern the meticulous way that the words had harrowed into him. She could even read, by the dimming light, an occasional phrase.

It was proof beyond any doubt, but oh God, how she wished that she had not come to it. And yet, after a lifetime of waiting, here it was, the revelation of life beyond flesh written in flesh itself.

The boy would survive, that was clear. Already the blood was drying and the myriad wounds healing. He was healthy and strong, after all. There would be no fundamental physical damage. His beauty was gone for ever, of course. From now on he would be an object of curiosity at best, and at worst of repugnance and honor. But she would protect him, and he would learn, in time, how to know and trust her. Their hearts were inextricably tied together.

And after a time, when the words on his body were scarce and sparse, she would read him. She would trace, with infinite love and patience, the stones the dead had laid on the boy.

The tale on his abdomen, written in a fine, curative style. The testimony in exquisite, elegant print that covered his face and scalp. The story on his back, and on his shin, on his hands.

She would read them all, repeat them all, every last syllable that glistered and seeped beneath her adoring fingers, so that the world would know the stones that the dead fell.

He was a Book of Blood, and she his sole translator.

As darkness fell, she left off her vigil and led him, naked, into the balmy night. **OO**



DRINK FOR TASTE, NOT TRENDS.

DOS EQUITUS
XX

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BODY

CONTINUED FROM PAGE 28

recovery rate for animals treated with TRH than those given naloxone, but to the great surprise of the researchers TRH was also effective in preventing paralysis even when administered 24 hours after the initial injury.

The gospel at that time was that you had four hours maximum to block secondary injury effects," Faden says. "When the animals were treated much later recovery was so dramatic that the lab technicians told us it was useless even to use a control group. There's no way to 'blind' a TRH study."

Faden believes that his research into a TRH-like drug now being tested in Europe may bring him a step closer to the ideal antidote: one that an ambulance driver can administer at the scene of an accident before any of the secondary damage leading to paralysis occurs.

If the naloxone tests just begun show positive results in two to three years—and Faden cautions that there are no guarantees that human reaction to the opiate blocker will duplicate animal studies—then he hopes to begin a similar trial on TRH. "This is an incredibly promising time in neurology," Faden says. "The study of endorphins may suggest treatments for spinal and head injury stroke, and possibly even certain cancerous tumor growth. A number of so-called untreatable diseases have already been implicated." He adds: "That's dramatic when you remember that the entire field didn't even exist ten years ago."

According to the American Paralysis Association (APA), approximately 40,000 people each country more than \$2 billion a year in medical treatment, workdays compensation, and lost wages. Lifetime care for the average victim will top \$1 million. Even so, combined federal and private sector research funding amounts to less than \$20 million.

"It doesn't make economic sense," says Kent Walczak, who is now the president of the APA. "There's hope now where there wasn't any before. Remember that in terms of numbers and cost to society, spinal injury is a much greater nightmare in this country than polio ever was." □

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Once we get
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STARS

CONTINUED FROM PAGE 34

bly meeting, which took place in Greece. What they eventually decided was who would select the temporary and the permanent names for these planetary objects.

Once this was settled, the IAU then moved to decide on the names. First a group of astronomers, the IAU's Commission 6, selects a temporary name. Whether an object is to be assigned a permanent name is decided by a second committee, the Commission 20, which monitors the positions and movement of comets, satellites, and minor planets. Finally, selecting the permanent name is done by a third committee, the Working Group on Planetary System Nomenclature (WGPSN).

In the case of the new moons of Uranus, various names have already been proposed. Since the discovery of the moons coincided with the tragedy of the space shuttle Challenger, one of the more frequent suggestions was to name seven of the moons after the seven astronauts.

The idea was forwarded to the IAU, but it is not likely to be realized. In the past the IAU has named only planetary features after people. For example, some craters on the moon bear the names of deceased Soviet cosmonauts and of the three American astronauts who died in the Apollo 1 fire. Also, Soviet cartographers announced that two craters on Venus would be named after Challenger crew members Judith A. Ares and Christa McAuliffe. But the IAU has traditionally preferred to name planetary satellites after mythological or poetic figures.

As part of the naming process, the WGPSN consults with the discoverer of the object to ask for his name candidates. One factor that will influence Symon's choice is tradition. While Uranus is the name of an ancient Greek god, the god of the sky, the names of its moons have their origins in literature: Oberon and Titania are from Shakespeare's *A Midsummer Night's Dream*; Umbriel is from Alexander Pope's *The Rape of the Lock*; Ariel and Miranda are from Shakespeare's *The Tempest*.

The tradition of Shakespearean names was started by astronomer William Herschel, the discoverer of Uranus, Oberon, and Titania. While Symon admits he personally finds it a "strange thing" that Herschel opted for literary rather than mythic characters, he has deflected to tradition and has been brushing up on his Bardemanship in search of new names. "After all, Herschel started it all two hundred years ago. It's got tremendous historical momentum, and I'm not likely to change it," Symon explains.

Once he has made his choice, the question will be up to the IAU to decide. Whatever they choose, it should be remembered what the Bard himself said about that proverbial rose. And Symon no doubt echoes the sentiment that no matter what they call his moons, the success of finding them would



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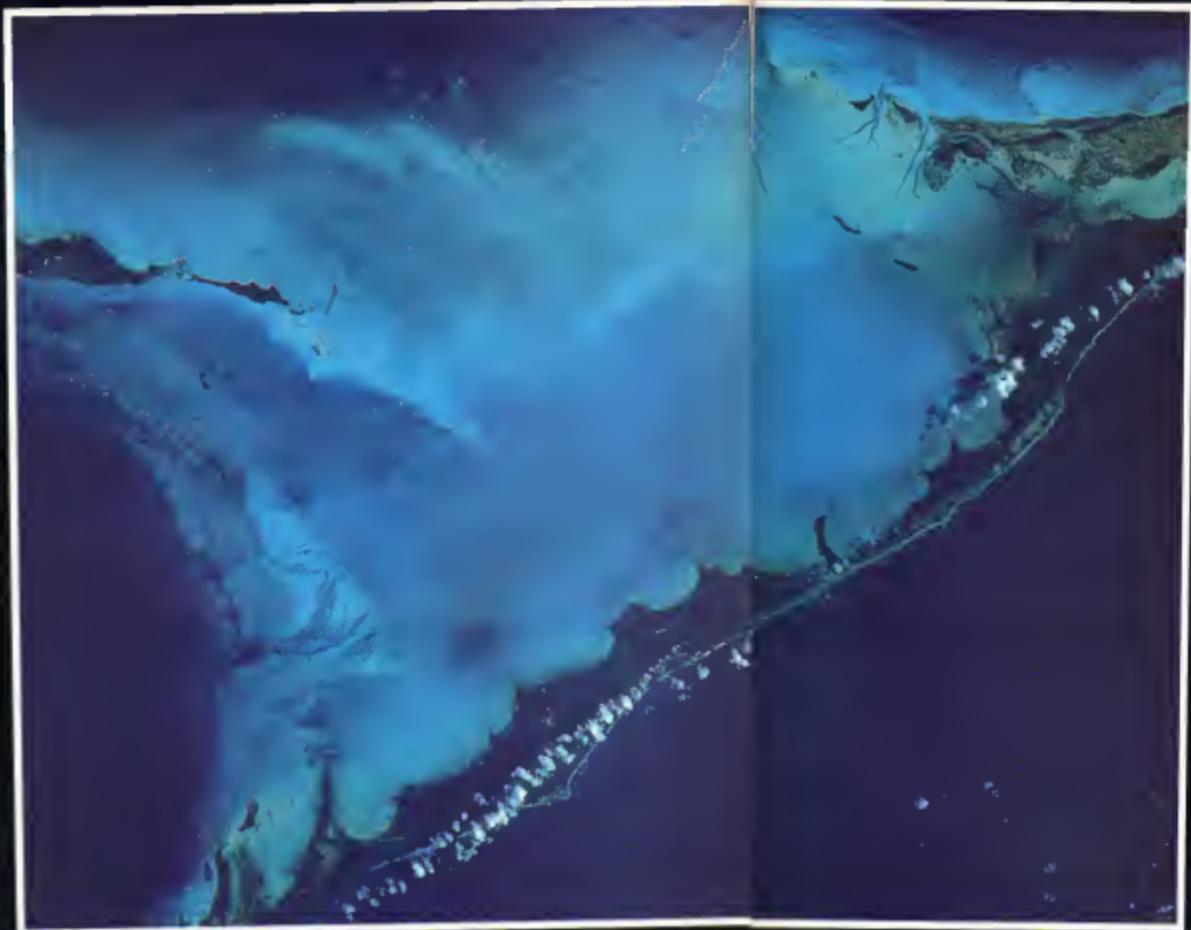
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PHENOMENA

Two hundred miles below the camera that recorded this image, a portion of the banks and islands of the Bahamas gleams like polished turquoise in the bright Caribbean sun. The dusty tropical ocean air affords an excellent view of the patterns carved by strong ocean currents on the shallow floor of the bank, which appears as light blue. Beyond this undersea plateau, the color of the ocean darkens as its depth plunges thousands of feet to the bottom. Images such as this have not only increased our knowledge of the subtle dynamics at work on our planet, they have forever altered our perception of our place in the universe. As the first generation in history to see the earth from the perspective of space, we now share a common awareness that we inhabit a delicate and beautiful world whose survival depends on us. This photograph was taken aboard the shuttle Challenger in February 1984 and was made using a Hasselblad camera and Kodak film 00.

CONCLUSIONS

In previous editions, we called on Science, Religion, Atheism and Philosophy to relate to questions on the adequacy, or inadequacy, of physical being and the transcendental nature and rationale of all existence.

Man's fallacy lies in taking that which exists for granted, as the omnibus of all that is and ever will be—when that is surely not so. We explore and analyze things in and of the physical universe, we bring it to issues, even split it atom—... but we never put ourselves outside of the physical domain and appreciate of things... sort of like looking in on the material world with eyes from outside. This acceptance of the physical makes it supreme on us—its laws and causes and effects engulf over our whole show, weave in bonds.

The real choice we have to make is between the physical—... is it our ultimate goal?—and something beyond that, and if so, what?

This brings us to our various disciplines under consideration. Does religion answer us? It could, if it would be true-to-itself, carry through, and not do such foolish things as dogmatically look to precisely the wrong thing—physical phenomenon like flesh and blood—for salvation and deliverance.

Can science fulfill our ultimate quest? Not ever—because by nature it has the phenomenon of the material universe as its very foundation and domain. While it explains and has proven much to dispense superstition on many fronts, it cannot deal with the out question of what's beyond the material universe and its laws? It lacks ultimateness, deliverance.

The atheist hardly deserves mention at all—without wonder, how could he ever know any answers?

That leaves philosophy, free and unbiased, to sort things out for us. It can freely deliberate from within or without the physical realm. It could even crown religion as the ultimate ruler, if that is what it finds—but then only when recognized and practiced anew, conform with ultimate truths.

So let's go to work, philosophy, and find those incontrovertible facts and truths that will set the spirit free. Let the Dark Ages in fundamental thought be behind us. Let not ever again error and distortion and superstition bend our vision of the true, cognitive insight into the real nature of all things.

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LANDING

CONTINUED FROM PAGE 16

a frequent contributor to *Ozim*, has written four books about the future of human space development but none touching on spacefaring extraterrests. In the debate over the reality of UFOs, he is a prominent debunker of sightings. Putting aside his natural skepticism, he chose coordinates M-25N-26 as their most likely port of call.

Extraterrestrial visitors will be primarily from a spacefaring civilization. The desire to identify a core of common experience with those humans chosen for first contact, and thus to enhance the chances of establishing successful communications, will lead to choosing a landing site where embryonic spacefaring is already being conducted by Earthlings, Oberg says. "The most obvious site is NASA's Kennedy Space Center in Florida, which also offers excellent facilities for genetic security and for parking."

• Sociologist Marcelo Truzzi is the founder and editor of *The Zetetic Scholar*, a monthly journal of UFOs, parapsychology and related matters. He claims to be essentially neutral about the existence of UFOs but distrusts professional debunkers, many of whom he feels are more authoritarian than objective. His suggested landing sight yielded no firm map coordinates.

"I assume that 1) The aliens have monitored and understood our culture. 2) Their landing is to be viewed as friendly. 3) They want their contact to be clear and incontrovertible. A good meeting these conditions would be the ballpark on the opening day of the 1986 World Series," says Truzzi. "It will provide a large landing field before thousands of spectators, full international radio, television and press coverage, and the likely presence of important political figures. The aliens might even demonstrate goodwill by joining in our national anthem."

Once these answers were in, a second round of polling reduced the experts' opinions to two possible answers. And there our panelists stood their ground. Two—Stanton Friedman and Bruce Maccabee—hold that aliens will head for the Southwest to survey our weapons, either to safeguard their expedition or to learn whether we will threaten them as we proceed into space. The rest are equally convinced that aliens will be too civilized and perhaps too powerful to fear human aggression. Thus the Southwest will have little to offer them.

The answer location won out. And with that the answer was clear. Former *Ozim* editor Bove had produced the majority's verdict. The aliens will land first in New York at map coordinates P-27.

Fully 129 readers agreed. Many cited the United Nations as the aliens' destination. There the visitors might simply greet the peoples of the world and announce their friendship, they might ask us to put aside our nuclear weapons and save the world from possible annihilation, or they might make it an order endorsed by advanced ex-

traterrestrial technology. Some saw communicators as the key. Radio and television networks would help the aliens get their message across. Others felt that the aliens would come simply to learn and where better than in a city with so many universities, museums and suburbs?

A week of sifting reduced the finalists to eight. Each offered something special—a unique insight, an unusually well-kept argument, or simply a good summary of the reasons aliens would land in New York City.

Bove, Friedman and Oberg were charged with the responsibility of choosing a final winner. So at last, here they are: the winners of *Ozim's* Great UFO Contest.

First prize, a seven-city Caribbean cruise for two goes to Betty L. Riddle of Kansas City, Kansas, for the following analysis.

Throughout history, as we know, exploration has been advanced not by soldiers or sailors but by merchants. Marco Polo and Columbus were seeking to expand European markets, not just roving around. The first aliens to the planet will probably be doing the equivalent. Their technology will enable them to verify the New York area as a center of worldwide communication and trade for everything from high-tech items to toys. As a result, I see the New York City area as their likely landing site.

Second prize, \$350 in cash, goes to Russell Eulstein of East Alton, Illinois, who managed to reconcile the disagreement between our weapons-fearing and pacifist panel members. He writes:

I chose New York City as my landing site for three reasons: 1) It is the center of the world's most effective worldwide organization, the U.N., allowing contact with all world governments at once. 2) Many large news centers are based there, giving maximum coverage. 3) If the natives are hostile, they probably won't use nuclear weapons near a large population center.

Finally, our \$100 third prize goes to Patty Bowen of Monroe, Louisiana, for this entry.

New York City will be the landing site. Monitoring broadcasts while traveling to Earth, the aliens will find New York a center of population, culture, communication and the United Nations. Landing there would guarantee the aliens a forum to present their greetings and to communicate with other sentient species.

To those who did not win, we can only hope that you enjoyed working on your entries as much as we enjoyed reading them. We've always known that *Ozim's* readers own some of the world's sharpest minds. You've surely proved it. We'll be holding other contests and we look forward to reading your entries and to all, please remember what we said in the contest announcement: We don't claim that aliens will ever land in New York, just that this was the best answer that good reasoning and a liberal dose of imagination could produce. In fact we're not saying that extraterrestrials will ever visit Earth at all.

Just in case are *Ozim's* editors spending more time peering out the office windows these days? Or is it just our imagination? ☺

MUSIC

CONTINUED FROM PAGE 10

the academic community. Some East Coast academicians were disturbed by the twenty-one-note piece sounding rather like baroque music, remarks Blackwood. They thought that didn't express the spirit of our times properly. Our times are ugly and terrible, and therefore our music should be ugly and horrible, and what's this looking back? This isn't progressive, they said.

The pieces at times sound conservative because they are primarily illustrations. But Blackwood says, "These studies stand on their own merit as compositions. My purpose was to express what is inherent in the different tunings. I've tried to discover the most musically appealing arrangements within each tuning—those chord progressions that will eventually become standard formulas as the tunings come into more widespread use. In this way he sees his studies as a group of sorts to Bach's Well-Tempered Clavier.

Blackwood found some tunings easy to work with and relatively accessible to our 12-tone Western ears. 19-tone was the easiest. Others, such as 13- and 23-note, were extremely foreign. Thirteen-tone, in particular, with no tonal relationships even remotely similar to the 12-tone scale, was very troublesome. "It is the most alien tuning of all, it

goes against the way the brain is hooked up," Blackwood says.

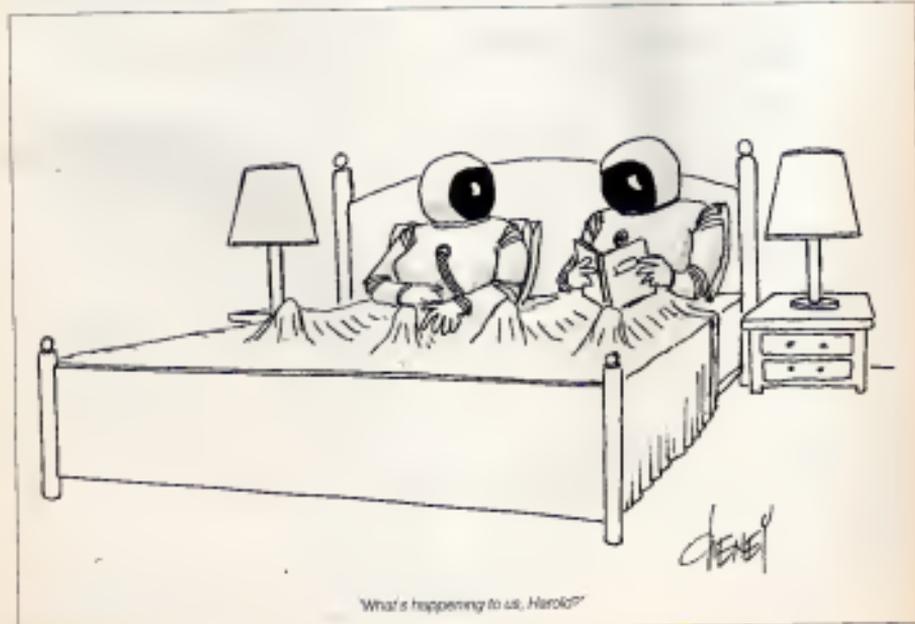
Commenting on Blackwood's opinion, University of South Dakota professor of psychobiology Jan Berkhout says, "Experimental data suggest that the coding of pitch information in the central nervous system involves pattern and feature detectors that are sensitive to the presence of small integer (or simple fraction) ratios of pitch. This amounts to postulating the existence of special circuits for the detection of fifths and fourths. Berkhout's statement casts doubt on the view expressed in music training and behavioral conditioning programs that a mind is a blank tape on which anything can be recorded with equal ease. Yet, on the other hand, various listeners have singled out 11 of the 12 studies as personal favorites—suggesting that no one tuning is intrinsically more pleasing to all ears than any other. The exception is 24-note, the quarter-tone tuning. The composer isn't surprised. To the mathematical Blackwood, that tuning was the only theoretically uninteresting scale among the 12. The best use for twenty-four is just to leave out every other note. Yet even that étude is haunting a passacaglia that evokes The Phantom of the Opera (Bach's Toccata and Fugue in D minor).

Blackwood plans to continue his research, building on his earlier work and taking advantage of state-of-the-art electronic equipment, including an improved Scala-

ton. He plans a second recording with longer compositions in 15-, 16-, 21-, 22-, 23-, 28- and 31-note tunings. The 31-note work will link Blackwood with Don Carlo Gesualdo and Girolamo Frescobaldi, sixteenth- and seventeenth-century composers who were fascinated with that tuning. Blackwood theorizes that some 12-tone tunings would have been discovered by early twentieth-century composers had World War I not deflected their development. He has investigated this idea in a set of études reminiscent of Ravel, Debussy, Rachmaninoff, and other turn-of-the-century composers.

Since his microtonal study began, Blackwood has seen little change in most theorists' inclinations. "They work with quarter tones, third tones and whatever tones, but no one seems to think about dividing the octave equally into notes other than a multiple of twelve. But microtonal music has a future. The new generation of keyboards with computers have the capability to play in any equal tuning, any tuning whatsoever. The subject is difficult, even with the proper electronic hardware at hand. But I wouldn't be surprised if the peculiar resistance soon evaporates because people now have the wherewithal actually to hear it." □□

Blackwood's Twelve Studies for Electronic Music, Medo is available on record for \$9.95 from the composer at 5303 South Shore Drive, Chicago IL 60615.



What's happening to us, Herold?

Dedication.

If you have conviction and dedication, you can solve this J&B cross-number puzzle. Note: keep a dictionary and an atlas; nearby, they may prove useful.

CLUES

ACROSS

1. (Catch...times Homes of the Apocalypse) plus Tribonacci in the Big Parade.
3. Atomic number of gold plus atomic number of wolfram plus atomic number of quicksilver.
6. (Number of hours in a week plus number of days in a week plus number of weeks in a fortnight) times perfection in keeping.
8. First four digits of pi.

10. (Proof of J&B plus zero on a Las Vegas "brand") minus double the number of Platonic solids.
11. Helen plus Howard Johnson.
12. Number of characters in Moe Howard's acting group times sides on license plate.
13. Signs of the Declaration of Independence plus one-eyed jacks in a deck.
14. The year of financial Black Friday minus a contemporary expression. "___skidoo"
16. Three-eighths of 10 percent of a megabuck plus half a C-note.
18. "G&I" dollar plus rest on Madison Avenue with no houses.
19. Number of batters faced by the winning pitcher in a perfect game

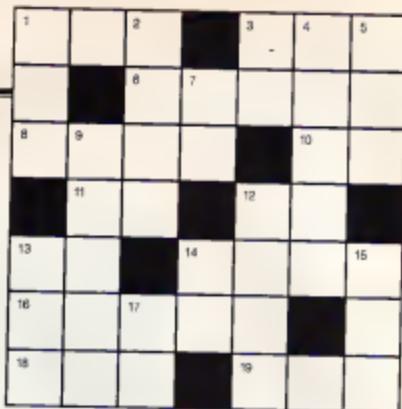
times 3-cent stamps in a quarter of a gross.

DOWN

1. Syllables in a haiku times planets in the solar system.
2. Dalmatians times speed, in RPM, of a "single."
3. (States touched by Mississippi River minus states bordering Florida) plus states bordered by only one other state.
4. [(Leagues Under the Sea divided by jumps in a Bottom catch) times periods in a hockey game] plus dollar equivalent of 6,000 bits.
5. Middleweight plus welterweight (maximum pounds).
7. Baikin-Robbins plus Coins in the Fountain minus holes in a bowling ball.

9. (Overture year plus half a antiquicentennial) minus Little Indians.
12. Year of Roger Maris's record minus Maris's record plus Maris's uniform number.
13. (Poets on Star of David times poets in an inch) plus most poems by a player in an NBA game (Wilt Chamberlain, for the Philadelphia Warriors versus the New York Knicks, March 1, 1962).
14. Pounds in a stone plus grams in a cubic centimeter of water.
15. Marile times Berna times Ruth times Gehrig.
17. Jack Benny's perennial "age" plus a baker's dozen.

Look for the solution to this puzzle next month in *Oxys*.



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Whatever happened to nitinol?
Plus: writer's rules and riders/rimules

GAMES

By Scot Morris

"It's a gift from God. Never mind what's going on, just use it."
—nitinol expert at MIT seminar

When you first play with a piece of nitinol you begin to believe its advance billing as the "wonder wire" and "miracle metal." It is also called memory wire because it "remembers" the shape in which it was forged or annealed. Take a straight length of the wire and coil it around a pencil. Slip it off the pencil and it stays coiled, but drop it into a cup of hot water and stand back. Immediately it springs back to a straight wire—perhaps so fast that it flies out of the cup and across the table. At the transition point a wire coil may move at thousands of feet per second and generate instantaneous forces of over 100,000 pounds per square inch.

Nitinol (pronounced ny-in-oll) was discovered in 1962 by William Bushier at the Naval Ordnance Laboratory in White Oak, Maryland. It's made of nickel and titanium and gets its name from *nickel*, *titanium*, and *Naval Ordnance Laboratory*.

An early prediction was that nitinol would be used in space. You could make a dish antenna of any size—even a half-mile across—then fold it small enough to fit in a shuttle payload bay. In space the wire could be reheated and—poof!—there would be your antenna. A decade after the prediction, there is very little nitinol in space. The proposed antenna would be so heavy and so expensive that you could build it more efficiently with nuts and bolts.

Ridgway Banks of San Rafael, California produced the first patented nitinol heat engine in 1973. A replica of the Banks engine sketched in 1977 is still running at the Hanford Science Center in Richland, Washington. "Under the right conditions," Banks told us, "nitinol not only doesn't wear out but its performance improves. After hundreds of millions of revolutions there is still no discernible metal fatigue.

Then there was the free-energy promise. "When a nitinol coil contracts at a high temperature, it produces much more force than is needed to stretch it out again at a lower temperature," says Banks. "More mechanical energy comes out than was put



in, although a lot of heat energy is absorbed in the process."

Banks is now banking on an irrigator pump that would be powered by the temperature differences between solar heat and the underground water.

Jack Cory, a mechanical engineer in Escondido, California, has studied the feasibility of powering nitinol engines by the temperature difference between surface water and deep water at power dams. He estimates that in the body of water behind a power dam, about 100 times more thermal energy is stored than the potential of the gravitational head. He estimates that the power output of these hydroelectric plants could be more than doubled by the addition of nitinol engines.

"On a large scale," Ridgway Banks told us recently, "nitinol engines look very cost-effective—probably cheaper than nuclear, coal, oil, or anything other than hydroelectric."

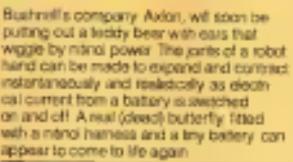
Nitinol has had some notable successes:

- Bone plates for compression-setting of fractures, surgical correction of scoliosis, or abnormal growth of the spine, artificial limb joints that lock tight. In every case the



idea is the same. Attach the nitinol in a supercool state, then let body temperature bring out its desired shape.

- A heart surgeon can insert a nitinol sheath by catheter to the site of an aneurysm. There it expands to form a permanent reinforcement to the artery wall.
- These are temperature-activated switches in automatic fire-alarm and sprinkler systems and safety nozzles for protection against scalding water.
- Nitinol hinges on greenhouse windows automatically close them in cool weather and open them up when it is warm.
- A new brassiere will have nitinol support, instead of steel, to continually restore the bra to its original shape when worn.



A SOLUTION LOOKING FOR PROBLEMS

It has been several years now since the waxy excitement and the "miracle metal" still doesn't have a miraculous application. None of the earlier promises have panned out big. The company that makes the most money with nitinol is Raychem in Palo Alto, California, and its biggest product is a weldless, boltless connector that forms super-tight seals in the fluid lines of the F-14 jet fighter. Useful, but not headline stuff.

Strangely enough, it now appears that the most profitable nitinol products in the near future may spring from nitinol's essential appeal as a curiosity—something to play with something to show someone. Nolan

Bushnell's company Axlon, will soon be putting out a leddy beer with ears that wiggle by nitinol power. The joints of a robot hand can be made to expand and contract instantaneously and selectively as much as current from a battery is switched on and off. A real (dead) butterfly, fitted with a nitinol harness and a tiny battery, can appear to come to life again.

FINALLY NITINOL FOR SALE

We haven't written about nitinol until now because there was no place readers could write to get some. For years the only samples we had were from the Naval Surface Weapons Center in Silver Spring, Maryland, or from novelty items available only in Japan. (Examples are shown atop the page, with the deformed wires at left and the beakled "natural" shapes at right.) Now, however, several nitinol products are available to the public.

Innovative Technology International Inc., 10747-3 Tucker Street, Beltsville, MD 20705, Thermobite (\$19 postpaid). This is a continuous loop of wire on an L-shaped plastic frame with plastic and brass wheels (left middle, this page). Dip the brass

wheel in hot water and the engine comes to life. It runs as long as the temperature difference between the brass and plastic wheels is maintained. (It also sets a \$23 ice-powered boat (bottom left, this page). It runs on the temperature difference between an ice cube on top and the pool water underneath.) The company also offers a one-foot length of .12-mil wire for \$3. **TiNi Sales**, Box 1431, Lafayette, CA 94540. David Johnson, a physicist in Berkeley, constructed the first nitinol turbine engine in 1977. The one shown at far left (\$60 postpaid) is a demonstration model but oh, what a demonstration! It produces the spectacular burst of energy captured in the photo by Omnis Randy Mayor. **TiNi** will also send a one-inch wire (.50-mil thick) plus a detailed instruction booklet (\$5) on using the sample in a tiny nitinol engine.

Memory Metals, 84 West Park Place, Stamford, CT 06901. Memory's Starter Kit (facing page, \$65). The company's specialty is alloys with even more refined memories than nitinol. They have two-way memory and spring back and forth between one shape at one temperature and a second shape at another.

COMPETITION #40: NITINOL

Invest a nitinol product that lives up to its "miracle metal" billing. The winner will receive an Apple IIc personal computer. First runner-up will get a TiNi nitinol engine and a sampling of nitinol products. Three runners-up will each receive \$100, and all five will get one year Omnis subscriptions.

Entries must be received by August 10, 1986. We're extending our usual deadline by two months to allow for maximum inventiveness. Working models are preferred. Omnis may use entries for any purpose without further compensation or permission. Employees of Omnis, its affiliates and agents are not eligible. Entries will be judged on originality; our guest judge will be David Johnson.

SAV LOYD'S DONKEYS

Above left is the answer to last month's problem of the mules and the riders. Did you have the "animal" experience that solves the puzzle? **DD**



LAST WORD

By Joseph F. Conroy

For the Bulgarian government the worst feature of this voracious cabbage is its tendency to head south toward the Greek border, rotting with its roots, as if were

In my work as a translator of scientific documents, I deal mainly with scientists from the United States and the USSR. In the trade we refer to these nations as the A countries. As is in the top of the head. Most of the other countries with a scientific literature we consider the B countries. B as in B-mother.

Since I do most of my translations in and out of English, Russian, and French, at least once a month I treat myself to something of interest. I spend one day reviewing scientific items published in the international language, Esperanto. Most of these articles come from B countries and will never appear in any major language.

My favorite Esperanto periodical is *La Science Revuo* of Praha (Czech). The Scientific Review from Prussia (Germany). The great monthly magazine is published in Budapest by an expatriate Chinese Esperantist, printed in Belgium by a Finn, and mailed from Spain. It specializes in the field of development of the smaller countries—the Netherlands, Yugoslavia, Malta, and so on.

To share some of its scientific bounty with you, I have chosen three interesting natural phenomena. MOLUSCA BIVALVA ALPINA MINKOFF. During a recent television interview, Professor S. P. Minkoff of Zurich's Swiss Air Experiment Station announced his discovery of a new member of Mollusca, located by unexplored mountaineers in a quiet area of the Tatra Alps. Minkoff inserted an expression to search out what he suspected was a pair of predatory dogs or wolves. What he found was the snow clam. This huge member of the mollusk family is apparently an adaptation of the common sea clam, but behind when the Alps were raised up from prehistoric seas. The clam burrows into the snow and avoids passing worms. As an unsuspecting skier comes by, the clam opens and—chomp! It lands the unsuspecting skier down to modify the perspective.

THE GYPSY CABBAGES is an attempt to avoid what may become an ugly international incident. Professor Florin Andreescu Katcheva of the Peoples' Agricultural Research Center and Workshop in Plovdiv, Bulgaria, has introduced her plan to stem the loss of cabbages from local farms. It appears that Katcheva's staff occasionally salsaded seeds of a new hybrid cabbage to the area's peasants last spring. The hybrid, named *lyuvosa vappalovitsa*, had not yet been fully tested.

We were all delighted with the growth characteristics of this cabbage. Katcheva declared during a presentation before the State Council of Agriculture in Sofia. The plants will develop resistant, grow quickly to about 100 times the size of ordinary cabbages, and need little care. They were specifically selected for their show-stopping qualities.

But Professor Katcheva added that the cabbages have an unpleasant habit: once established, they put up their roots

in whatever form they find after sowing.

For the Bulgarian government the worst feature of this voracious cabbage is its tendency to head south toward the Greek border, rotting with its roots, as if were, just last week the Bulgarian Special Police entered the area after Greek border guards were found among a group of cabbage as they had rotting in a field some six kilometers from their home farm in Lutzen. Responding to Bulgarian officers, the Greek government has denied any connection with the migrating plants and has claimed it had no intention of encouraging further border defections.

Katcheva has suggested that the border police check all identity papers carefully. "We must be sure that no one carries his cabbages and rotting our borders," she said in an interview with the Daily Worker. HYDROGEN CRABS when first spotted in Alaska, an odd-looking eight-legged the seaside visitor. Their great confidence in happily eating the palm fronds is being admitted to crab-shaped balloons floating overhead. Clearly, investigation is being made. The balloons are crabs. Last night a group had tried to find out why those crabs float or what they are from.

Professor Axel Dickson of the University of Maine has just released his preliminary findings on Crustacea *Decapoda* *Stomatopoda* *Geocarididae* *Decapoda*, the hydrogen crab. The crustacean, well known in its domain, is one of several common land crabs found along the Maine coast. Dickson points out that the crab swims about unaided on the shore and in streams. When the melting season comes, however, its peculiar habit of *Decapoda* becomes evident. The crab lives on partially oxygenated seawater, a food solution rich in hydrogen. As the crab eats its portion of the hydrogen is stored in its tissues. Apparently, this helps the crab float on the tide and so avoid shore predators.

For most of the year the weight of the crab's carapace is sufficient to prevent an crab from the hydrogen stored within. As the crab eats, however, and the shell a bit behind, the hydrogen stored in the crab expands, and the crab floats on the tide above the beaches. It is here, by above the beach, that the crabs make, clinging desperately to beachlines and leaves. Many would-be romances must have been insured by a sudden break that carried off the water. Complete along the coast at the time of year report hearing had people taking the right as the crabs take their grip. That they did, not burst.

Residents of Maine have long been accustomed to flocks of the crabs walking through coastal villages. In the early years of this century, crab shoals were organized by local sporting clubs. The hunters used small-bore firearms, and the hunt part of the game was followed by the loud bang of the crab and exploded.

Joseph Conroy is a freelance writer and a crab mascot who lives in Plovdiv, Bulgaria.

