# FUTURE SHOCK





DACE

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Yugoalavian-born surrealist Ratie painted this month's cover. Ratie creates space age rooms that juntapose images of romaniscern and technology, the way the Flemish masters used symbols to depict the religious age they lived in.

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FIRST

### By Candace Pert

 The scientist's ousting had a biological flavor—like a pack of wild dogs destroying a weaker member. instances i see Er G. I. Konsteau, a billetau, etteranderik esponsa kaussspisied, ustranzead by in bosse of sestiment that harbore besite horizon sestiment that harbore besite horizon the termine that harbore horizon the termine that horizon to all horizon the termine that horizon to all horizon to include the resolution of all horizon in all horizon to resolution to all every horizon to resolve the horizon in all horizon to resolve the horizon with horizon to resolve the horizon in all horizon to resolve the horizon with horizon to resolve the horizon and taken to

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STERUNG

The Christe have a strange maddotion " Cure you, may you be born in an intersting age For the attaces of the People's Republic, that age is now. With suprement sease and society, Christ have mode enromosy and age rested by Mosic Cubinal Perolation, age rested by Mosic Cubinal Perolation in escatask, er utating toward the year 2000 with a decomes purposedurises that is unmatched by any other country in the word.

While welling the Fac task for the story Future Shock Yeak Dien Verschnief (logge 38), treelence writer Dawe Burstein found bloechnotogisk developing synthebr insufn and synthesis molecules of transfer RNA, the research community was building somitaticated supercomputers and even meeting in telecommunications. And the supercommunity was welling in the second community was and welling in telecommunications. And the supercomputers and even side in door putming on choose service.

Burstein, who is currently working on a book about the mixence of high indichalogy on developing countries, says. We fail to understand mises created evelopments because we have bigotten high the years works who are bigotten high the years contain was expressed or grand commenda national was prepared to grand commenda national with unknown to us in the Vetal. In their long haloticed march, the Ornease have associuses to draw on. They are an adaptable people. And i appears that many American companies, including IBM, are betting on this adaptability. U.S. firms are gearing up for huge ventures in China. The year 2000 is a symbol, really—a goal to strive for "

While China dwells on practical, earthbound technology-using computers. for instance, to assign water buffalo on Wednesdays-others are engaged in a heated debate over the mittary use of snace in this month's Interview on page 60. Anthony Liversidge talks with physicist Bobert Jastrow outsooken detender of the star-wars faith. Jastrow assures us that defensive weapons in space will move us away from Mutual Assured Destruction into Mutual Assured Survival, a happier realm. He outlines the stages of star-wars technology, from the smart-bullet system through laser beams, electromagnetic rail guns, and the notorious X ray laser, the details of which are stiff a closely guarded secret. Scientists lately have initied hattle over the value of such devices, and several have launched salvos at Jastrow himself But Liversidge argues "Jastrow is making a worthwhile contribution to an important debate, forcing star-wars opponents to deal with his rebuttals I found to my great surprise that his opponents, in public debate and in congressional testimony, are not adequately refuting his claims and are often repeating their original positions rather than coming up with good answers "

On the lighter skie, freelance writer Richard Wolkomir examines the strange phenomenon of dowsing. In "Water Witches," on page 40. Wolkomir describes how the dowser typically holds a forked stick in his hands and crosses a field When the tip of the rod points to the ground, it indicates the place of hidden treasurea water vein, a lost ring, or a bit of ore While neither the scientific community nor the private sector officially endorses dowsing, Wolkomr discovered some fascinating facts. U.S. Marines dowsed for Vietcong tunnels and mines in 'Nam. A Pacific Bell employee dowses for hidden phone lines. And increasing numbers of urban professionals, using an assortment of gadgets, dowse over mags, sets of questions, stock-market reports, parking spots-they even dowse for the best sushi bar in town. Desnute their alleged successes. Wolkomir has his doubts. "The surest way to find water." he says, "is to turn on the tan

In this month's fiction, writers Bruce Sterking and Lewis Stank decision another quest, for proceess and objects during a trip to the past. In Mozart in Mirroshadke's (page 68), members of a time-travel project ust edge/memt-centruly Vieinau, where hey meet us with young Wolfgang Anadeus, Mozart, wenting Houry in the Anadeus, Mozart, wenting Houry in the Anadeus Mozart, wenting Houry in the Network (Andor House), and Stimer's recent book, Knotlens, as Barth Books release

In our second story, "The Ark" (page 44), Bruce McAllister describes a global ecological disaster A collection of McAllister's short stories, The Faces Outside, will be published by Borga Press DO

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### COMMUNICATIONS

### Gell-Mann Responds

**I FTTFRS** 

Lengayed working with writer Ron Schultz, who nierviewed me for Crant [Interview, May 1965], and the eremarks that were directly attributed to me were reported with accuracy. But I have a few comments on the introduction to the interview, in which I was not quoted directly.

First, athough I was concerned 20 years ago with ideas that led to today's superstring theories and have encouraged research on superstrings, they are not my work. Superstring theories have been developed mostly by John Schwarz, my colleegue at Catlech, in collaboration with a number of other physicists, including Michael Green, at the University of I ondon

Second. most MacArthur Foundation grant expenditures have gone to areas other than the felowerhip program. These include research in menial heath and parasitic diseases, policy studies on world environment and resources, projects in education and conservation, studies of taw and overmance, and other worthwhile navess.

Third, I'm not sure what Ornor means by superparticles, which are supposed to have been the unique constituents of the early universe. And lasty, I'm a theoretical physicist: not an experimental physicist. Murray Gell Mann Pasociena. CA

Editors' reply: Our thanks to Murray Gel-Mann for giving credit where it's due. What he said about early-universe elementary particles was that each was accompanied "at a somewhat higher energy by one of another class. Evidence for these superpartners of known particles" is currently being sought.

### Fish Story

Thomas Kovachevich's method for making paper 'come alwe' (Gamos, May 1985) is similar to the way dired bornto (fish) shavings winggle about after having been sprinkled onto hot noe. Not only is this a tasty snack when say sauce is added, but you can say that you ve eaten fish while it was 'still morino!"

Nita Collver Port Jefferson, NY

### Turkish Wrath

Erwin Chargalf states in his interview (June 1985) that "Americans are shortchanged on their oducation" and that "half-oivilzed people like the Turks have an amost holy regard for teachers ." This is a racist generalization unworthy of a scientes, who should be objective and unmersizificed

Having great regard for the long history of Turkish civilization, I think it was Chargeff's own education that was shortchanged F D Senesion Alterna

Cartoon Confusion

As a regular reader of your excellent publication, I was surprised by the cartoon depicting a convention of schizopirrencs wearing multiple name tags (June 1985, page 94). This cartoon perpetuates a longstanding misconception.

Schtzophenna is a mental claorder that causes a break with reality Symptoms include detaisons, haluceniations, or grossil disorganized behavior. The condition the cartoon refers to is multiple personality, which is characterized by the existence within an individual of two or more distinct personalities, each of which is dominant at a particular time.

R. Devid Couch Austin, TX

### Pseudosuccess

Pamela Weintraub's description of "The Impostor Phenomenon" (Cantinuum, June 1965)—the feing that one's accompletments are earned frauctulently—was guite interesting. Bat I deagree with the cause cited ankiety over being more successful than one's faither. In our society people are encouraged to surpass their parents are encouraged to surpass their parents.

Perhaps a bottor explanation is that the impostor phenomenon is an ego defense for someone who has displayed supenor stills or talents in a society of equals lif al people are created equal, and it have accomplethed some feat that others are unable to match, then i mush have cheated.

How comforting it is, then, to know (if only secretly) that I'm a fraud

Dennis Anthony Los Angeles DO

### DIALOGUE

### FORUM

Omm welcomes specialities, theories, commentary, dissent, and quasicons from readers in this open forum. We invite you to use this column to vice your, hopes about the future and to contribute to the And of Informal dialogue that provides thought and generates theseithroughs. Presen on the two cannot neuro suborrestons and that the opinions expressed here are not nocessarily those of the magazine

The Twenty-First-Century Nation I thoroughly enjoyed Omiti's special edition, Japan 2000 [June 1985]

When I was a child, the words made in Japan signified something that was cheap. If may transistor radios and linikets made of recycled in case. It's amazing how quickly and completely this notion has been turned around.

Today made in the USA and made the American way have been turned into notability advertising slogars while the Japanese have become the acknowledged masters of duplicating and retining the inventions of other nations. Despite this, there are people who find contot in lioking down on Japan's 'beehive' society and its presumed lack of inventionness

In Democracy in Armona (1930), Alexa de Tocqueville made an observation about the United States that can now apply to Jupan \* . . the inventions of Europea.<sup>1</sup> he words, 'are adopted with sagacity, they are perforted and adapted with administre skill to the worns of the country. Manufactures exist, but the science of manufactures is not outivated and they have good workmen but very fee invertes.<sup>5</sup>

Your issue showed that the manufacturing sciences are well cultivated in the beetwe il probably worn blo long before the Japanese become known for their inventiveness, too. Thank you for guing us a taste of Japan's honey rather then its sting Terry L. Wentz Monroe. WI

My compliments to the staff of Oran for your special edition, Japan 2000.

Technology has become an integral part of our culture. But as you have noted, the scientist is accorded the same respect. as the artist, thereby preserving the peaceful coexistence of traditional and modern values so important to the Japanese I thoroughly enjoyed reading this most

nteresting and informative issue

Courselor for Public Affairs Embassy of Japan Washington DC

Phoebe Hoban's article about Japan's quest to develop computers that simulate human thought [The Brain Race," June 1963], makes me wonder if we are losing our ability to produce cemuses.

Hoben periods the did territiar tune thes science will here all form the "chagging" of logical, diductive thought " Most people have never been taught to think (logical) or declaritively Will a people more work is being direct to 'Indigen' periods and the set missed B1 up his time with new forms of missed B1 up his time with new forms of dirudgen' We should'nt continue to disude counterlys, to be human requires work with offer burses.

Joseph Moten Scattle

Hiselio Matsubara claims that the Japanese are more open to new technology because of them history and bajets [First Word, June 1965]. What she doesn't mention, however, is that for most of Japan's history the people lived under an oppressive seconoral warlond system

Today, quasi-sequences corporations have replaced the warrood system, with company presidents taking the place of the warroods. Masuburs should also remember that Japanese labor unions were crushed in the Fiftes and now are just extensions of the corporations

I feel that there is more to Japanese society than meets the eye Although there is much to praise the Japanese for, I don't believe the picture is as roay as Omni suggests. Unlike the Japanese, I of other keep a disidantul eye on technology and mantain my independience.

Roger L. Lyons Columbus, OH As a concerned environmentalist, I was disturbed by Doug Gain's article 'Pro-Tech Psychology' (Mind, June 1965), in which it was stated that harmony is the best description of the Japanese at thude toward the world.

Despite the zero quote established by the hieranization Whaling Commission, Japan remains in violation by continuing to hint sperm whates, an endangered species. The Japanese use exploring hierorous to kill these magnificent animals, which are prized for their oil, an excellent industrail lubroant that is also used in nuclear warheads. The slaughter goes on nuclear warheads substitutes for the oil

In addition, the Japanese round up porposes, brutally killing them with successive statis in the back. The carcasses are then fad into a huge mincing machine are mashed to a pulp, dhed and sold as tentizer. Does this behavior suggest a culture "at one" with its extingent ment?

I fear that the Japanese are no more concerned about man's harmony with nature—and future implications for life on our planet—than we Americans are

> Marina Kuran Steriacoom, WA

I read Owni's issue on Japan with great interest and admiration. Being an American of Japanese descent and having voited Japan several times. I have tremendous interest in Japanese culture

Drug Gart's article remnised me of how group prented, Japanese society is 1 caused a mmor upmar at a Japanese facttool restaurant when I saked for onors to be omitted from my burger. Nobody even asis for something different, Devaling from the norm in Japan is about as common a delying the laws of gravity yet that society emtrances new technologies with a grate that Americans find amazing laws that Americans find amazing

How is it that a Japanese computer scientist at the varguard of his country's research into artificial intelligence world not even conceive of wearing a colored shirt at the office? "Cumpuser and curiouser said Alice."

> Scott Kariya New York

### KILLER WEED



By Bill Lawren

he deer sprang away, zigzagging nimbly through a stand of fir trees. deep in Oregon's Roque River National Forest. The hunters-Jerry Wapeman, of Klamath Falls, Oregon, and two friends-followed purposefully behind, their boots crunching through the dense underbrush. Suddenly the air was soilt with a deafening barrage of rifle fire. Two scruffy backwoodsmen appeared, both of them armed to the teeth. One of the ambushers put a shotgun next to Wageman's head, threatening to kill him "I heard a big bang?" Wageman said. "I really thought I was dead."

Wageman and his friends had made an partvertent and potentially deadly error They had strayed too close to the isolated "plantation" of a pair of reclusive manuana growers. Although Wageman miraculously survived-"it was ust a bad shot." he said later. "but it was enough to make me. bleed pretty good"-his harrowing experience was just one part of a story that has been repeated again and again with alarming regularity on public lands. dotting much of the western United States

From Hawaii, where a couple was murdered while hiking in a remote national lorest, to California, where patroling forest rangers have often been fired on chance meetings between mariluana growers and hikers, hunters, or rangers have frequently ended in threats, abuse, and outright violence. Although no one knows the exact number of such incidents, some authorities mantan that mariluana related outlawry has made many of the country's treasured national parks and pristine forests increasingly unsafe for recreational use

In fact, members of a General Accounting Office investigating team reported last year that at least six federally owned or thin widerness areas had been closed or restricted because of "potential danger from manuana growers.

You want to have a wilderness expenence?" asks John Cmolino, a supervisor for Californais Menriporto County "You wont have one here. You might get shot

"There's no question that some catastrophe is waiting in the wings," says California State Senator Barry Keene "Maybe some carload of innocent tourists is going to get



drastic change in the relationship between the nation's manuana prowers and the public at large. Ten to 15 years ago, rural manuana cultivation was a kw-key and essentially peaceful enterprise carried on by what Cimplino calls "comcob smoking old-timers and llower children from the Socties " As far as residents and authorities were concerned, mariuana cultivationeven on vast tracts of public land-was often overlooked and even toletated

But by the mid-Seventies this idvilic ambience had begun to change Attracted by highly publicized success stones and by searing prices (with the coming of svisemvla, a seedless manjuana that is exponentially more potent than the garden variety, the cost of an ounce shot from \$20 to as much as \$200), a new class of immicrant streamed in from the cities to take up the trade

Those newcomers who could afford it crowded the real-estate offices, buying thousands of acres of formerly useless backland. Those who couldn't, spilled out into some of the most isolated areas of the national forests

This new element, authorities say, included everyone from Hell's Arcels to the hirelings of organized crime. Usually more hot tempered than their lad-back. binnie contemporaries, these newcomers were rolled even further by crowding and by competition from "patch pirates"-pot thieves who themselves often raided plantations, assaulting and even killing the growers who lived there (In 1981 Humboldt County California, social worker Kathy Davis-who was not a commerical growerwas murdered in her isolated country home by patch pirates.) Violence begat violence, as crowers of all stripes took fresh pains to protect their investments, their

Nowhere was the situation worse than in the remote New Piver area of California's Shasta-Trinity National Forest

"Between 1978 and 1963," savs U.S. Forest Service spokesman Royal Mannion we were getting iterally dozens of reports a week of violent incidents in that area



California maniciana prower in search of profit, he charges more for an ounce 0.00

# SHOESTRING SIGNALS



By Ben Bova

e've created a revolution in communications here. And we've done it with a tremendous amount of volunteer work

When Mike Comberiate signed up for a five-week-long stint at the South Pole. he had little idea that he would one day help enhance communications between that outpost and the rest of the world. But thanks to the ingenuity of this NASA engineer and the help of the National Science Foundation (NSF), a unique satellite linkan effort that could have taken several years and up to \$35 million-was established in just under a year, for the nominal

Combenate a thirty-seven-year-old spacocraft systems engineer at NASA's Goddard Space Flight Center, had worked on a series of scientific satellites. He'd also been to all but one of the seven contipents and decided it was time to see Antarctica. For his 'vacation' he volunteered to make a trek to the end of the earth to give some input on how to shelter scientific instruments from the harshest of elements

While visiting the McMurrie station in Antarctica, Comberiate learned that scientists there had recently begun using communications satellites to relay information to the United States. But some scienfists at higher latitudes like the Pole relied on ham radio like equipment for their link with McMurdo. There were limits to the amount of data that could be transmitted And the link was tenuous, highly dependent on thoky conditions in the polar ionosphere.

Engineers had considered several ways of sending information, but most were just too costly or were impractical because of the Antarctic environment. Using microwave relay, for example, would mean building

"Then I got the idea of working with satellites already in polar orbit. I thought we could use the satellites to transfer data from one computer station to another Combenate explains

Weather and Earth-observation satellites such as Nimbus 7 and Landsats 4 and 5 swing over the Pole every day. Comberiate knew that they carried equipment that could easily be used for communications. OLEVI

between McMurdo and other Pole posts He sent a proposal to the NSF and hoped that his project would receive funding.

It would cost onlying to use the existing satellites. He needed only enough money to build the ground equipment and to purchase the special antenna parts. The University of Texas at Austin had an ongoing interest in Antarctica and, intrigued by Comberiate's proposal, offered to ponate \$200,000 The NSE also put up \$50,000. Once the money came through. Combenate and his team at Goddard began rummaging through NASA warehouses for surplus materials from which to construct the tracking system

We refurbished some extra equipment. integrated this with new equipment, and checked it all out end to end at Goddard Then we packed it up and reassembled t at the Pole 1 Comberiate says

Part of the sectors of equipment would be dropped at McMurdo, the remainder, at the Pole Unpacking it seemed a herculean task. In addition to its weight, there was another problem-components might franze and break if exposed to the elements



The South Pole satelitie data link

for more than a few hours. But the NSF's field crew was ready." Combenate says "We got the critical stuff indoors within an

The steerable antenna system had to be shie to withstand temperatures of -126/E gusting winds, and snowstorms. To keep energy needs at a minimum, engineers decided to heat only the movable parts of the system A dome over the system serves.

On December 19, 1984, exactly one year from the date that Combenizte submitted his six-page proposal to the NSE the system was set in motion. It has been functioning beautifully ever since

When they used harm radios, scientists could send no more than 75 bits of data per second, with one error every 100 bits The satellite system can transmit 10 000 bits per second, with no errors, between the Pole and McMurdo. And the system isn't dependent on weather

If you send a signal to the satellite. Combenate explains, "it will send it back down, over the horizon, without the noisy ionosphere causing any interference. Essentially, anyone who can see the satelite can pick up the signal

Until the satellite hookup was established. the lack of good communications was hampering some of the work being done. by scientists at the Pole. 'Before we had the satelite link, for about rine months out of the year everything went in and out of the South Pole by telegraphic message," save James T. Peterson of the National Oceanic and Atmosphere Association, in Bouldet Colorado "There was a limit to the number of characters you could sand Occasionally information would be garbled. Now you can get it within a day.

### SPACE/TIME

September 1, Voyagsr // is 1,656,000,000 miles from Earth and 114,000,900 miles

September 26. Department of Defense shuttle flight slated. Crew will include Commander Carl Bobko Pilot Ronald Grabe, and mission specialists Richard Mullane, Robert Steward, and David Himers DO

# DREAMS AND THE ANTEATER



By Kathleen McAuliffe

hen a group of neuroscientists recently proclaimed that dreams were meaningless and best korgotien, they could scarcely have guessed that the spray anteater—not Freud—would prove to be their most formicable adversary

To be sure, Freuds disciples can point to myraid cases of patients who have gained powerful insights through an examination of the latent meaning of their diverse. But such anecotoriel evidence does not always, hold up in scientific court. That's why the biological tostimony of the unitality antotater has stirred considerable interest among psychologiats and neuroscientists

The importance of the spray antealer, also braves as the excitable, like the excitable, like and position in the evolution of dreaming, oxplanars neuroscientist Jonathane Wilson in his record book, *Rain and Psycha*. One of two mandreames—or ogg-system maintrailis—in exaptions today, the excitabmatic sequence but unlike exact the like the spray of the second sequence of the second produce REM (regad eye exontering).

It is tempting to view this outfly as evidence of the cachina's close adhiston to reptiles, an erthe class of animals that mover appenences EBM. Yet the exhibits, which emerged 180 million years ago, that a datterful ymarmialian beain in orie important respect its brain is more like ther of *Hono* sapires than any other species. The ochidrals printorial contex is massive in relation to the cach of its brain.

This instabilities that is a clitten overhooked by those who regard the well-developed human prefortal costor as a unique mark of intellectual status). Using use beind the forehead, this part of the brain gives use from chimps and appa, whose similar thrms or well by morindial cost of using so what is this low marked. Lowly read staps removed from reptiles—doing with a preferated actes worker out of proportion?

According to Winson, an associate professor of neuroscience at Bockefeller University, the answer is one of the keys to understanding the meaning of dreams. The first placental and marsupal (pouched) 20, chevil mammalli to evolve from the monotome line, he observes, have a far amaliar performation contax than their precideossors do. Comoding with the disatic shmisage of this part of the torain, however, is the sudden emergance of REM sleep Could desiming, the wondered, have taken over the functions that the large prefrantal cortax performs for the echidan?

Written kurnet to the classes exectments of Proch dream sensative Wohld Jowel for cluster, in the States Jowert Sonthell and rubble movement of Jung dreamag that intolog movement of Jung dreamag most between the state of the state of the most beam of the state of the state of the PRM black, the rots read out and head clearers from the annual stated engancy proy in thirds, Jowerts aubled the angure your handhard to Jowert a balance angure your handhard to Jowert a balance angure your handhard to Jowert a balance angure your handhard to the state of the state of the most balance and stated angure your your moth of the state and out of the state of the state most balance and a state of the state of the state.

Winson pondered the meaning of this nocturnal replaying of the day's events. Using ratis, he begain to chart the electrical activity of the hippocampus, a section of



We are the cheamers of cheams, but why?

the brain involved in memory: During REM sleep, his electrodes datacted a slow brain wave called theia rhythm Further investigations revealed that theia rhythm occurs in the hippocampus only all one other time: when the anmal is awake and encaged in species-specific activities.

During REM sileep, then, it seems possible that animals are reprocessing memories of the day's most significant experiences but if that is true, how does the echidina manage to get along without dreaming?

Writion once again turned his attention to the exhicits coverator perional cortex. A person whose perional cortex has been damaged showing imcluke behavior. Such the report.save incluke behavior. Such the report.save of a particular action. 'It is in the proferonal cortex.' Wrison says, "Mat memore a overst sappear to get formulated into complex strategies that guide our conduct."

The exhibits What therards, was using its says exhibits a constraint experiments into the waking state—as the events solutially until of in real time. With a simple annial like the exhibits, this groupsch appraise to have worked will enough", says Winson Toutin don't for marmits, with more sophisacited between a protocols to exolve, nature performance on the solution in the solution of the solution in the solution that the solution in like performation comes. The solution is is comvined, task in RRM sleep.

"Thrumsnihild continued to prove along the same lines at the cohinar' argues Winson, 'we would have to carry our prefinant contra a noor sing the vector (referring) and a coornight needbarrow collectific contractions and a coornight needbarrow comparisive) The contract schema with the comparison of the contract schema with the provide with the contract schema with the provide schema with the contract schema with the provide schema with the contract schema with the provide schema with the schema with the

To Winson, then, dreams are far from meaningless, as some neuroscientists contend. To be sure, then tobarre mages and twests of piol are hard to fathorn. But no matter how fantastic, Winson would agree with Freud that within these internal dramas le our most basic selves **SO** 

# RECIPES FOR ROBOTS

# ARTIFICIAL

By Bill Lawren

At this glance the experiment looked like an exercise in streer play, moting and street filling the scientists between grants. Using a computer, Stanford electrical engineering professor Brain Reid hield to teach a simulated robot how to cock Julia Chrids bede Weijington.

After 13 hours and 60 pages of computer instructions—'you can't tell a robot to spread seasoning eveni,' Reid says, 'you have to specify the number of grams of seasoning per square continuent'—'Heid gave up, vancuished by trying to teach the robot chell how to wrap the finished beet in a pastry shell.

Findity2 Gatulatus programmag? A was not of was not not was not not the above Actually, Boit?s cultivay computationary was on of the first stagge of labor on a grant concept known as damaint production of parts—a long-term project that, when completed, will lead damaint products of parts—a long-term project that, when completed, will lead same that when the completed statenes in which robot assemblars work under instructors from central computers. Equily labor end.

demand production will enable factories to reproduce parts from the past—everything from a turbins blade for a B-S2 bomber to a door hinge from a 1952 Studebaker even when the machinery that organally produced that part has long since been consigned to the scrap heap.

The scientist and the concept began to come together shortly after Beid joined the Stanford faculty in 1980. A look at Stanford's on-campus integrated circuit factory convinced Beid of the news for a computer language that could accurately specify the steps involved in a manufacture ing process. When he applied to the Department of Defense's Advanced Research Project Amency for a grant to develop this language (called FABLE), he met with an unexpectedly onthusiastic response. 'The military had a long-standing interest in demand production of parts, he explains, "and they saw the development of FABLE as a vital first step. Actually "be acimits, "it was the first that I had heard of demand production 1

But within a few months of this introduction,



Beef Walkington—and B-52 parts—will be produced by the same do it-all machinery 22 OMN

Reid was immersed. The test odition of FABLE was completed in 1986, and an improved version will be assued this year. At the part Reid should be ready to embark on the next and perhaps most difficult sing to write computenzed instructions for the manufacturing of a neal-file part—in this case an integrated circuit. Here, the biggest problem is to ensure that the instructions are truly 'portable', that they can be used to manufacture the same part at different factories.

The next step will involve making computer simulations of real factores much as flext simulated a robot for ins beet withington test—so that the valability of the manufacturing instructions can be tested in factory designs provided by private on factory designs provided by private opporeitors, will duplicate in the computer each assembling machine in a given real life factory.

"If the process calls for turning on an oven." Red says, the instruction will go to an oven smalation instead of a real oven. The smallation limit has the user that the oven would have done after receiving the instruction when the receiving the instruction when the receiving the would have done after receiving the instruction when were read. Here is subthe instruction when wanted." All does its that smultized factories should be ready that sendulates in sub-sets.

The next step, Reid says, will be to feed the fested instructions to real machines in real factories, beginning with Stanford's integrated-circuit plant

Of course, the nagoing question remains Given Reid's failure with the beef Welfnoton simulation, will the real system work? The Defense Department is convinced that it can and so is interested bystander George Heimeler, a research vice president for Texas Instruments. "I think it's not only possible ' says Helmeler, 'but very, very useful." Reid himsell, though cognizant of the problems, is equally sanguine. "It's all a matter of time and money " he says. "You have to remember that the beel Wellington thing was one person-namely, meworking halfheartedly for a short period of time. If I had had even as little as a month-Reich adds, "I would have finished it "DO

# DIGITAL ORRERY

## STARS

By Edward Regis, Jr

ow will our solar system end? Will it wind down peacefully or violently, finging its bodies off to the nether reaches or drawing them together into a crasting finale of planets, moons, and asteroids?

The long-tern stability of the solar system is one of the classic problems of admythytecs. In the jargon of those trying to solar which the oattisk of several booties simulation indust, Each planets is position by the sum and begt of the jarket of versions zoos and all event their mitworks in mouthenth all event their mitworks in mouthenth all event their mitworks in the discovered, the mainements of pred citry the solar sevents subgrame day see durining.

"A two-body problem can be solved completely," says Cornell University astronomer Pater Giarasch. "Some innoads can be made into a three-body problem. But a rine-body problem? Just about hopeless."

Now Gorald Jay Sussman, professor of electrical engineering and computer science at the Massachuselts Institute of Technology, has come up with a way to solve a loss body protrion—and to fraccast the behavior of our planetary system. With the help of colsagues at the California instate of Technology, search designed and built a computer whose were system. He adjust a computer whose were system the digital correl (named after the seventeenth-century mochanical solar-system models called correline).

Working with off-his-belt Tachta memory orige, Fainchild logo circuits, and advanced adder and matipleier components donated by Heviel/Tackard, Sussman and his colleagues built a machine made of this separate processor boreits, essentially small computers, one for each solarsystem body. The inventors them linked those ling "planet computers" with parallel circuits so each of the simulated planets would "real" the gravitalionel pull of its neghtor simulaneously.

This one-of-a-kind, special-purpose architecture gives the computer the ability to handle data at a bistering speed. On a thai run, the digital orrery emulated the motions of the five outer planets-

Solar system circuits and planets on microchips. The digital arrery is the new crystal ball

Jupiter, Salurn, Uranus, Neptuno, and Puto—for 40,000 years into the future. It took a VAX (an expensive general-purpose computer) about one hour to run this problem, the digital orrery achieved the same results in 100 seconds.

The errory may be able to tell us the final fate of the solar system, but before it is asked to crunch the ultimate number it will be put to work on lesser riddles. The the case of the missing asteroids.

"The asternot bolt between Mars and Jupter contains several Housand bodies the size of mountains," says Sussman, "but they aron't spread out evenly. There are last of gaps—so-called Kriwbod gaps cripty spaces where there are absolutely zero asteriotics. Why?"

Jack Wisdom, an astronomer at MIT, has theoreed that one of the gaps is produced by the gravitational influence of Jupiter, but Susamen wants to use the orrary to figure out what's causing the rest of them.

The whole solar system is subject to the same types of gravitational disturbances that produced the Kikwood gaps arrong the astexids' this means that interactors arrong the planets may give rise to unstable regore batveen item. After another shakodown, the orrery produced data that suggested it would be impossible for a body to maintain a stable orbit between Jugiter and Saturn.

"What we mainly hope to find out," says Sussman, "is how the planets got where they are, whether the solar system could have turned out otherwise. Pight now, no one knows."

So far the digital onery's longel look mother full the basen an externed projection of Plub's orbit. Usably the outrest of Plub's orbit. Usably the outont for 2 of the 944 years it takes to takes and the sam. Because their paths are not in this are plane, there's lifely danger of the two planets paths. The flub danger of the two planets are the planet takes are and the same transmission. The and same and a-hair million year simulator, the old or early that we expected it is. Same Sameman. The behavior all stably, doi: to a handba difference were "Sub-



# CONTINUUM

### QUANTUM CONSCIOUSNESS

Boganny, seach or he ultrate connection between native and connections rearry two decades as within the ago Ago and search of the ago and the ago and the ago and Ago and the ago and t

My mind reached out for understanding, and by 1974 Het Ittel quantum physics and consocularies were deeply connected. I begins to realize that the brain may be governed by the laws of quantum physics rather han the laws of biology or neurophysioogy As a result, such leating as lowe and hats, commonly thought to be God-given or incapable of scientific understanding, could be transition (in bit leating.goe of quantum physics)

The only replace of quarking physics lies in the wave-patitics designed. Hence expects lies some, provide a some physics, candia, and to only increments behave file particles, and other increments of the physics of the particles, and other increments of the physics of the particles, and other increments of the physics of the particles, and other increments of the physics of the physics of the particles of the particle physics of the phys

I argue that the wave-particle duality of quantum physics holds true in the human brain, orchestrating the behavior of individual nerve cells as they relay than chemical messages to one another The wave-particle duality action of electrons, for example, Could give rise to seglings of inorfliness, of ego and hatred, in the quanturn world, electrons suffer a paradioucal life. Because of their particle behavior and their electrical repulsion, no two electrons can ever occupy the same space. They are docrined to solitude.

In their wavelike guse, however, electrons are forever seeking their opposite particle, the position, even though such a meeting would result in their destruction. The electron's dectingal charge is a cry for the return to the void. It hopes and fears to attract its opposite, its autimative partners, the position, in a dance of death.

Similarly, love and feelings of compassion may be created by photons, particle-wave units of light. As waves, photons tend to march together, working toward a common end. Lasers work because photon waves are 'in love with exch other."

Love and hate, success and failure, volence and peace could bealt manifestations of energy of forces and admore objects flowing hrough our bodies, brains, and minds as particles and waves down and the thin is the particles behavior of our observacost, sinvester and unotserved. Wind is then an outpowlin to bearve, which to below and the act of concretuents.

For example, one act of conscisures could cause a charge in summary strates were samp advected in the the membrane covoring our prants. These were are allocated with the mode wills. A pathod asservation would memorately "freed the the ecuter pathon, resulting in the appearance of hought. Another compenentary" were closeration where the protein ternaned underwork would produce therapes in the energy of these were, would show these tops of outling a were and particles would show these tops of outling as were and particles.

Understanding how the brainfind works may is within the whole range and assenal of the mathemetical language of quantum physics. The probability equations in all the behavior of alternic objects may depend on the wave-into-particle actions of consciousness. Without such actions the workid and all of its participants world remain ways, ghostlike quantum waves, and there would be nothing material at al -/FERD ALAN WOLF.

Fred Alan Wolf is the author of Star Wave: Mind, Consciousness, and Ousnum Physics (Mecmillan Publishing Company)

## CONTINUUM



Do stellar winds oscitat like guilar strings?

#### SPACE GUITAR

In 1983 and 1984, the Voyager spacecraft missions detected a mystericus radio signal emanating from an ulknown source in space Now, after months of analysis, a fino of space-plasma physicists has concluded that the signal may derive from a phenomenon that they likon to the music of the spheres

About 4 billion miles from Earth, explains University of kawa physicist William Kurth-who analyzed the signal in tandem with lowa's Donald Gurnett and Frederick Scarf of TRW, in Redondo Beach California-the electrically charged gas plasma known as the solar wind begins to run into similar plasmas generated by other wave reflects free electrons. which release waves of energy called electron plasma oscillations. These oscillations in turn generate the radio signals detected by the two Voyagers.

It is here that Kurth draws

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he muscal analogy. If your brink about what heppone when you pluck a guttar sima, he asys, you don't really have the strings what are sound waves that propagate fricting the air to your age it frough the air to your age it for a string the air to your plasma containers are the radio waves we deted are the sound waves.

The investigators are still trying to determine why the signal seemed to appear, then disappear. If may be, sumbase Kurth, 'that it's always there below the threshold of what cur instruments can detect and that the Voyagers simply caught it during its peaks.

-Bill Lawren

"One of the earliest lessons I learned as a child was that if you looked away from something, it might not be there when you looked back."

-John Edgar Wideman

### ELECTRONIC WANT

Job humers eager to skip al the pointese classifiedad checking, phone calling, application filling, and interview hopping involved in sanding employment can now simply tap into a computer. A national, 24-houra-day service called, JobNit beset in Bedford, Massachusetts, offers a central computerized database designed to match high-tech professionals with client companies through directronic want acts.

A pb servicer with a personal computer and modern signs on with the service, arritrs a resume into the data bank, and punches in a password to scan a detailed listing of pb openings If a given ad sounde promising, the registrant can call up some background promising, the registrant can call up some background promising, and send the company a verbaltm regume.

At the same time, a time in the market for fresh talent can hook into the service, browse leisurely through all the relearing, then salect and print those that seem to meet the job specifications. Resumes show up without names and addresses to guarantee confidentiality and are assigned code numbers so your own boos would automatically jump past you in the job isangs. The interested employer contacts JobNet, which in turn notifies the applicant

Jobs are typically high tech--chemical engineers, computer scientists, hardware/software specialists, systems analysts, data processors---whit clients that include Lockheed, Pacific Bell, and Bank of Boston

The reaonale for devicesing the service as that the opportunities now available to the high-fectorizing, leid an unumber the qualified popula: says durink grading and the second service and the second service all top-orch professionals in all socies to a stock y and all hand the second service all top-orch professionals the new funce, Sacoly fore seas computer, pick harding for bechnicing, social analysis. Bechnicing, social analysis.

-Robert Brody



Job humers can give up pounding the pavement and go online The fatest employment service is a 24-hour-a-day silicon want ad



The best skinny fast-lood French fries are born in the desersoil of the Northwest. Now a competitor arises in the East

### POTATO WAR

it may never rival such areat internecine struggles as Army versus Navy or Schultz versus Weinberger but to the combatants, the Great American Potato War is serious business indeed. Playing Helen of Troy is a redoubtable spud known as the russet Burbank, the common brown-skinned vanety used for baking and for making those unbelievably skinny French files served up at your local drive-through

Up to now, the Pacific Northwest has had something of a corner on the russel Burbank, which thrives in the sandy desert soil of Washincton, Oregon, and especially idaho. In fact, the Northwest produces 75 percent of the russets grown in the country But breeders back East are casting an increasingly coverbus eye on the Burbank, Experts count at least a dozen breeding programs currently brewing in the East and Midwest all of them designed to produce a russet notato that responds to the more easterly growing conditions. "They're trying," says Oregon State University crop scientist Al Mosley, "to breed us right out of business."

The competition has Mosley and the Northwest potato farming community more than mildly worned Because five dollars a hundredweight from Idaho to New York-Northwestern growers often have to struggle just to break even A horregrown Eastern russet would obviously be much cheaper for buyers in the urban East and would deprive Northwestern growers of their highest-volume markets.

So far none of the Eastern breeding programs have borne substantial fruit "But if they do," says Mosley. "we'll have to sell our potatoes 

"Wham! Them it was, the world solid as a mok dense as a doorknob

### BABBI F 123

Little did Ekzabelh Barrett Browning know when she peoped her love soggets to hushand Robert that if she were alve some hundred years in the future, she could have saved herself a lot of time and trouble. If she felt the need to wax poetic these days, she could simply turn on her personal computer and plug in Babble 123 Presto, random romance.

Thanks to some would-be Romeos at Fairfield Software in Fairfield lowal computers now have an artificial heart to go along with their intelligence And if these programs red mass and a cool bottle of Dom Perignon, they are drivering a sort of silvertopound savoir faire worthy of any dime-store Don Juan Not only can Babble 123 verses as "My engine starts to rev when you blow in my beer" but it can also help you



Izabeth Barnett Bro -Waker Porty Reniaced by \$19.95 software

express those hard-to-come by sentments fike "I suppose you'd like to call your lawyer." For those of a less subtle nature, Babble 123 can be more specific "This is the kiss oft baby!" Those computers mally know how to get to agr

But Babble 123 is more than a smooth-talking disk that can output sweet nothings. Containing more than 7.000 words in its vocabulary. it can produce everything from immemorable office memos to Ph.D. dissertations on a variety of subjects guaranteed to confound and confuse. With such theses as "Einstein's wife was a relative model" and directives like "If you don't know what you're doing, at least be neat," how can artificial doctorates with artificial secretanes be far behind?

Marc Halberstadt, a spokesman for Fairfield Software, says that Babble 123 will be on the market soon for \$19.95 It will be available for the Apple II Macintosh, IBM PC, Atan, and Commodore 64 computers The next time you're wondering "How do I love thee?" let Babble 123 count the ways-Leslie Epstein

"I am accustoming myself to the idea of regarding every sexual act as a process in which four persons are involved. We shall have a lot to discuss about that "

-Sigmund Freud

"We live in an age when unnecessary things are out only necessities." -Oscar Wilde

# CONTINUUM



The white meat of the future may be bleached dark meat.

### WHITE MEAT

Prefer while meal to dark meat in turkey or chicken? So do most Americans, which is why white meal is generally three times the price.

Now there's a way to writely ports by changing multiply ports by changing dark meat to light James Actor, prefissor of lood science at Clemon Linnessity, in Clemon, South Carolins, performs the alchamy by peeting dark mast from the bornes and cutting tinto finger-site sitings in an agutator with water and a bleaching agent. Ten minutes and three water changes later (eg meat as a light as the most delicate breast most be most delicate breast

"The taste is diluted," concedes Acton, "but it becomes more flavorful it you batter and fry it. It would be ideal to use in fried chicken nuggets or blended with white meat in delisiberabit luncheon meat."

Dark meat is dark because it consists mainly of muscle Locked inside each muscle's thousands of fibers is a reddish pigment called myoglobin Acton's process breaks open the fibers and oxidizes the pigment Acton says three major

food companies are leading the process, although for proprietary seasors he worth reveal their names. They're looking at these blasches sodium basifile, hydrogen percoxie, and assoches acid Acton prefers ascorbe acid witch a another name for witch the another name for witch the another name for out the color And any resdue if leaves would have only a beneficial effect."

-Douglas Starr

"Alts, mankind has yet to invent a system of relationships more natural than money."

-Vassily Akayonov

### MAIMED LOBSTERS

One of the many talents of the Marine loster is its ability to regenerate a lost claw when the nocessity areas The troubles that the process can take from two to three years, according to Ed Blockmore, a lobelerman for 31 years and the current president of the Marine Lobtemanik according to

According to Blackmore, a lobater with in the Down East vernacular, "shoot a claw" simply to get free of an old-tashoned wire or wooden trap. It can also lobe a damging limb when traps are hauled over the side of the faihing boat. As Blacimone puts 8, "Crunch, cnunch, no more claws "

Such maimed Maine lobsters are called culls, and through no fault of their own, they are depressing the price of lobster meat in markets and restaurants up and down the Eastern seeboard, where the customers, understandably, want perfect two-clawed lobsters, not culls. In recent months, they the been setting for 40 to 50 cmits a prund less

That's why Blackmore and members of the Marne Lobster Advisory Council are so enthusiastic about a new lobstering law that will go into effect in March 1987. the legislation would mandate runners on the traps so that over the side of a heat their claws won't break off. Not only that, but one-inch square openings in mesh traps will inch squares, and three-inch escape panels will be mandated to cut down on the growing number of culls

From the Maine lobsterman's point of view, the regulations are long overdue in an industry where the workweek can range "from zero when the lobsters ain't crawin", "to 72 hours when they aire, which is customarity between June and November, according to Blackmore. Despite the new law, he

Despite the tew taw he concentrational behavior to problem that's tileay to continue to be hard to do can with Weekenders have atways been a problem in Mane, where they routney drag the ocean bottom in search of shellish, chewing it up and marring lobeters with an abandon that assonates disperdit upon the welbeing of these crustacean oreastures.

Culls, they say, and up in salads, sandwiches, and Newburgs They're not the ones you see paddling around in the tanks of fancy restaurants — George Nobbe

"Death sometimes changes people for the worse." ---Joseph Heller



Lobster clew protructing from standard trap. When the trap is hauled over the side of a boat, "Crunch, crunch, no more clew."



Retmartack, shown with the typ of a special applicator (at with this a matter of technic the retma back to place.

### EYE TACK

Optical experts at the Duke University Eye Center, in Durham, North Cardina, have successfully combined the skills of a watchmaker and the delicate touch of the microsurgeon to tack badly torn and folded relinas back to the wall of the human eye.

At last count. Drs. Eugenedo Jaan and Pobert Machemer have used up to five stainkes-detel tacks, each junt 2 7 millimeters long, to help restore the sight of 16 patective the sight of 16 paversion of a cotrame: tack linst developed in Japan to reparwhat was once considered imparato freidhaut caused by a severe blow to the head or such retainway to populasia and conditions htreguling from diabetes

Patent's suffering from such problems have told doctors at Duke that the effect was like a black curtain being drawn partially or completely over their sight, usually preventing them from detectins either color or motion

The ceramic retinal tack

was the key that Dyson Hickingbotham, a research designer of microsurgical instruments at Duke, needed to solve the problem "We felt we could improve on the Japanese design by making it easier to insert and remove the tacks," he says The ntinal tack he ultimately desinned has a bladelike to and a ball head that a microsurgeon, using a specially designed applicator, can grasp from any direction "The through a one-millimeter opening in the eve " says Hickingbotham. "That's the size of the incision the surgeon makes to work inside it.

Machemer and Do Juan say the new tack offers hope to those whose sight has been severely innited by this relaively uncommon but complicated form of reinal dotachment, in which the relina tegs away from the eye wall and lotes in on itself Previous surgeal efforts to liaiten and reattach the refins have failed

"The tack has given us a way to restore sight in cases that were formerly considered hopeless," says Machemer, who described the case of one of his patients at Duke the way. "The retra around the option-nerve head in the eye was totally detached and balled up like a fast in the operating room we were able to unfold the membrane and fattern it, both each time it refolded it smply work/int say in place?

So they used the tacks that Hickingbothm had designed. The procedure they have developed uses a subcon di, njectod into the eye, to provide addhonal support for the tacks, which are left in the eye until the refina has a chance to head \_\_\_\_George Nobbe

### RUSSIA'S ATLANTIS

Bestore the fourth century so, the cincent town of Area was perched like a cheer on the edge of a springboard, on the lip of Russias Crimeen pennsula. The anatogy, in lact, may be more than poetic, for sometime in the drim park Area simply sank from sight, leaving behindn orbing but a few tainished comes dha

Last year Soviet scientss decided to launch a comprohinsive search for the fost city Trained divers were sent to an an underwater expedition to the part of the supposed sile of Akra. Amost immediately the divers found clues tragments of pottery and weeter diructionation they were on the right track

ht pay dirt Divers found linked to a partially intact adjoining delense wall. Fur ther exploration brought to light remnants of an ancient harbor complete with ships anchors. But the nucce de resistance was the discovery of an old well which vielded a treasure trove of archaeological evidence, including a collection of black lacquer ceramics, wooden tools, and the most exciting discovery of all\_a series of upbroken iars, or amphorae, that still hore the trademarks of ancient potters

The discovenes were quickly dated to the fourth century ac and ascribed to the once-lost ony of Akra According to the news agency Tass, Soviet archaeologets surmerged, just the ancient city "might have become submerged, just like the mythical Atants".

-Bil Lawren



Diver emerges from Crimean Sea with ancient pottery

# CONTINUUM



Diver models the Insriever soubs denture. Previously, it was safe to go back in the weter only if your tech were secure.

#### SCUBA MENACE

What is the greatest fear faced by an aging scuba diver? Not the bends, not sharks, but the simple fact that when he loses his teeth, his diving days are over.

You can't hold the arrhose mouthpiece with your gums, explains Tom Hurst, a prosdentures the pressure on your front teeth will pry them loose in back, causing imitation and pain. So Hurst designed the first denture for divers. He got the idea nearly 20 years ago, when as a Navy dentst, he was removing the teeth of an expert in underwater demolition "He requested that I delay the needed his teeth to do one last inh "

List spring Hurst produced the prototype device for a sorty-three-year-old soubadiving patient who still has his upper molars and lower front teeth it's a removable acrytic insert that fils like a thood acanet the molars and front of the upper jaw. It is featurelises except for a tabthal comes down against the lower force tests. When the vestere tables down, the tab-holds the non-thejace against the lower test in a comfortable, mouth-closed position. The tab is narrow includ to it at pass through the mouth-place on either simply opps out the divice and push this normal choppers back in

"He says his never been more conflictuation dama," says Hurst, who adds that because of its simplified construction the diving dentures cost hat as much as ordinary dentures. The next stop is to generative the technole by producing a technole by producing a technole by producing a technole by producing a Heat. Thow all i need is to find a scuba diver with no techni au il "-Douglas Star-

"There is nothing as mysterious as a fact clearly described "

-Gary Winograd

### VOLCANOES

Deep in the Jemez Mounland of northern New Mosco, on the slopes of one of the world's largest extinct violances, the oscientest are building ministure volcannes of hear own Contained inside sheel cansiers the man-made, islomatorybound models may provide information about how the real ones work

Kennehl Wöhletz and Decem Irk-Cause Ihier is Robert Irk-Cause Ihier is Remos sphere II ziehen zu seine of the song-extent Vahle Caders volcano. Syngh to distamme file augue be chareron. To do so, tary haier und a soale model is nugliky these lete high and 30 moher aliametur, and sold them aliametur, and sold them aliametur, and solds, and aliametur, and solds in guest aliametur, and solds and due is growing studi of a spray unclaud in suger due is a growing studi is a spray unclaud in suger

The information we have gamed from these tests allows us to characterize the relationship between particle size and the energy and temperature of the steam exploded out of a real volcano, says Wohletz

His concerns include geothermal-energy possibilities as well as the potential, perhaps, of one day being able to predict when and where such eruptions as those al Mount St Helens, in

### Washington, or El Chohon, in the Mexican state of Chia

valcances kill some 400

people a year, and each eruptors a chierent. Some are explosive and immodally devalating. Othors, Net those no Fisavian, excute a solve occorp. Jains flow. The deability is the buggest problem lischip scientiste problem lischip scientiste problem lischip scientiste get ance 1975. While molecular a particular victorio explose a particular victorio explose when a cabee is what we're



Man-made miniature volcano erupts at Los Alamos

32 ONINI

B James Heyl, an admitted topophile at the University of Georgia, has been doing what topophiles have been doing for centuries-making up geography tests to discover whether their students can identify continents. countries cities rivers and mountain ranges

A map lover of long standing, Heyl admits he knew what to expect, but even he some recent quizzes given to freshmen and sophomores campus where he is an associate professor of geography in a department that has long prided itself on a widely

Heyl gave his students a world map on which they were to pinpoint 35 of 40 numbered locations. Early in the school year, three of his clesses combined to score an average of 57 percent correct. On the last day they averaged 73 The professor says that only one student managed a per-

Among the places the classes were asked to locate were such relatively easy spots as Greenland, Australia, Hawaii, Hudson Bay, Italy, and Norway Among the more obscure were the Kamchatka Peninsula Sumatra the Red and Black seas, the Ganges River, and the Tropic of Cancer

"They did horribly," Heyl In foreign school systems, students are routinely drilled on geography. But in this country, the subject is not re-



Globes are alien objects to most of today's students

quired in public schools as a general rule. Our students don't seem to feel that they have any real need to know where foreign countries are."

That, he says, is not only incorrect, it could be costly in the long run, considering the lob opportunities awaiting facile geographers in financial market anavisis, medical research, international banking, communications, and transportation.

"I think we don't learn other languages routinely, for the same reasons we just don't are located," said Heyl, who

We will continue to work on the problem here." he promises. "but it would be much better if the knowledge-and interest-were ceiped earlier" in the educational process -George Nobbe

"Tact is the ability to make a person see the lightning without letting him feel the bolt."

-O. A Battista

If it takes a while before a sweetening agent that the ancient Aztecs called tzopeamong your friends, don't blame it on A. Douglas Knohom His research indicates that an herb of that name is 1,000 times sweeter than sugar

To start at the beginning. the University of Illinois pharmacologist had some beip from a graduate student in discovering the natural compound growing wild on the central Mexican plateau The student, one Cesar M Compadre, told Kinchorn that he had uncarthed an ancient description of the plant in the journals of the sixteenth century Spanish botanist Francisco Hernandez.

Hernandez called it by its formal Latin name Lippia dulois. Compadre and Knohorn celled it hemandul cin, in tribute to Hernandez Tests on the intensely sweet plant, whose Aztec neme translates to sweet herb. reveal that it contains no no toxic effects among mice. who've consumed it only orally, and seems to have no cancer-causing potential

Just how the herb, which the Aztecs chewted as a natural sweetener will be used commercially is a matter of boundless speculation. It may never become a popular tabletop item, savs Kinghorn, but it could be used as a hourd commercial sweetener in everything from tobecco to mouthwash

Preliminary findings have been turned over to a Westport, Connecticut, company called University Patents, Inc., which will handle the notential multibilion-dollar commercial applications of hemandulcin.

-George Nobbe



Aztec bust The Aztecs chewed a plant called topelicxhult. which means sweet herb Today it's called hernandulon

# CONTINUUM



The autocuer. These microcomputerized eyeglasses allow the deaf to see speech by flashing special symbols on the lens.

#### SEEING SOUNDS

Computenzed eyeglasses that virtually allow deat people to see speech are about to be field-tested, according to the inventor

"Our results in the laboratory have been very encouraging," says Robert Beadles, of North Carolina's Research. Trangie Institute, "but the realitest will come when we give this device to fifteen or twenty deal people who will wear it in the real world tul-time."

The autocuer, as Beacle's inventors to acled, consistent of a pair of special eyeglasses hooked into a poolek microcomputer that (wa a minimorophone) differentiates the sounds of speech, then converts each sound to a symbol vaually depicted for the water soil and the sound soil tens for the sound "he," or the symbol C for the sound "coh"

When used in conjunction with traditional lip-reading, Beadles says, the autocuer has achieved a high degree of accurate speech recognition for deal subjects. Primarly designed for one-on-one conversation at close range. the autocuer could also be used to understand newscasters on TV or to follow a teacher's lecture from the classroom's front rows.

The first autocuers could be commercially available as soon as 1987, according to Beadles, with the price as low as \$1,000 once mass producton begins

Further in the future, he suggests, the autocuer's capacity to identify speech will be expanded "Improvements in the device could make it sufficiently accurate to allow a deaf person to communicate reasonably well on a telephone "

### -Eric Mishara

"If the world came to an end we wouldn't know how to dig a hole to cimb into " ---Steven Spielberg

"We are preparing our children for an unknown world."

#### -Margaret Mead

### SCIENCE-FICTION QUIZ NO. 4

Since 1953 the members of each year's World Science Fictor Convention have voted achievement awards to writers, artists, and editors. These covered awards are called Hugos, named after Hugo Genebach, publisher of the first science-Action magazine.

Many Hugo awards have gone to stories that were forgotten scon afterward. But some classic science-liction novels have received justly earned Hugos

Here are descriptions of five Hugo-winning inovels that fit into the latter category of time-tecorred classics. Can you name their titles, authors, and the years they won their Hugos?

 A man commits murder in a society where almost everyone is telepathic and then tres to hide his guit from the police, who can read his mind,

 In a world that has been shattered by nuclear war, the Catholic Church attempts to help rebuild civilzation by canonizing a Jewish nuclear scientist.

 Written by a British author, this science-fiction novel deals with the problems created by enormous overpopulation.

 Another Englishman wrote this novel, about an extraterrestnal spacecraft of enormous size that enters our solar system

out the structure toms But we speak about atoms any language. Warner Mesenberg

#### INSWERS

"The importance of a scientific work can be measured by the number of previous publications it makes superfluous to read." —David Hilbert

"For in much wisdom is much grief, and he that increaseth knowledge increaseth sorrow." —Ecolemastes 1:1

Í

The https://www.mars became five classics

34 OMNI



The largest nation on Earth tries to ride the third wave into the twenty-first century



FUTURE SHOCK ROLLS OVER

BY DANIEL BURSTEIN

### Chen Jianguo is a spiritual cousin to Steve Jobs and the wunderkinder of California garages.

A typical street scene in the Chinese capital of Beiling reflects a country locked into its past. A peddler is selling peaches and apples from a mule-drawn cart. Along the curbside, an old cobbler repairs worn-out shoes while a handyman bands metal sheets into pots and pans. Nearby, a tailor takes a customer's measurements and begins to sew a pair of pants. Except for the tailor's antiquated sewing machine and the honking of automobile borns in the background little exists to place the scene in the modern world. But just below street level, in the dingy basement of an apartment building, another China exists, a China of the twentyfirst century

Chen Jianguo, the young chief engineer who presides

over this subtransient workstop browns in the Churk Ste Lotter, is a sprinal ocusin to Steve Jocks and the California gange watur inde the microsomular involution of the Severities. Unlike them, Chen doesn't under staff ich tars nowhere to turn for advice and staff ich trans nowhere to turn for advice and staff ich trans nowhere to turn for advice and German-the understaff with the twise laught himself From those he has cubed a solid cube the understaff with the twise laught himself. From those he has cubed a solid cube the understaff with the twise laught himself. From those he has cubed a solid cube staff watur of a summer technology. The English the species as targetly timited to 8980; AMA MOM and EPROM.

But he must be doing something sight The industrial-process-control computers has workshop turns out are bought by local factorios even before they are finished in his sparte time—what there is of it—Chen toaches microelectionics. "Surphody wants to learn," he says through the interpreter "Everyone knows tochnology can help China overcome bockwardness."

Science and technology are experiencing a renaissance after the devastating and chaote years of Mao Zedong's "Cultural Revolution" (1966 to 1976), when universites were clease, untelectuals formeritod, and research projects zigzagged at the mercy of polisical whim "Today vice charman Deng Xidaping and other too feedos have called

Bathed in magente light, e technician crafts semiconductors in a factory in Beijing (above).



for the liberation of scientific research from political control and allotted vast resources for education and research. Already China has launched its own supercomputer program. It has become a world contender in bioengineering and has initiated the most ambitous overall technology and research program in the developing world. The govommont's official goal is nothing less than to catch up with current Western technology, maybe even surpass it, by the year 2000. And at least in part, this quest toward the tuture depends on the potent, not-so-secret ingredients of capitalism-material incentives, more encouragement to entrepreneurs, foreign investment-all in the contract of a socialist economy

The big question is how successful China will be The obstacles are formidable. By Western standards, the country is a backwaind hation. An efficient national phone system is still a deteam. The broycle is the most popular form of temportation. China is thrying to develop and use twenterleh- and twentytrat-contury technologies in a world barely out of the 1800s.

The courtry is ful of surpress. Arnost every day brings a new headine-making development. Onna becomes the world's third ingrest producer of agricultural antibiotics (after the United States and Japan). Chira pins with McDionnel Douglas to build an advanced US -designed commercial aroraft, the first such arcraft built outside North Amatica, Ohna holds to this context ences on robotics and soltwate development and establishes its first solar energy corporation, China lavs plans for its first manned space mission late this decade Chinese researchers have even built their first supercomputer, the Galaxy, Capable of 100 million coerations per second, it was designed by researchers at the University of Defense Science and Technology, in Changsha, Only a handful of more powerful computers exist in the world

Easily the most stunning of China's scientific successes has been in the field of biotechnology. The Shanghai Institute of Biochemistry astounded the world in the Sixtus by being the first to produce synthetic insufn. More recently, it also beat out

Swiss and Japanese researchers to become the first to synthesize a transfer RNA molecule (Transfer RNA, or tRNA, attaches to an amino acid inside cells and guides it to the correct position for protein synthesis.)

Chness suborties have also established serval state-of-the-art part versues with foreign time. In Shiers province, for ristance, a phirmaceutical organization has recertly signed a contract with Brogen (a world leader in combinant DNA research, with headquarters in the United States and he Netherlands). Together the two groups will carry out extensive tests using garmainterforein on Chinese cancer patients.

Attempts to leapfrog directly into the Computer Age are all the more remarkable in a country where many lack indoor plumbing. Contrasts between the past and present are the most yivid in the farming regions. of China. During my visit to one of the more up-to-date villages, the community leader invited me into his house, a simple, cementfloored building of two rooms, a bedroom and a sitting room. Eight people lived there It was heated with coal, and some bicycles were fined up in a small closel. Sifting on the mantelpiece was a television set, placed there as it to show that this household was part of the modern world. And because it was the leader's house, on a table in the corper there was a microcomouter

Communes no longer exist in China, and land that was once collectivized is now being redivided among families. Much of that re continues derived is

Do dowsers dely modern science—or do they tap our sécret springs?

# WATER WITCHES

### BY RICHARD WOLKOMIR

Officials of the World Bank, in Washington, DC, recently invited a burly, white-bearded author named Christopher Bird to address staff members on a surprising topic: "Dowaing—Its: Potential for the Dovelopment of Water and Other Resources" in the unlikely setting of the august

PHOTOGRAPH BY LEE MCELFRESH

organization's offices, Bird urged World Bank employees to encourage drought-stracken Third World nations to seek underground water using what amounts to witchcraft

For centuries, country faik have used dowsing—also called water witching or diuring, to find underground water, ores or even tost possessions. Typically, the dowsee, clerching a forked stick, triverses a field. An abrupt downward arc of the stick's tip indicates "of prevel".

Bird has chronicled the success of dozens of dowsers. In his address to the World Bank, Bird-who holds a Harvard biology degree, coauthored the 1973 hest-seller The Secret Life of Plants, and published a book on dowsing. The Divining Hand in 1979argued that dowsing could help and nations overcome their water shortages. He cited the pharmaceutical firm. Hoffmann-La Roche which in the Sixties and Seventies sent one of its executives. Peter Treachvell, Ph.D. around the world to dowse for water at proposed factory sites. 'Roche uses methods that are crofitable, whether or not they are scientifically explainable." Treadwell remarked in 1972 "The dowsing method pays off. It's one hundred percent reliable

Other companies, including oil and utility companies, have occasionally resorted to dowsing, though most are loath to admit it. But in 1980, Pacific Bell revealed that one of its Montlerey, California, repairment, Tom Harmon, had used two lengths of cable to find build conduits. Harmon, who learned the art from "an old rancher," continues to dowse when looking for hidden phone lines.

Even U.S. maines in Vistnami dowsed for Vietoong turnels and traps in the mid-Sioties, solciers at a simulated Vietnamese jungle at Camp Pendeton, Catioma, were taught to dowse for land mines, communication wres, and concealed chambers be fore being sont into combat.

In the past few years, prowing numbers of urbanites have taken up dowsing. Their search, however, is not necessarily for water Using such instruments as plastic rods. pendulums, coat hangers, and L-shaped rods, they wave their dowsing tool over an object, map, or set of questions. They downe for archaeological sites, to predict a trend in the stock market, to determine which local restaurant serves the best sushi. Psycholocist Sam Shaffer sees dowsing as an aid to counseling clients. "I use it as a check on my own therapies, asking guestions like, "Am lusing the most effective approach with this client?" he says. One woman says she's right on target when dowsing for parking spots in Boston '

 have repeatedly laied to produce results in controlled studies-most of their success continues to be anecdotal

Nevertheless, interest in water wetching is riving The 14-year old Amencan Society of Dowests, in timy Darbury, Vermort, has about 3,200 members workdwire. The membership has jumped about 10 percent the fluctuands of others who do not being to the society-can produce bases full of owners, who credit them with instaing werphing from wet size to text most.

In a journal of the World Bank, Steven Serdahalay, formerly a serior engineer in the Transportation and Water Department, explained why he invited Bird to locture on dowsing. The got an open mind about such things, The wrote

Apparently, even government officials have investigated dowsing. In December 1984, Weslay Groesbeck, a US, Army lieutenant colonel stationed in Tunis, tele-

In the mid-Sixties U.S. marines dowsed for Vietcong tunnels and traps. Dowsing for simulated land mines was part of the training at Camp Pendleton.

phoned the American Society of Dowers. The governor of Tunisia's parched Gabes province, he said, wanted the society to help find new water supplies. Soon dowers from the society will obtain dealled maps of the region and will try to determine—by doweing the map—the best yeal signs.

Frequently, dowsers find what they seek Probably the most famous case on record occurred in 150, when a Wane dowser, Henry Gross, used his diviring rod to pinport three sites on Bernucia where drilles could lap tesh water II was a bold predition. Goologies had maintained that Bermucla hadro underground treels water at all

Nevertheless, the Bermuda government decided to fund a test of Gross's divinations Well-diffing rigs work to work. In each of the three spots that Gross had indicated, the differs hit fresh water.

Few dowsers can attord to wing their way to Bermuda to display their abilities. For most, dowsing is a aidoine, an activity mote other engaged in for furt then for profit. Paul Sevigry past predeted till the American Society of Dowsers is a retired Air Force officer, a veteran of the Weld War II givier corps and the Koreen War A former sce-car ching; he finished second in his last race, the International Grand Prix of Japan, driving a Porsche. Sevigny serves as a side judge in Vermont's Caledonia County Supreme Court. And he is an ace water witch

Although Swagny's theores on hydrology, may run countre bandraft bandraft. Ogg, his diartes result, at the to he power of the standard bandraft bandraft. She movel from New York Chy to an oid warmst filmshough and here any service of band ware stapped running. Shrower of band ware stapped running. Shrower of band ware stapped running bandraft bandraft ware stapped running bandraft bandraft bandraft her bandraft bandraft bandraft bandraft bandraft her bandraft bandraft bandraft bandraft bandraft her bandraft ban

That was in February. By May the house was still wateriess. Backhoeing a trench for a new pipeline was too expensive, and drilling a well was even more costly.

"When I moved to Vermont, one of the first people I saw was a dowser walking through a field with a forked stock, which had mpressed me, and I finally decided to get a dowser to help us," Alexander says The dowser she called was Paul Sevony

Che Saturday atternoon in May, he drove the 60 miles from Danville to East Montpeller, where Alexander Ived, and marched through the field under which—somewhere—her water pipe iay. To the astonishment of Alexandre and her finetas, Sevignys driving not abruptly arced down. "Here's your pipe, and here's where the broak is," he told her

Several empty holes later, one digger asked, "Are you sure you know what you're dong?" Sowgry was confident. The next day, with no other roccurse, Alexander med digging again. "Six inches from the spot he'd shown us, we found the pipe, and it had a hairine crock," she says

A too in Sevigry's office bugst with hindrive littless from such clients he even there so contrast issued by the Vermont Agency of Transportation For S100 a days, he was to downs for water to regions in a spring in the Usan of SL Aldrahup that had dwaholid Presurably that contract, issues in Decomtion 434 with this such legal amengement behavior is suba and, in effect, a sorcer, Ale he sub con with all of the 325, 400 and the too a boal shally because he matter to hear to boal shally because he matter hear to boal shally because hear matter hear to boal shally

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### FICTION

How do you kill the beast lurking in a child's dangerous dreams?



### BY BRUCE MCALLISTER

No one so strong, no one so lovely in all the things of this world as the eagle ready for flight and the jaguar whose heart is a mountain. -Aztec poem

It took them twenty years to die. Not the fifty or one hundred the forecasters. had imagined, but twenty. There were rumors of gene-splicing experi-ments gone wild Rumors of ecological chain reactions more complex than the world's finest biologists could understand. Rumors of extortion-chemical and biological blackmail-

America, even North America. The rumors of accidents and pure anarchic terrorism-poisonings of antelope herds in North America, toxic rain at the Kenyan National Parks, epidemics in the Jersey Zoo on the British Channel Islands-ware not rumors at all. They were fact, Beckman knew

The animals began to die. They died exponentally. They died in their natural habitats and in the confines of wild-animal parks and zoos. There were suddenly new strains of resistant bacteria, new pharmaceutical miracles remained dreams. strains of virus. New organ collapses from toxicity. new, unforeseen breeding problems. It was a tidal wave of death, and it took two decades. He had seen it in the figures even then, given his training. while others had not

In ten years, one hundred thousand species were gone from the earth, only the genetic material of but had married a woman from a distant country-



thousand five hundred. The adainst the natural resources of Alnca, Asia, South Alberta game farm, two thousand five hundred. The Woburn Wild Animal Farm in Britain, three thousand two hundred. The Phoenix Zoo, one hundred thirty. The Gladys Porter Zoo, two thousand four hundred The San Diego Wild Animal Park, five thousand three hundred. There were seven hundred ten arks, and all were full. Test-tube births. artificial insemination, and cross-species surrogates had not been enough, and the dreams of cloning, genetic engineering for adaptation, and

> Within twenty years five hundred thousand specles were gone, and the number was rising

Lawrence Beckman was a systems analyst for one of the three largest aerospace firms in Southern California. He had been one for fifteen years. He had been born in Los Angeles, had never left.

PAINTING BY MARSHALL ARISMAN

the more fortunate left-in cryogenic ice One by one, like prison doors slamming, the world's zoos converted. One by one, like the fastest Centric printers, the petitions began, the mediations, the rankings, the race to get places on the arks for the species left alive. But the arks were full The New York Zoological Society hard a warting list of three thousand. The National Zoo in Washingion, eight thousand. The Basel Zoo, two thousand. The Darwin Center in the Galapapos, eight hundred fifty The London Zoo, four



and this, he realized now, was like leaving, very much like leaving. He was Caucasian, He was the only child of a late second marriage. He was a widower

That was all, and it was not enough

It could not keep his daughter alive

He withdrew their savings, a little more than filteen thousand dollars. He contacted his stockhroker to have the few stocks they owned-another four thousand dollars—liquidated. The bank, at his request, made out a cashier's check for nineteen thousand dollars to the Los Angeres Zoo to Griffith Park.

His daughter, See Chee, stood beside hm as he did this. He could teel her presed against him as they watched the voice activated teller type the check for them. She was shaking He threed not to teel it. He thought instead of her labored breakting at night, all the times he had had to waken her in the last two months, straid he wouldn't be able to.

They went together to the encert post oftion in the ritk town, where they mailed the check in an old-astroned business overlape with a covering later that read. "See and Machime Here is a start if you and here hasity Orus. It has no pendias that the Poople's Republic of China has obtain and here hasity Orus. It has no pendias that the Poople's Republic of China has obtain to address monthly. We also promos to address monthly we also promos of balance of the obtain of the service of the obtained of the product of the service of the obtained of the promosal minimals."

Many of the words were See Chee's. She was only ten, but she had gotten good at this, and he felt pride.

The check was returned in a week

Attached was a letter expressing the zoo a appreciation but explaining how chmate control alone for two animals like the "Nandarin pandas" would reach ten thou sand dollars per year, and how there were medical, dietary, security, and facility overhead costs as well. The letter did not give a total fugue. It did not need lo

When he went to her bedroom later that day, it was not homework she was doing on her terminal. She had the facemaker program in again, her beck hunched to him, and was drawing one of the pandas on her acreer. Its features told him it was the mother LI Chu. The face was familiar, and he could see that the was working from a color printout on the floor by her stool

He took a step toward her, but she erased it before he could reach her

When she turned, her dark arms in her lap, he saw how red her eyes were

"You don't have to hide it," he said

She said nothing. She averted her eyes found another program. booted it, and began her homework.

When he went to her room that night to luck her in, she was asleep. The screen glowed eerly in the darkness, a new face stamp back at him, the hesitart amile more human than animai. The bearlike head, the big, ovel eyee, ead bandit mask, broad, if other black nose—The features they both new so well. When he stepped up to the screen to erase it, he found he could not it was here. It bothered no one. It was the best mgh-fight se could have, and unlike some things in their lives, it was still alive, and he just could not do it.

He awoke that night from the temble silence in the house, rose in tear, rushed through the darkness, struck himself painfully against a wall, and finally reached her room. She was still breathing.

He slopt on the floor by her bed, where he could hear the sibilant whisper of her lungs and know she still lived

There in the darkness he could magne her round moon lace, her straight black heir, and the epicarthic olds of her almond-shaped eyes. He could see her mother, May Nagua, his wild He could imagine her people under the towering Annamite Cordifiers, on the cathered Plan of Jars, in the shackwy Laokien highlands ther eyes, her full lips, there straight har

If the pandas were allowed to die, if they could not be saved, a place not found for them, then See Chee would die too, in the night, like all the others.

their fear Lying there, he felt their fear

She did not awake crying that nght and he did not have to wake her But at breakfast it began agan, and there was nothing he could do. He could not even get out of hild her, He could not get her again and hold her. He could not move. He could only think of the catalog-ordered catahne lying wrapped in an old flower-print sheet in the darkness of his o closet

The next night, as he lay on her floor, he heard her breathing stop twice

May Nague was a nurse when he trst mether, and a nurse when she died. It was in a hospital in figlewood, and the week he was admitted for prostatilis she took very good care of hm It was the first time he had ever been away from his work. It was the first time his shy marrier had not gotten in the way with a workan.

May Nagua lived with her family in Fourtain Valiey to the south in the Hmong community there. It was a large family with a chief, Chief Yuur: Even now, few of them spoke English well, fawer all had careers like May Nagua's. She spoke English very well, she had a career in the round eved world Buil like the others, sine fail it. The fear It was an onew that sometimes the United States. It was an onew that sometimes the Free Paopie, dod in their sleep The obcoils of do it understand it. It was "respectively among the was a cardiac netwo conductor problem". It was a cardiac netwo badguing synchrone that had killed young badguing synchrone that had had young synchrone some abord it was the fear

They had felt it in China two hundred years ago and had fied to Laps because of it. There only thirty years and they had felt it enem. They had foundit America's "Secret War" against the bloody Pathet Lao. and now the invading North Vietnamese were going to kill them for it and so as if to say thanks, America's CIA had dotten them out. The Free People were in Montana now in Seattle, in Providence, and in Southern California. The older mon and women still wore brass bracelets, were superstitious about colors and told stories about animals that talked like people. The children wore clothes from Fedoo and Target. T-shirts with the names of rock groups. and were opport at the fast games you could play on machines like television seta. But even now the men and women, young and old might die in their sleen. A sound at nicht, the troubled breathing, a breathless body in the morning. Like May Nanua's brother. Like her grandfather

They felt it even now the tear

She had been told, as many times, Do not leave the hospital alone at night. May Nagua. Do not leave the car doots unlocked if you are going to travel surface streets. Do not leave the freeway for surnot stop on the way home, except for gasdon't even stop for gas. Fill your tank at home Do not stop anywhere, for anything gua, he had said again and again, and she seemed to believe him, and finally he stopped worrving "It's a dangerous world out there," he said to her one day, cheerfully joking at last "Seventy-five percent of Los Angeles is minorities!" But she looked at him as confused that he was sorry he had ever said it-even as a joke

She died downtown—out of gas—near a park—taken as she walked the few blocks to phone him, perhaps to ask him what she should do

Not long after he saw what was happening, he took its doughter to San Depo, to the Twelfit World Conference on Breeding Endangered Spoteis in Capitry Wing sat logether in toiding chars on the sunwained grounds of od Babos Aste-, only blocks from the famous aco — and listened capitally to some men and worms appak leat, and "operate drift." There were no lead, and "operate this Time, they wide toot reporters, and the audience was sparse

He walched See Chee closely, wondering how much she understood. Could she see in? Could she see what it meant—the weakening by captive inbreeding. feeble genes bird to feeble genes, the pairs too weak to start their kind over again? How the only sciences that offered hope were still far in the future?

She was, he saw, doing her best to understand. She was a good girt. He thought of the day—one Saturday in a smoggy summer—when a little girt had come running into the house, brushing at her lag with a frantic hand, tears everywhere. "Was on my leg!" she'd cried. "Was on my leg?" twes all she could say. "What was on your level as the could say. "What was on your twes all she could say. "What was on your the sould say." She was on your say the sould say. "What was on your say the sould say." What was on your say the sould say. "What was on your say the sould say." What was on your say the sould say. "What was on your say the sould say." What was on your say the sould say. "What was on your say the sould say." What was on your say the sould say. "What was on your say the sould say." What was on your say the sould say." What was on your say the sould say. "What was no your say the sould say." What was no your say the sould say." What was no your say the sould say. "What was no your say the sould say." What was no your say the sould say the sould say "the sould say." What was no your say the sould say "the sould sa

leg, Daughter?" May j Nagua had asked, holding her daughter's bands in hers Ike little birds as if to tame them. See Cheel had answered. "A straffacket. Mommy A big yellow and black straitracket!" Her mother had smiled, he had laughed, and See Chee had only cried more, so he had stopped They had hugged her, made soothing sounds, and together, like a little army, had gone outside to find the new wasp nest in the rafters and to rid the all, of the terrible vellow and black "straitackets," the only animals she said she

Then it was a yellow moon he was seeing, over a littered park downtown, where they'd found the body, and he was tearing away from it, yelling inside. That night he dreamed of an animal fair, of a tiger, and a gun

At the functed—a torg, quiet after with beautiful centeronial dress and many words spoken by Chel Yau, the entre commany in attractions—the chel Yauri more tentals then any rapp would have been, this toroxic have of man. The 'gatelean's the spoken and the spoken is to been, the toroxic bechman. Now she is clead these now integreen. Now there is clead these now integreen. Now there is a child with being entities would and no not have and you will do it the bed you "in 'When Begiven Integli varied, all the speaking, that her own mother never died. If the pandas die, your wife is indeed gone, and your daughter should be dead, too. That is what she is feeling, Mr. Beckman. It is a "survivors" guit —not unfike what combat verearis expremence."

He did not know what to say, He walled, and the woman wento "We must work to help her understand that this equation aschelic as it may be psychodynamically—is a fantasy, that papdas are animais—not poople—hat in the end they really do not matter That she—your doupter—swar matters to those who low her" He nodded and managed to ask about the breading

"I am not familiar with the syndrome

you describe." The woman answered, but i wouldn't worry, Mr. Beckman Your daughter is only a child If I'm not mistaken, the Laotian refugee syndrome you describe allficts only adult males. But I can certainly look into it if you would like me to."

He nodded and left. He was alone, they both were alone Words meant nothing.

The professionals weren't there a hight to hear the labored breating, to hear it stop, to waken his daughter and make the breathing begin again. They werent there in the day to watch the tears and shaking, the inability to concentrate, the obsession. They could not possibly understand

If the two animals were allowed to dieif they could not be saved, if a place could not be found for them somewhere-

ten to the man who was speaking now in the bright sunlight of Balboa Park, where everything said was said without hope

When he was through, because See Chee asked him to, he sang her favorite song, the one that began. "We went to the Animal Fair the birds and the beasts were there the lot baboon by the light of the moon was combing his auburn har..." faces were watching waiting for an explanation he could not give

It was four months after the funeral that See Chee began to show excessive interest in the pandas, whose plight he and she had witnessed on their living room screen

Within a month it was clear to him that the was living for the endangenet pair. When he look her to a professional, the woman said, "bree whoth while we call a postsraumatic stress syndrome. Mr. Beckman, Her mother's death was a tauma, and panela mother have become your diauptiter and your when It she can keep them alive she can feet, psychologicality then his daughter would did, too in the night, like all the others

It took him six calls. He was shaking, but in the end he got them the appointment, and for a moment he could see some hope in her eyes and could imagine that her breathing slowed.

The Los Angeles Zoo was where it had strengs been — in a small "whilemess" rates toward the center of the oily. But the oil wells had been eating into that widerness to trivently years, and the zoo was not what it had once been. The wells bobbed and dipped like still birds a mere hill away from the zoo compound, end the domes inside tooled like blue mesch twos; all his hidden



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from view. He had brought her here twice. when she was weinner-to this "Animal Fair " May Nacua had been with them

There was little traffic as they anproached. The bridge and the main gate it led to-such bazy memories from his own childhood-were still there, but the crowds were not. The public wasn't really invited. You could apply for a visitor's pass. ves, and visit with a group. But you would wait six months, and when your day finally came there would be metal detectors. unico-stross analyzors, and trained doors soffing for the poisons some Grazy might try to bring in for the animals of this ark.

The magic, the sense of wonder, was none. Yet no one complained. What mat-

least two of each kind eating, sleeping, and, whenever possible breeding behind the blue walls the armies of attending nutritionists, vertebrate biologists epider miologists, and yeterinarians all looking on, quarding against a virulent world.

The curator's office was on the fourth floor of the new administration building. Through the window of the receptionist s office they could look down on the compound below. dome after dome pleasant green tarcalyptus, oleander, sand pines from Turkey and Africathese were trees the air couldn't kill. As he stared at them his daughter's hand in his he felt a brooze through the glass and behind his eves saw

ghostly squirming things, tawny bodiesmemories that were not his of wild continents, bright birds exploding from dark rain forests, icy waters where while predators basked in the light of a hundred suns. Then tarmac again, blue domes, trees

shrubs somehow holding on He was still holding See Chee's hand his own hands unsteady, and the curator was in his office doorway at last, addressing him, saving, "Mr. Beckman, I really don't know what I can do for you. My assistant,

John Neumann, tells me he spoke with you at some length last week He was not going to let them in

Yes.' Backman said

The curator stared back. It was a white,

norous face with the blush of broken can illarias. The eyes were a wonderful blue. round and with crow s-feet at the corners The hair was white and wavy making Beckman think of a snowy equat or, finer still a snow longard-both gone now

What I'm trying to say. Mr. Beckman." the man in the doorway was say ing it's that I'm noi sure I know what I can do that hasn't already been done.

He wouldn't look at her Beckman realused. She did not exist for him

You can let us sit down \* Reckman said The man had little choice. As they sat he took his place slowly behind a sumps ingly clean teak-veneer desk

son. Sitting down, she kept her smile, it was someone else's smile, and Backman had to look away

"We are concerned about the pandas." he said quickly.

"Of oourse you are " the man answered 'but you both must understand---" his hands were folded on the desidon with wonderful control as he looked at the father then the daughter-That there are many many animals and many many peo-

He had his own script. Beckman saw to it they were children. He had dealt with children like them before

Excuse me.' Beckman said 'You talk What we don't understand-' Beck of petitions. We hear constantly how im-

portant they are. Yet we also hear of animais awarded places with petitions much shorter than those of many unplaced animais. Could you tell us why this is. Mr Binner?

The curator smiled referring to Mr Beckman, are those where assessments by the scientific community carry special weight You may be chus manatee the the so-called House ton toads-since these base received more than the usual attention in the media As it turns out. Mr Beckman, cases like these are much more frequent than anywhere the lay cubic has been able a species in?" The man paused 1 m sure you're aware of what those assessments might be

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man began, the script as clear to him as it

We?' the man stopped him "You're re-

Beckman looked at See Chee, at her dark hair moon face, wide eves. When the anger came he let it. He needed it

The ord, Mr. Binger, is my daughter." To See Chee he said gently, "See Chee this is Mr. Ringer-the man who runs this 200

pantsuit smilled, and said. 'I am very pleased to meet you. Mr. Binger," She offered him her brown hand, which he finally took. She knew how important this was They had rehearsed it many times. It might all make a difference ... with the right peri

It was Beckman realized, a question When he did not answer, the curator answered for him.

Genetic uniqueness for one. Genetic diversity for another. Genetic engineering possibilities would be a third. There are many others, Mr. Beckman

"Shouldn't-" Beckman began, slumbling, the script gone. "Shouldn't some special weight- He stumbled again and then somehow the acrint was there, and he was rushing with it "Shouldn't some special weight be given to the votes of another group of experts? I'm speaking here of the children's groups, the Scouts, the YWs and YMs, the petition clubs, the school groups like my daughteris, not to mention

the zotogical societies and witch's leaf endors whole metheratings are primarily young pergle. These young picobia have the work of the second picobia have to yours and we remain the duty you and the other zoce in this country dropped the momentary your reasons. — How you and down and there septimises the took a breath... twolld the lo suggest Mr. Ringer, that children know bash what ammark they low, what ammarks should be kept in took be amound be extend to be any the took a be amound be extend.

When the curator didn't interrupt, he continued quickly 'it completely aston-

ishes me, Mr. Ringer, that our zoos—the very institutions once entrusted with instilling a love of wildlife in our children can no longer hear a child's voce."

The silence lasted only a moment, and when the curator spoke, Beckman knew they had lost.

"That isn't outle fair. Mr. Beckman, But I suspect you know that." The man was caim He was still smiling. "As you must be aware, children had considerable say in the selection last year, for this very zoo, of the California brown bear-a species of projound sentimental significance state. We have eight we're happy to report They also had considerable say in the selection of the black-footed ferretone of our most touted national treasures-for the Bronx

Zoo, with six specimens. And the western sea otter for Marineland. And the harp seal - tor the National Zoo "

He paused for effect. "Anmels that chidren happen to find charming because they have anthropoidal leatures or are offerwise 'adorable' are, I assure you, well represented in the arks of this nation—or as well represented as they can be, given the times we hav in, Mr. Beckman."

Beckman feit his face grow hot. He could not look at the man. He started to rise, but the man was not through with him. The voice had changed. It was now, somehow, full of compassion.

"Mr. Beckman, we do not have room in our zoos even for our own species. This so OMNI

zoo is ranked fourteenth in the nation by budget, yet we have two of the seven remaining specimens of the Hawarian Kuauar go, four of the remaining eighteen sandhill cranes in existence, and six of the remaining dozen Canis lupis nobilis. We even have, it pains me to say, two of the last eight Halvaeetus leucocephalus-simply because neither DC, nor San Diego, nor the Bronx, nor any of the other thirteen facilities ranked above us in budget have room for them. This is a national disorace. Mr. Reckman. The two Heliseetus snecimens are sick. They are dving. They are victims of what specialists call inbreeding depression, and we cannot find a place for them in one of our finest arks.

cated of sciences—computer modeling, multivariant analysis, parallel processing matters that I'm sure you, with your background, understand better than I, Mr Breckman."

He said it cently.

But then the voice changed again

'They are the ones who must decide which specimens are of the greatest importance to mankind's future, Mr Beckman, and they have decided that your pandas are not We are not speaking of the last two pandas in the world, Mr Beckman. There are len others in Chria. These two are not even a reproductive pair, Mr Beckman, The man started at him.

He could feel it rising in him, threatening

 to take him. The fear. Was See Chee teeling it too? Was she looking through the window, her breathing beginning to change? Was she drawing a pandala face behind her eyes, to make it go away? Was she remembering the stills, the videptexts, the pages and pages of printout on the anatomy. behavior, and needs of the ber shung which she kent in her dresser drawers like snapshots of someone she missed very much?

Then, to his suronse, he was standing, he was shouting at the man before him. "Why in God's name isn't our own State Departmentour God Almighty State Departmentinterested in those pandas, Mr Ringer? Why isn't it in the best interests of our nation to grant those animals asylumsimply as a des-

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and Beta models than anyone else. In fact, when **TOSHIBA** It comes to VCR's, no one stacks up to Toshiba. Total and the Reference of the Name Reference of the Reference of the

> Beckman marveled at the feeling in the man's voice, at the compassion for the poor Haliaeetus leucocephalus

"You must partiarly be away, "the man we continuing, pande, sympathic, "that we have had the entrie fuctorating matter of your Mergodynamic methods and a sympanew. There are simply too the interaccers spaces on the arise in the country. They are vacated only by death or by aiterations in the priority last. The US mediation learn—ail trained spacings." Comparison of the contenues, but schoolased other spaces as well To the schoolased other spaces as well. To the schoolased other spaces as well to the ture—simply as a gesture to a nation as important to this world and our own tuture as China is? The cost of keeping the pandas alive is nothing—nothing!—In the face of national budgets, Mr. Binger!

The office filled with silence. He could teel See Chee's eyes on him

A look of pity passed across the curator's face.

"That is an interesting question, Mr. Backman," he said. "Everything is symbiclic in international intercourse, isn'il 17 Even animalis You have certainly touched on a truth that young people today—Ake your daughter—must understand as they make their way into a future neither you nor Will be around to see..." He paused for effect, then went on. "You ask about China, yet apparently you have not been keeping up with the finer points of the news?" Again it was a question.

"No." Beckman answered, looking down "I have not."

Apparently you have missed the subtle problems we are having with Pek Ziao and his glonous New Republic. The press can be stupid at times. Mr Beckman, but there were glimmers of this as much as two years ago. The voce was condescending. "I really do not understand how you could have missed it."

My wife, Beckman wanted to say My wife my daughter

"The fact is," the man continued, 'our triffaera economics are stratened. We are, so to speak, 'denormalizing relations with the New Repetition: We are not wining to nsis what we have with considerable agony logied in Thrid World stability with Moscow. We are willing to make certain symbids sacriflees—no matter how snores the Chrises may be in their concern for their ammals." He paused one last time. "I imagine the mediation team has been under considerable pressure, Me Beckman."

The words came so quick!

What did the man mean?

"Does this answer your question?" "What are you saying?" Beckman whis-

"You know what I am saving ?

"It isn't possible...

"Of course it is possible. Mr. Beckman Don't be naive

It was possible—this, the simplest of explanations. All the rest—scientists media, lons, computer models—were meaningless in the face of it the diplomatic game, the quiet war of nations where the casualties never knew it was a war.

He obsed his eyes See Choe was there and the pandas his save piscenthic tolds and the pandas his save piscenthic tolds the save moon saves and almond eyes of the highlands. He saw diplomats arguing in fleak varieties moons like into one, reveenee throug, straking their mends while the sad gyes, the almond eyes bolded on from the bamboo hickets unable to understand theorem as the war fell around them.

He opened his eyes.

"How far are they from admission?" he asked quietly "How many slots down the list are they?"

"Far too many, Mr. Beckman." The man was curt. He was standing now. He was not going to let it start up again.

How many?" Beckman repeated

"Eleven or twelve, I believe—but the exact number doesn't matter. It is not going to happen, and I refuse to encourage faise hope. If you'll excuse me .

Beckman stared at him

"Is it over?" See Chee whispered. "Yes It is over."

The man walked them to the door

There. See Chee's hand in his-warm, alive-he turned one last time and said continuit on ever a





How one maharaja's fascination with the beauty of the heavens produced these monuments to the stars



PHOTOGRAPHS BY PETE TURNER



Jajour, Delhi, Benaras, Mathura, Ujaini, The names toll the wonders of the East Thore latitioned mathemaps once drwell in regal splenitor. And there stand these structures, onealthaling monuments to salronomy.

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Some 250 years ago, Maharaja Sawai Jai Singh II founded the city et Japar and, through Machiavefian intrigues, welded several small provinces into a mighty rai, Yet his real lovs was not statemat but astronomy, Intrigued by

A Real Property in the second

The Samral Yantra, a giant stone sundial 90 feet high, is still in use today.?



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These satellites will be dreadnoughts of the skies. They will have their own weapons. They will have flobilas of space destroyers around them, says this star warrior of President Reagan's Strategic Defense Initiative

# INTERVIEW



Namin 22, 1989 President 2, 1980 President 2,

a high-tech astrodome matched by or shared with the Russians that would make "nuclear weapons impotent and obsolete." At a time when the United States and the Soviet Union face each other with 10.000 warheads apiece, stockpites equal in explosive power to a million Hiroshimas, the dea has an undervable appeal Early polls showed the public was overwhelmingly in favor of Reagan's suggestion Defense pundits, politicians, and strategic-theory professors. however, are not so easy to convince. Among them the battle

PHOTOGRAPH BY PAT HILL

over star wars rages more fiercely by the month. Recent copies of Commentary manazine, a particularly enemetic arena of debats, have fairly exploded with intellectual missiles and scorching laser beams of argument and counterargument over SDI.

The brouhaha in Commentary was ignited by a university physicist who is in favor of the idea, a fairly lonely position among academics. In the defense industry, star wars has its supporters, including many scienfists who are not in the pocket of the administration. But scientists on campus, including some with a lot of experience in weapons clesion and strategic analysis, tend to be skeplicai

Carl Sagan and Nobel laureate Hans Bethe, for instance, are prominent supporters of the Cambridge, Massachusetts-based Union for Concerned Scientists (UCS) which published a debunking book. The Fallacy of Star Wars, last year. Physicist Sidney Drell is cocliroctor of the Stanford Center for International Security and Arms Control, which also put out a cautionary report. In late spring 1984, the UCS collected signatures from more than half the membership of the National Academy of Sciences for a nettion adainst weapons in space.

These scientists dende the "perfect detense" as a "half-Buck Rogers, half-P T Barrium' fantasy. A leaky star-wars um: brelia, they allege, will cost trillons, will never work efficiently, and will be ridiculously vulnarable to cheap countermeasures. Nuclear strategists say that a permeable screen will be no different in impact from the antinuclear missile defenses of the past, which the Antibalistic Missile Treaty of 1977 was designed to banish. Their concern is that any attempt to install or even research it will further upset arms control, causing the arms race to escalate even more precipitously

Physicist Robert Jastrow, professor of earth science at Dertmouth College, in Hanover, New Hampshire, rejects these fears And he has roundly defended star wars since the President's famous speech. He has merclessly ribbed the UCS for a couple of early errors. For example, the union first calculated that it would take 2,400 laser-equipped satellites to shoot down Russian missiles but then revised this foure to a low of 162. This and another miscalculation figured promnently in Jastrow's Commantary article, "The War Ansinst 'Star Wars ' " In it be accused star-wars critics of doing "shockly work."

Their furious rebuiltals pointed out that prostar-wars analysts had made similar mistakes, and they referred to Jastrow's "blunt sword" and his "parroting" of others' criticisms. They spoke of his "hysnalike tendencies" and his dependence on research done in defense labs at Los Alamos and Lawrence Livermore

Jastrow however, is far from the only man under attack in this notoriously no-holdsbarred debate sparked with accusations of irresponsibility, breaches of scientific ethics, and egregious misstatements. Indeed, star wars poses langled questions, most of the answers highly speculative. Arguments and OWNI

robuttals proliferate, and a truly informed opinion demands serious study. One crucial difference between the two sides has emerged. The star-wars supporters are the optimists, above all in the matter of U.S. technology. They believe a nearly invulnerable defense can be developed to knock missiles out of the sky so efficiently it won't pay for the Bussians to try to overwhelm it with missiles, decovs or sabotage The Bussians will have to answer it not with more missiles but with their own defense technology. The happy result would be a shared strategy of mutually assured survival, a detensive arms race that can then beat a downward path through arms reduction to total abolition. President Reagan insists he will share star-wars technology with the Busstans. Some find this difficult to believe

Another conclusion in the midst of the debate. The future of star wars, even its ultimate strategic impact, hinges on cost. Here guesses vary hugely and are muddled by secrecy The administration set up the SDI

The smart bullet is a device the size of a twopound coffee can. It has a computer that senses the oncoming missile and steers the bullet into it 9

organization under General James Abrahamson to pursue an R&D program with a budget envisioned at \$26 billion over the next five years. Besearch into electromagnetic rail ouns, charged-particle beams, chemical and X-ray laser beams, and other luturistic methods to shoot down intercontinental ballistic missles is proceeding apace

In Jastrow's rosy view, the effort is just fine He sees the SDI beating a path to a nonnuclear world, and he has laid out his reasons in a book. How to Make Nuclear War Obsolete, published by Little, Brown. He prodicts that if all goes well, star-wars defenses will be built by both major powers and that this will load to mutual "builddown," and the nuclear stockpiles will vanish

Jastrow's can-do confidence about the success of a technological initiative belts. his long involvement with the space program. He started off as a bright kid from the Bronx, who entered Columbia University at skteen, and emerged with a Ph B, in physics at the start of the Fifties. A protege of J Robert Opponheimer, at Princeton, he dis-Inquished himself in theoretical physics with two papers and subsequently joined the Naval Research Labs, in Washington, D.C.

Soon afterward he crossed the street to join the fledgling U.S. satellite effort. He then received an offer from the newly formed NASA to head its theoretical research division in Washington at the start of the Sixties Jastraw moved the division to New York, chrislening if the Goddard Institute for Space Studies. His aim was to get away from the capital's overly worldly spirit. "I am not a political animal," he readily contesses. In 1977 Jastrow became adjunct professor at Columbia to teach a course. Stars, Planets, and Life, for both the geology and astronomy departments. The accessible course became hugely popular, and class sizes grew to 500 students. This initiated some of the faculty of the astronomy department, and political machinations began. Finding these cambul in midterm Jastrow handed over his class to a colleague and walked away from Columbia for good. His departure did not go unregretted. "The world would be a dul place without a Jastrow," says a senior geologist Since then each summer he has taught Planets, a similar course of equally stupendous size, at Dartmouth

A kind of academic journalist, Jastrow seems inspired to put complex ideas in terms anybody catt understand. His forte won him a couple of hundred early-morning science shows on CBS, and he turned the material into three books. Red Stars and Giant Dwarfs, Until the Sun Dips, and The Enchanted Loom

Jastrow Invited Interviewer Anthony Liveradge to his apartment in New York Oily. The telephone rang constantly, while his assistant rushed to send a latter to The Wall Street Journal

Omni: Why is this debate so acrimonious? Jastrow: I haven't heard any rude words, except ones directed against mel But it has occurred before in the first round of the ABM [antibalistic missile] treaty. Then there was the argument over the H-bomb. But it's the first time that the public has learned that physicists do not address their own subject matter objectively.

Ornni: How strongly do you feel on this issue right new?

Jastrow: The subject was completely outside my attention until I read an article on the MX and learned that the Soviets, starting in 1972, have built up their arsenal to awe some levels. When an argument enunted over where to base the MX it was obvious to me that the way to take care of the MX was to defend the silos. Then I learned that the ABM treaty prevented the opvernment from doing that. Official policy since 1972 has been to keep America defenseless against Soviet nuclear attacks

When I heard the President's star-wars speech, I thought, What a relief he's finally broken the mold of this conventional thinking. Then all hell broke loose, as the scienfists and journalists proceeded to ridicule and criticize him. My friend Richard Garwin fol IBM Harvard Cornell and a leading Union for Concerned Scientists expert1 said it won't work. And others called it technologcell per in the sky. I hough if such a new field drives on unchracture, it been revetigation. So I looked into their chicenes and proposel, and Do's Gaiven wrote an actioproposel, and Do's Gaiven wrote an actiotation of the state of the state of the my sources in Livermone, Loo Alamos and bo look no installigations construct and wrote to look no installigations con by one. I fund the area y site gaisance on by one is fund the area y site gaisance on the was wrote, some the use of documentation in my obustalling one before the state of the state of the state of the value before.

Jastrow: No, I'm mostly amused. To be called a hyena is in my view a rare honor because. it suggests that I must be doing something right. Theroretical physicists usually do rather dry things that don't get anyone's gears engaging. That Dr. Garwin was incensed encuch to call me a hyena implies a certain effectiveness to my actions. I have simply out into the record the changes they have made when estimating the number of satellites needed to shoot down Soviet missiles Their estimates have dronned over a ninemonth period from twenty-four hundred to one hundred sxty-two. The public should know what the accuracy and credibility of the UCS is on this vital point

Owni: Why do you suggest they are biased toward Inding star wars a waste of time? Jastrow: This small, vocal band of physicists has stated that they believe defending the Unified States against Soviet nuclear attacks will bring the world closer to nuclear war They then proceeded to calculate the technical feasibility of this program that they had already decided was destablizing. Then calculations showed the program was costly, ineffective, and easily countered. Those calculations were later revealed to be wrong. But why didn't these competent theorists check their results and find these errors? People make arrors-Einstein made lots! He was famous for them in calculus. My conclusion is that when these physicists got the result. It acreed so well with what they had already decided, they relaxed their guard. Omn; You believe that whatever we come up with, somer or later the Bussians will come up with a counter to it?

Justice: No, there's a laise symmetry in this reactioning. Sometries a direct or defense is stronger, and that disparry persists for doalses or for centilies. Since World Wai I the offense has ruide with the nuclear weaponting that has a person of the bit has a hard hard and the bit has a stronger of the there are a bit has a person of the bit has a disparation of the bit has a list of the stronger of the bit has bit of bits to bit out what it will cost. The issue is exectly what it will cost for us to put up an effective defame

Owni: You say that this system will cost sixty billion dollars, plus fifty percent, but don't others predict if will cost up to one trillion? Jastrow: That trillion-dollar figure is off the will and has no justification in any of several



realistic estimates made. My socy-billion dollar foure is for only a first-peneration, twolaver defense of limited effectiveness, estimated conservatively at ninety nercent. The three- or four-layer defense, which has laser and particle beams and exotic technology. would cost more. My own estimate is based on the cost of the Manhattan Project, inflation, and the rule of thumb in the defense department that, just as Cadillacs and Chevies cost so much per pound, fancy military and NASA satellites cost so much per pound. Maybe it will be two hundred fifty billion dollars. But you must remember that our budget for the offensive deterrent from now till the end of the century is upwards of seven hundred billion dollars!

Omni: You say you tear "the possibility a few years hence of a preemptive Soviet strike amed at the ....termination of the existence of the republic " Isn't that paramoid?

Jastraw, Ill's an old saying that even paranods have enemies. The Soviet fifth-genersion missile is possibly as accurate as the MX, our newest generation. They now have about ten thousand accurate first-strike warhads, enough on paper to preempt and win a nuclear war. We have fewer than one thousand comparable warheeds.

The Soviets have not attacked us because of our submarines. While these aren't effective in destroying Soviet military targets, they are a deterrent against a Soviet attack on our crites and civilians. If the Soviets destroy our bomber bases, sub pena. and missile silos, won't the American president fire the submarine missiles, signing the death warrants of one hundred million Americans in the inevitable Soviet counterstrikes? My bet is that he won't But the Soviets can'l be sure he won't, so there's a deterrent there. Four or five promising nonaccustic methods for detecting a ihmerged submarines are now being researched. And as a consequence, it is very unlikely that the submarine deterrent will remain intect. Our whole safety hangs by that one thread, which could shan sometime in the Nineties

Onvertisent is a pay to militarize space? Jastrow: Space was militarized in the Skties when the first military satellitee wont up. The air during World War I was not militartaed until amplanes started reconnoiseing battlefields. The enemy discovered you can't hight a war with somebody snooping on you, so they started to shoot them down. So it is with space.

Ommai Shouldn't people be afraid that these space waspons will be used for offensive purposes?

Jasifow: A laser baser can burn a hole in your hand on the ground from space, but who would use a biflor-ddirs satilite to burn a hole in your hand? These things are only cost effective if you can melt a hole in the sion of ten or more one-hundred-million-doltar missiles with them. We will rever dream of using them for those other purposes.

Omni: Electromagnetic ral guns, fifty-thousand-mile-an-hour antimissile stingshots are going to deliver two hundred kilos of projectiles, so couldn't they deliver bombs? Jastrow-The rair guns with have a poyload of viry a couple of pounds. The question is winther a satietific you pass off on the activersary as offeners exclusily has nuclear weapors on board. A projectle gating down in four minutes would be hard to protect against the atmospheric destruction upon of a big satellitic caraining a couple down up a big satellitic caraining a couple down satellitic termines and the satellitic for the satellitic termines and termines and the satellitic termines and the satellitic termines and termines and the satellitic termines and the satellitic termines and termines and the satellitic termines and the satellitic termines and termines and termines and the satellitic termines and termines and termines and the satellitic termines and termines and

Omn: What about bombs small enough to fit into a suitcase?

Jastrow: That turns out to be a bag of beans Carl Sagan keeps talking about bringing them inside a bale of mariuana, playing on the fact that we can't close the border very successfully. But if we spent a couple of billion, we could seal that border fighter than a drum. There are classified methods that make it extremely easy to detect from the air any fissionable material coming into any port or any city like Washington with extraordinary sensitivity So, in effect, it is impossible to structile in a bomb through a port or into Washington. If we've eliminated every threat to the existence of our republic from ballistic and cruise missiles down to bombers, and a bale of marijuana is the last single threat. then we'll seel off the goddamp borderi. Omm: You believe that the SDI is a path that will do away with nuclear weapons? Jastrow: With a defense you don't have to

be as reprove should be as side builting more missible. If you have an adopt-perorst-effective defines and you have to huxand warhaped and the Svetter have ten thousand, only have thousand of herms can get filtruigh. Source may end with the party large filtruigh. Source may end with the party rath—filtraits this propose of building usenet because here could not spend the and other high days and the filtrain.

Critician low boylob come operant relations ingelow Jastrow. The Sorkie's have spent at least free hundred billion dollars on their missiles. If one in file gets through, and that's a very contexvative lique, then they must build file times as many missiles to get the same number through as if the American's had no defense Five times a halt titlion is two and a helt trillion.

Ormit Title costs lavor the defense by such a large amount, why do the UCS people or Dr Drell of Stanford still insist that atlack is much more effective than defense?

Jestrare Drell, Garven, and I agree on the cost of the determe approximately billion dollars por startific Since each startine maskes costing at least one hundred million dollars each—or two billion allogather—the cost trade-off at least two to one in lavor of the determs: Other extimates yeal toxicable raflos us to five to one Garven has initiated the cost of our determs by samp at needs thou-



sands of satellites, not one hundred

Dr. Garwin insists a fast-burn booster of Midelman type would cost about fifteen percent more than an ordinary Middetman. eleven and one half million dollars per warheart. So three thrussori [spole-warheart] Midgetman boosters, his proposed Soviet countermeasure would cost only thirty four and one half billion dollars. But according to present drawoo-board estimates and Dr Retcher's projections, implementing this fastburn feature would mushroom the cost to one hundred million dollars per warhoad Using this figure, the cost of the countermeasure would be three hundred billion dollars James C Fletcher, a physicist who formeriv headed NASA, chaired the delensive torthnologies sturky panel that set out to sesess the technical feasibility of SDI --Ed 1

Dr Garwin has again misstated the probable cost of his countermeasure by one of those famous factors of ten or more!

Omnit: WII star-wars defense lead to a competition in defense, replacing MAD (Mutual Assured Defense) with a strategy of Mutual Assured Survival?

Jastrow: When even an bighty percent oflective defense is in place on both adds, the undear-tipped missie will no longer be a useful weapon for any purpose Burkdown will commence, with the end of that road leaving just a few weapons on each side.

Omni: Many people hold the President's intelligence in less high regard than you do

Jastrow, President Reagan has more brains in his thumbrial than many academics have in both cerebral hemispheres. He saw the possibilities in this technology as no politician has before

Omni: What system do you see being set up as the initial star wars delense?

Jastrow: The most mature technology is the smart built do you should have a two-ayer delense of smart builts in the early Nncthes The smart builts in a deve about the size and shape of a two-pound coller can having a computer that sense the oncomng missile and steers the built into it. The Dull has no guiprovider in it, built he force of the collision releases more energy than UNL and it blows up the warhaed. Once the warhaed is damagod in any way, it cannot the part in any user.

Omni: Won't this delicate satellite sotup be tremendously vulnerable?

Jastrow No. Satellites are vulnerable now because no one is shouting at them. The first arripance that went up in World Wert I. In World Wert in World Wert and and had mäching apair installed in them, and the because the local solutions will be the endody. These [SDI galabilities will be the code of the solution of the large descriptions. They'll insert (SDI galabilities wave the take of the earth.

Orani What are the weakest points in your own views?

Jastrow: The premise that a defense shoot ing down eight or nine out of every ten Sovict warhcads is a rate of attrition that will prevent the Soviets from over going to nudear war against us if madmen gained control of a Soviet state, we can't be sure what they would do. Whether the Scuero would be daunted by a two-and-one-haftallion-dollar expenditure for the purpose of destroying the United States seems to be the weakest noint

Omni Doc't miltani computers screw up all the time? Isn't apphisticated military hardware notoriously upreliable?

Jastrow: If you want an error-free computer. you build two of them. If each is good to the order of one operation in a billion, the chance of a failure with two is one in a billion squared. one in a million tellion, in effect, zero

Omer People are also afraid that the SDI system involves a loss of human control

lastrow: When the SDI system is in place, should some isolated missile appear in snace that doesn't fit into our book for planned launches, there's planty of time for word to go back to the United States to evaluate whether it is actually a hostle act or a commercial launch. If a massive Soviet throat occurs, there will be no ambiguity about the propriety of our response. Bernember, the remove to a Soviet attack on our system now is completely beyond our hands. Currently, we have no idea whether the warnings that come in are real or not in spite of checks and counterchecks. If we make a mistake now in our computerized warning system the result is catastrophic. If we make a mistake on the other system, all we do is fire off some lasers

Omni, Isn't there a gap between our artificial intelligence and a future computer that could frink like a human?

Jastrow: Your brain puts out nearly twentywe watte basten billion neurons, and ten to fifteen power connections. To have that many connections run on twenty-five walts is the name of the game. That's on the distant horizon. The software to match the nower of the brain at its best is a question of architocture, and challenges like the star-wars baltio-management computer will carry us toward that aim But its full achievement. I guess, lies centuries ahead. But what is a century in the scale of the cosmos? The beings in the universe that I was taking about at the end of my book are the beings in the mature life of the cosmos. The solar system was a cloud of dust five billion years ago. The average age of the stars in our galaxy is seven and a half billion years. The beings around us, if they're there are two and a half bittion years older than we are

Omnit Are you a skeptic about UFOs? Jastrow: Why would a being with the ability to cross the distance between stars bother to stop down in New Hampshire and pick up some woman and give her a physical examination? This is a typical report. I am sure they would be immune to all our lethal instruments, but somehow they never descend on the White House. They always come down in remote places where only one or two people can see them. On the other hand, I think we must be prepared for this contact DO



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### The ROSICRUCIANS

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BY BRUCE STERLING AND LEWIS SHINER

Example in the order of the control of the control

High, chan-link fences surrounded the square mile of the complex. Rice had been inside them for two years, directing teams all over the priorite as they ordered Nantucket where soulked up to serve as tankers, or trained local pipe fitters to tay down line as far away as the Sinai and the Gulf of Mexico.

Now, finally, he was seeing it all from the outside, despite the objections of Sufferland, the company's political asion. His mere presence, she claimed, would only worsen the future sincek that had left the city reeling. Rice head no pagence with the attluide. The

PAINTING BY ETIENNE SANDORFI

plant was up and breaking design records. and Rice was due for a little R and R

A moped sputtered up the hill toward him, wobbling crazify. The rider couldn't keep his high-heeled, buckled pumps on the pedals while carrying a huge portable stereo in the crock of his right arm. The moned lurched to a stop at a respectful distance, and Rice recognized the music from the tape player Symptiony 40 in G minor

The boy turned the volume down as Rice walked lowerd him. "Good evening, Mr. Plant Manager sir. I am not interrupting?

"No, that's okay." Rice glanced at the bristling hedgehog cut that had replaced the boy's outmoded wa. He'd seen the kid around the dates, he was one of the regulars who waited day and night outside the fence. begging for radios, rylons, jabs of penicifin, But the music had made something else fail nto place "You're Mozart, aren't you?"

"Wolfgang Amadeus Mozart, your servant."

"Ill be goddamned. Do you know what that tape is?

"It has my name on it "

"Yeah. You wrote it. Or would have, I guess I should say About fifteen years from now."

Mozart nocked. "It is so beautiful. I have not the English to say how it is to hear it."

By this time most of the other gate people would have been well into some kind of pitch. Rice was impressed by the boy's tact, not to mention his command of English. The standard native vocabulary didn't go much be vond radio, drugs, and fuck. 'Are you hearled back loward town?" Rice asked

'Yes, Mr Plant Manager, sr."

Something about the kid appealed to Rice The enthusiasm, the glearn in the eyes And. of course, he did happen to be one of the greatest composers of all time

"Forget the titles." Rice said. "Where does a guy go for some fun around here?

At first Sutherland hadn't wanted Rice at the meeting. But Rice was the company expert on temporal physics, and Jefferson had been pestering the American personnel with questions about time holes and parallel worlds

Rice, for his part, was thrilled at the chance to meet Thomas Jefferson, the first Presdent of the United States. He'd never liked Washington, was glad the man's Masonic connections had made him refuse to join the company's "godless" government

Rice sourmed in his Dacron double knits as he and Sutherland waited in the newly an conditioned boardroom of the Hohensalzburg castle "I forgot how greasy these suits feel," he said

"Al least," Sutherland said, "you didn't wear that goddamned hat today." The VTOL let from America was late, and she kept looking at her watch

"My tricom?" Rice said. "You don't like it?"

"It's a Masonista hat, for Christ's sake It's a symbol of anfimodern reaction." The Freemason Liberation Front was another of Sutherland's nightmares, a local politico-religious group that had made a few pathetic. CAINI

attacks on the pipeline

Oh loosen up wil you. Sutherland? Some grouple of Mozart's gave me the hat. Therese-Mana-Angela something-or-other, some broken-down aristocrat. They all hang out together in this music dive downtown 1 just liked the way it looked.

'Mozart? You've been fratemizing with him? Don't you think we should just let him be? After everything we've done to him?"

"Builshit," Rice said, "I'm entitled, I spent two years on start-up while you were playing touch football with Robespierre and Thomas Paine, I make a few night spots with Wolfgang and you're all over me. What about Parker? I don't hear you bitching about him playing rock and roll on his late show every night. You can hear it blasting out of every cheap transistor in town

"He's propaganda officer. Believe me, if I could stop him I would, but Parker's a special case. He's got connections all over the place back in Realtime." She rubbed her cheek, "Let's drop it, okay? Just try to be

Marie Antoinette sprawled across the bed's expanse of pink satin, wearing just a scrap of black-lace underwear and leafing through an issue of Voque.

polite to President Jefferson. He's had a hard time lately

Sutherland's secretary, a former Hansburg lady-in-waiting, stepped in to announce the plane's arrival. Jefferson pushed angrily past her He was tall for a local, with a mane of blazing red hair and the shiftest eves Rice had ever seen

Sit down, Mr. President." Sutherland waved at the far side of the table. "Would you like some coffee or tea?"

Jefferson scowled "Perhaps some Madeira "he said. "If you have it.

Sutherland nodded to her secretary, who stared for a moment in incomprehension. then hurried off. "How was the flight?" Suthorland asked.

Your engines are most impressive," Jefferson said, "as you well know." Rice saw the slight trembling of the man's hands' he hadn't taken well to jet flight. "I only wish your politcal sensitivities were as advanced."

You know I can't speak for my employers," Sutherland said. "For myself, I deeply regret the darker aspects of our operations. Florida will be missed.

Imitated, Rice leaned forward, "You're not really here to discuss sensibilities, are you?"

"Freedom, sir," Jefferson said. 'Freedom is the issue." The secretary returned with a dust-caked bottle of sherry and a stack of clear plastic cups. Jefferson, his hands visbly shaking now, poured a glass and tossed It back. Color returned to his face. He said, You made certain promises when we joined forces. You guaranteed us liberly and equality and the freedom to pursue our own happiness. Instead we find your machinery on all sides, your cheap manufactured goods seducing the people of our great country. our minerals and works of art disappearing into your fortresses, never to reappear!" The last line brought Jefferson to his feet

Sutherland shrank back into her chair "The common good requires a certain period of. uh. adustment-

"Oh, come on, Tom," Rice broke in. "We didn't 'ioin forces.' that's a lot of crap. We kicked the Brits out and you in, and you had damn-all to do with it. Second. If we dhill for oil and carry off a few paintings, it doesn't have a goddamned thing to do with your Iberty. We don't care. Do whatever you like. just stay out of our way Right? If we wanted a lot of back talk we could have left the damn British in power."

Jefferson sat down. Sutherland meekly poured him another plass, which he drank at once. "I cannot understand you. You claim you come from the future, vet you seem bent on destroying your own past

But we're not," Rice said. 'It's this way History is like a tree, okay? When you go back and mess with the past, another branch of history splits off from the main trunk. Well this world is just one of those branches.

"So," Jefferson said. "This world-my world-does not lead to your future "Right," Rice said.

"Leaving you free to rape and pillage here at will While your own world is untouched and secure?" Jefferson was on his teet again. "I find the idea monstrous beyond belief, intolerable! How can you be party to such despotism? Have you no human feelings?"

"Oh, for God's sake." Rice said. "Of course we do. What about the racios and the manazines and the medicine we hand out? Personally I think you've got a lot of nerve, coming in here with your smallpox scars and your unwashed shirt and all those slaves of yours back home, lecturing us on humanity.

'Rice?' Sutherland said

Rice locked eves with Jefferson Slowly, Jefferson sat down. "Look," Rice said, relenting "We don't mean to be unreasonable Maybe things aren't working out just the way you pictured them, but hey, that's file, you know? What do you want, really? Cars? Movies? Telephones? Birth control? Just say the word and they're yours.

Jefferson pressed his thumbs into the corners of his eves. "Your words mean nothing to me, sir I only want ..... I want only to return to my home. To Monticello. And as soon as possible

'is it one of your migraines, Mr. President?" Sutherland asked "Thad these made up for you." She nushed a vial of nills across the table toward him

#### "What are these?"

Sutherland shrugged. "You'll feel better " After Jefferson left, Rice hall-expected a reprimand Instead, Sutherland said, "You seem to have a tremendous faith in the project "

"Oh, cheer up," Rice said, "You've been spending too much time with these politicats Believe me, this is a simple time, with simple people Sure Jefferson was a little ticked off, but he'll come around Relax!"

Rice found Mozart clearing tables in the main driving hall of the Hohensalzburg castile. In his faded jeans, camo jacket, and mirrored sunglasses, he might almost have passed for a teenage from Rice's time.

"Woligang!" Rice called to him. "How's the new job?"

Mozart set a stack of dishes aside and ran his hands over his short-cropped hair. "Wol," he said. "Call me Wolf, okay? Sounds more

modern, you know? But yes, I really want to thank you for everything you have done for me. The tapes, the history books, this job—if is so wonderful to be around here."

His English, Rice noticed, had improved remarkably in the last three weeks. "You still fiving in the city?"

"Yes, but I have my own place now You are coming to the gig tonight?"

"Sure," Rice said. "Why don't you finish up around here, III go change, and then we can go out for some Sacher torte, okay? We'll make a right of it."

Rice dressed carefully, wearing mesh body armor under his velvet coat and knoe bittches. He crammed his pockets with giveaway consumer goods, then met Mozart by a rear door.

Security had been stepped up around the castle, and floodights swept the sky. Rice sensed a new tension in the lestive abandom of the crowds downtown.

Like everyone else from his time, he towered over the locals: even incognito he felt dangerously conspicuous.

Within the citcle Rice faced into the darkness and relaxed. The place had been conworld it tom the lower hall of some young anistics town house, protrading binks all marked the lines of the cit walls. The patrons were locals, mostly, dressed in any Pealitime gaments they could scavenge. Rice even saw one kod wearing a par of bere all koattees on his head.

Mozart look the stage. Mnuettle guitar arpeggios screamed over sequenced choral motifs. Stacks of amps blasted synthesizer rifle lifted from a tape of K-Tel pop hts. The howing subience showered Mozart with confetti stiripped from the club's handpainted wellpaper

Afterward Mozart smoked a joint of Turkish hash and asked Rice about the future

"Mme, you mean?" Rise said "You weuchth believeit Sixbillion papie and nabody has to work it fley dont want to. Five-hundredchannel TV in every house. Care, heloopters, clothes that would knock your eyes out. Plenty of easy sex. You went muse? You could have your own recording studio. It'd 20.004 make your gear on stage look like a goddamned clawchord."

"Really? I would give anything to see that. I can't understand why you would leave "

Rice shrugged. 'So I'm giving up maybe fitteen years. When I get back, it's the best of everything. Anything I want '

"Effeen years?"

"Near You gottle understand how the porall works "Rightmon if as a tigation da syou are tail, ust tog enough for a phone cable and a popile will of a, maybe the odd bag of mail, heading for Realitme. To make it any bigget, life to move popile or ouplument through, is expensive as hell So expensive they only doi if wee, at the beginning and the end of the project. So yeah, I guess we're stuck here."

Rice coughed harshly and clark off his glass. That Ottoman Empire hash had unlied his mental shoelaces. Hore he was opening up to Mozart, making the kid want to emigrate, and there was no way in hell Roce could onthin a Green Card. Not with

He was drunk on history out of control, careening under him like a great black motorcycle of the imagination, and he felt like St. Michael the archangel on speed 9

all the millions that wanted a tree ride into the huture—billions if you counted the other projects, like the Roman Empire or New Kingdom Egypt.

We you making a pile? You are boking at the hero of Satiburg In fact, your Mr Parker Is supposed to make a tape of my last and togeth Scon all of Europe will know of me? Somerone should at Morant, in Geman, from across the club. Morant glanced up and greatured crysticatly. We avoid, me. He lume's back to Rice. "You can see that I am dono Ine."

"Sutherland she worries about stuff like all those symphonies that you're never going to write."

"Bulishit! I don't want to write symphonies. I can listen to them anytime I want! Who is this Sutherland? Is she your girlfriend?"

"No. She goes for the locals. Danton, Robespierre, like that. How about you? You got anybody?"

"Nobody special. Not since I was a kid." "Oh yeah?"

"Weil, when I was about six I was at Mana Thereas's court. I used to play with her daughter—Maria Antonia. Marie Antoinette she calls harsell now The most beautiful gri of the age We used to play clusts. We made a joke that we would be marined, but she went oft to France with hist swine, Louis."

"Goddamn," Rice said. "This is really amazing. You know she's practically a logend where I come from. They cut her head off in the French Revolution for throwing too many parties."

"No they didn't

"That was our French Revolution," Rice said "Yours was a lot less messy."

"You should go see her, if you're that interested. Surely she owes you a favor for saving her Iffe."

Before Rice could answer Parker armved all their table, surrounded by ex-ladies-inweiting in spandex capts and sequined lube tops. "Hoy, Rice," Parker shouled, serenely arachronistic in a gitter 1-aint and blackleäther josins, "white did you get those unhip threads? Come on, lets party!"

Fice watched as the girls crowded around the table and grawed the corks out of a crate of champagne. As short, fait, and repulsive as Parker might be, they would gladly knite one another for a chance to sleep in his clean sheets and raid his medicine cabrent.

"No thanks," Fice said, untangling himself from the miles of wire connected to Parker's recording gear

The image of Mane Antomette had seized him and would not let him go.

Fice sat naked on the edge of the canopied bed, strivering a little in the air condtioning. Past the utiling workdow unit, through clouded panes of eighteenth-century glass, he saw a lush, green landscape sprinkled with try weighterfalls.

At ground level, a graden creve of lormer artistos in blue-domin overalls triumined weeds under the bored supervision of a postainer guard. The subst. dotted head to cockade on this tatigue cap, chewed guar and toyed with besting-the schewed guar machine gun. The gardene of Petit Tission, the Versalities Lettel were treasures deserving the best of cale. They bothoged to the commend through a time portal.

Mane Antoniette spravled across the bed separeo pink silh, vavanje a schap of black lace underwaa mel lasting through an schae of Wage. The bestcored walls were an asses of Wage. The bestcored walls were pert silly rumps, pink haunches, knowingly unsted las Neutos looked dazody from the portrait of Louise O'Morphy, lattenishly apravled on a diven, to the selek, creamy expanse of Torrette's back and thefte. Hen expanse of Torrette's back and thefte. Hen commensionwers allowed and other Man. Ne





BY RICHARD WOLKOMIR

Computer programmers and lumberjacks are on the way out. The new wave includes laser technicians and salmon ranchers PHOTOGRAPH BY TOM PAYNE

Back mhb Files, side-ruis assentiers lad smake Their produdir ass clever and connect, an util recessity for physicite, chemisti, and crack young duotati in high school, college and beyrolf. But hough the law association and device keeps to unmaking many is bothical and, a waa not sche keeps to unmaking many is bothical and, a waa not sche keeps to and the device calculator and compared to the scheme mover in an age of negati advance, careers are likely to based and required the technology on whoir hery are based.

House in an adjust of https://doi.advahotic.careefs afe (Hoy) to change as frequently as he technology on which they are based. Today's marketplase teems with new producet from engineered microbes to expert computer systems that give legal or " madical advoid, irom hobol surgeons to electronic shoes. This wave of change has aready begun to after or endicate many abol; forging new careers in this wake. But according to workplace. watcher Marvin Cetton, aufbor of Jobe of the Fulure (McGlaw-Hell), the uphasel has barely logur. The fulure farm, for inspance, will be rain not by the all-American farmer but by technied watcids transform (incidence, gene splichting, and compilater programming. Machineta will be reptaced by rohold; socretarines, by computions or disabase specialistis. Even the abstractories took, the basidbare of the greasey spoon, is facing demise. The kildhen will contain a compared controlled information

The kitchen wit contain a computer controlled introverse system capable of mong and heating ingredients with perfect efficiency: says Robert Weil, editor of *The Ornni Future Almanac*. "The food will come faster, the stock and booths will fill and empty more often, making reetsuand towners proce motes."

"Computers will change just about every jdb, from teacher to taxi drivet," concludes engriser Jim Solberg, director of Purdue

watcher Marvin Cetron, auftor of Jobo of her Reure (MoCraw-Hel), the upheaval has baava boyound to the function for the surger and Automation. The mark technologies of tobolics, evaluation of the second technologies of tobolics advances transmit has baava second second second second second second second technologies of tobolics, advances transmit has baava second second second second second second second second technologies of tobolics, advances transmit has badvances and technologies representations are abadvances transmit has badvances and the propries will open areadvances transmit has badvances are advanced technologies representations are abadvances and the propries will be advanced to the second se

Our survey of those new arenas is based on interviews with university career counsetors, futurists, economists, and technologists. Here are profiles of ten job categories doorned to obscurity, and ten job categories on the nex.

#### TEN CAREERS ON THE WAY OUT

FACTORY WORKERS By the year 2000, according to Solberg, virtually all assembly-line jobs will be performed by robots amarter and detter than those of loday. And soon after, sophistoated design computers will begin to ceptage factory engineers. The infant technologies of robotics aquaculture, bioengineering, materials science, and fiberoptics will open arenas we can barely fathom 9



as well. Designs generated by these computers will shunt directly to computers running the factory, obviating the need for blueprints and, hence, draftsmen, And in the front office, executives will dictate to word processors that understand English, rendering typists and stenographers obsoleto

2 CLERKS US Department of Labor projections through 1995 call for about 66,000 fower mail corners and neetal clorks. Floctronic mail will reduce mail volume, according to the economists, and smart machines will sort what paper mail remains. Most other clerks will be seeking new employment as well. For instance, analysts from Arthur D. Little, the international consulting firm, predict the demise of the keypunch operator As debit cards with built-in electronic chins come into vogue, computers at the sales desk will instantly transfer the price of the purchase from the customer's bank account to that of the store, eliminating the need for backroom clerks to key in the data. As electronic banking comes into its own, in fact, experts predict a dwindling need for bank clarks. Many telephone-operator jobs will succumb to automation. And proiferating electronic databases will make file clerks. obsolete. Robert Bruce, director of placement at the Claremont Graduate School, in Orange County, California, predicts that other victims will include meter readers (the num-

Assembly line workers, conceptualized on the overleaf, will be replaced by the computerized factory, symbolized above by abstract circuitry 76 OMN

bers will be transmitted to headquarters electronically) and bookkeepers (comruiters will crunch the numbers with ease) 3 MIDDLE MANAGEMENT Blue-collar workers will not be high tech's only casualbes. In fact, according to Solberg, "Computers are mally a bigger threat to white-collar workers " Solberg points out that while the move to replace muscle with machinery. is already well under way the next revolution-replacing minds with chips-bas just begun. One dwindling group will be middle management-those who advise too management on such issues as marketing, stralegic planning, and engineering. As Cetron puts it computer networks and expert systems that simulate a specialist's decisionmaking skills will "gradually usurp the middie manager's role as information gatherer and analyzer

4. INCOME-TAX SPECIALISTS. The need for income-tax accountants is likely to diminish. especially if income-tax simplification efforts succeed. And regardless of policy, sophisticated computer programs can already analyze your financial status, apply an expert's knowledge, and minimize the tax you must pay. Whether used by individuals or professionals, such programs will speed up the time it takes to complete a tax form reducing the number of professionals reoured for the task

5 COMPUTER PROGRAMMERS. Ironically, one career to succumb to the computer revolution is ant to be that of the computer programmer 'Artificial-intelligence computers will program themselves," says Alfred Mathiasen, a careers expert at Clemson University Sociologist Robert Avres of Camegie-Mellon University, agrees, "Although employment for computer programmers. hasn't peaked," he says, "we may be over stating the need for these people; there's a wide scope for automating the writing of programs." New computer technologies. moreover, may reduce the need for chip designers as well Indeed, computer-aided engineering systems allow engineers with no special expertise to fashion customized integrated circuits for whatever purpose they have in mind

6. AIR-TRAFFIC CONTROLLERS 'Air traffic controllers complain about stress, and one reason may be that they rarely see the aircraft they're directing " says Carnegie-Mel-Ion's Avres. When people can operate a vehole with direct visual contact-truck drivers. watching the road for instance....they do well. Avres notes, "But an air-traffic controlter's information is degraded because it comes to him from a screen, making it efficient for a computer to handle the work " While some passengers might find it unnerving to ride a jetiner controlled by some silicon brained R2 D2, Avres says, "It works fine for the space shuttle, 'A Beapan administration plan for switching the air-traffic control system to high tech would cost about \$20 billion over the next 20 years but would simultaneously save \$25 billion. A single airtraffic controller could then do the work three or four do today

7 OTHER PROFESSIONALS Through 1995. the Department of Labor projects an increasing need for physicians, veterinarians, and lawyers. In the long term, however, forecasters like Cetron predict a drooping demand as expert computer systems come into workaday use. Already, for example, an experimental "doctor on a chip' at the University of Pittsburgh has demonstrated proficiency at diagnosing illnesses and prescribing treatments. The same sort of technology will eventually be synthesized for a wide spectrum of professional expertise. Thus, tomorrow's law office would include not a live of high-priced attorneys but rather a single attorney for complex cases and a team of paralegals who consult computers as they handle routine work

8. FARM LABORERS. Tornorrow's farms will be automated food factories requiring minemai human muscle. The farmer will become an adricultural engineer who, according to some industry scenarios, will command his empire from a central tower, remotely operaling an army of robot field hands that plow, plant, irrigate, cultivate, and harvest. As the labor proceeds the farmer will use his compuler to plan plantings, order supplies, and schedule maintenance.

Bulletime resource and a set of the set of t

10. FAST-FOOD RESTAURANT WORKERS With two-job couples and carentis singles becoming the norm, fast-lood restaurants should multiply Jobs in such quicke eateries, however, are spit odecline because the hand that brolls your burger or that fries your outer with be made of aluminum.

### TEN CAREERS ON THE RISE

FIRE\_PROTECTION ENGINEERS: We can now predict mahematically what will happen if there is a fer or explosion at a contain site and then design more efficient saleguards. Because of these new fechnolgies, fre-protection engineering is coming mo its own, says David Lunch director of the Center for Firesafety Studies, at Worcester Polytechnic Institute. He says the two. scholos row offering this speciallyworkstar and turversity of Maryland---uppk lass than to percent of the durant of cubility depotion engines. It is not prospects had. "Society is more lititous which makes industry more prone to proing at look reasonable measures is prevent which makes industry more prone to proing the second second second second measures industry disperdent on computers that may contain respecable data. Since wone a small free can be disaferua. Sincer at bombings are another modern work We bombings are another modern work we have bombing as another modern work.

2 DATABASE MANAGERS Databasescollections of facts, figures, records, erecesses, names, addresses, and other information stored in computers-base become the nervous systems of many large compames. According to Bob Weinstein, author of 149 High-Tech Careers (Collier Books-Macmilian) database managers are essentially information gardeners. They prune and thin their data "pardens," discarding outdated mformation, adding new data, and updating the collection. Typically the database manager has at least a bachelor's degree in Liboral arts, computer science, or library enencel or an MBA, with expertise in computer systems and programming. Besides working for corporations, database specielists also find jobs with independent database services that provide over-the-phone information for a fee. Others work for misseums



libraries, and research centers. These jobs require high levels of responsibility. To control an organization's data is to shape its memory.

3 ACHACULTURISTS. "If world population continues to prow at the present rate. If will soon double, generating jobs in housing. transportation, and food," says the University of Vermont's Lawrence Simmons, Many of the new food producers will be benesting the oceans at fish ranches, seahed plantations, and other new aquaculture enterprises, some afready under way At Japan's experimental offshore Oita Ranch, for instance. "wranglers" in fishing boals herd sea bream. Hatched in one set of onshore tanks anyi matured in another, the young bream put on weight grazing in seahed nastures. where they learn to swim to a feeding station that emits a characteristic noise. When they are ready for the table, the same noise summons the unsuspecting fish to harvest. Meanwhile University of California at Santa Cruz marine biologists have built an expermantal sea farm in San Francisco Bay. They produce a single crop: kelp covered with herring eggs, an Asian deligacy, Harvested within hours of the egg laying, the kelp is pickled in brine and dried to form a caviarcoated cracker. Most of the crap noes to Japan, where it sells for \$8 to \$20 a pound

Other projected aquaculture jobs include knfl herder, lobster farmer, and salmon rancher. Jobs in aquality capticulture are already available far from the sea, on the Middle West's increasingly common and successful cattish farms.

4. LASER TECHNOLOGISTS Laser techpology, according to the Federal Bureau of Labor Statistics, is among the fastest growing fields with about 30,000 new technicians needed in the next five years alone Many additional jobs will open up for laser scientists engineers and other specialists Uses for lasers range from microsurgery to industrial cutting tools, telephone communications and the Reagan administration's star-wars project. And future computers may be based on photons rather than electrons. encoding information on flashes of laser light According to Kenneth Teegardan director of the Institute of Optics at the University of Bochester, the shortage of workers in this field-200 new engineers and 3,500 new technicians are needed each year-could cripple America's ability to compete in fields as diverse as robotics, automated manufacturing, communications, and defense. Technological luturists predict that what electricity has been to the twentieth century, the laser will be to the twenty-first. Thus, they say, the field will spawn a wide range of specialities For instance, Cetron predicts that 40,000 new fiberaptic technicians will be needed by 1990 to handle the fiberoptic testing equipment that some manufacturers already use to check aircraft parts for alignment. In addition, automated factories will need some 200,000 inspectors to test equipment that uses fiberoptic sensors

5 SPACE TECHNOLOGISTS Space travel is becoming so routine that even senators and teachers will soon be shuttling into orbit. There are plans aloot for a permanent space station, bases on the moon, and orbiting factories. One drug company, Johnson & Johnson, has announced plans to orbit a vaccine-manufacturing robol satelite. According to Arthur D. Little space engineer Peter Glaser, all the recent out-of-this-world activity will generate a need for a new specialty, space doctor, not only to care for astronauts but also to work in orbiting hospitals treating burn victims heart patients, and others who can benefit from a zero-gravity environment, Robert Bruce, of Claremont Graduate School, foresees such new jobs as spacelab technician and snace researcher. Educational administration professor John Hovie, who is Texas A&M University's resident futurist, believes that as humanity's occupation of the void begins in earnest, jobs will open up for space construction workers. The University of Vermont's Lawrence Simmons says that another extratemestral pro will be the space production technician, skilled in managing orbiting factories. Also needed, of course, will be zero-gravity engineers to design space equipment ranging from solar collectors and spacetugs to the Orbiting Hilton.

6 PROFESSIONAL HUMANISTS to matter how dominated by technology society becomes, "Have you hugged your computer today?" is unlikely ever to be a serious injunction. In fact to offset echnology's sterity (prioritory's society will require a cardre of ornlessional humanists. Arthur O. Little vice president Alma Triper, for instance, predicts the proliferation of ethicists who will work in such institutions as hospitals, helping physicians and families decide when to allow terminally if natients to die. They also will work for government agencies and for businesses, heiping firms decide when duty to stockholders must be superseded by duty to society. Professional networkers will help set up computer contact between people who have similar interests or information to share says May Harding, director of the Center for the Study of Alternative Futures, at Bhodes College, in Memphis, She also anticipates professional listeners to offset high-tech society's loneliness and to facilitate problem solving-in businesses, for instance-when relationships break down because opponents do not truly hear each other. According to Harding, other new specialties might include community builders. (anodeci as more people "telecommute" from home offices), job-sharing planners, homeoffice designers, intercultural managers, (heloing diverse peoples interact amiably in tomorrow's global society) and values forecasters (helping industry anticipate shifts in people's desires and concerns)

7 DIGITECHNICIANS With digital technolagy busity transforming everything from banking to morowave ovens, the need for people to maintain all the equipment can only go up For instance, government projections call for computer service technician jobs to



increase 97 percent by 1995. According to the Electronics Industries Association, will require armies of domestic digitectinicians just to maintain all the crouitry in our digital. Tws, stereos, and videocasette recorders. And Cetron envisions the need for some 1.5 million robatcatis in a decade.

8. EDUCATIONISTS. In a world that runs on drastically changing, ever more complex skills, tomorrow's worker will continually be returning to school for retraining. Such a learning society will require educationists Public schools will become more diverse. with students choosing schools that match their abilities and preferences. Teachers' status-and pay-will rise as computers begin to handle routine drills, enabling humain instructors to function as supervisors of each student's individual program of learning Although Department of Labor projections call for a 37 nercent increase in the need for elementary-school teachers by 1995, tomorrow's public-school teachers. backed up by computer aides, may actually be fewer in number. Except in engineering. university teaching jobs already are project ed to decline. But the learning society will create new educationist jobs, including writers who will prepare computer videodisk lessons for students, and televideo teachers, who will offer interactive TV courses. And corporations will hire battalions of teachers to bandle their in company education nrograms, already the fastest growing segment of education

a DEFARTICIANS in graving America the werging agrin resea mutality and the number of sensity extremes graves constallity in 1979. You partners But 1920 the intervention should virtually double. In tight of the facts, effective projects the need for 700,000 gensition second workers and another 300,000 where the second workers are another 300,000 where the second workers are

10 ARTIFICIAL-INTELLIGENCE ENGI-NEERS. The country is already suffering from an acute shortage of supercomputer engineers to work with electronic megabrans. For instance, there's a dearth of compiler writers, who create programs enabling computers to "talk" to ordinary mainframes Also needed are parallel-processing engineers to design computers that chew away at all facets of a problem simultaneously. Finally industry projections call for 50,000 artificial-intelligence experts by 1990. These computer specialists, who study human intellicionce and invent ways of similation if in silicon, will create machines with vast flexibility and scope.

Says one Arthur D. Little engineer. "Some of these machines will ratiocinate ther way into intellectual thickets and brier patches. When they get stuck, they may need another specialist—a computer psychologst—to help them out." DO  The patterns portrayed a number system. An orange disc with a triangle in the center stood for zero.

### ANTIMATTER

UFO UPDA

I W Whiteside may be eighty-three years old, his vision dim, but as far as he's ophoemed, he can shill see the obvicus, in this case the varied patterns of an alen onde.

"Sharon's UPC code," named for Whitesude's granddoughter Sharon, reportedly arrived untodop on the nght of May 2, 1981, Sharon, then age nine, was paying a visit for the mght She had just grandlafic which she noticed a peculiar outer of lucts.

As Whiteside recalls, Sharon said, "Look, there are protty achts on the well."

"I just told her to go to seep," Whiteside says, his him voice dissolving into a chuckle, as it often does "But she persisted, so I turned to look."

Whiteleads, a corrent field Labs communications engined to tion Gisenvoya Unions, was amazed to see a which performly ipremot respected. It Raibed abouty four times, he says, and their hosted setting the setting has a setting the setting the setting to the booknesse (shown next to Whitesede, above), forming dicate two onbesis across. The second free patients: all bigauthuly colored, the jewethy, "Whitesede notes "Each patients was separated face times."

To the former engineer, a pattern could only be a measage And thanks to "Sharon's photographic memory," he says, he managed to record fibrally dezens of patterns, composed not only of inspeccides and discs, but also thannes, rectancise, and sources.

After weeks of interpretation, Whiteside had his conclusion. The patterns portraved a simple number system. An enter stoud period. enter sto

Whitestide's tails has already work a vote of confidence from J. Allen Hynek, ufology's leading seentist, now residing in Scottsdale, Arizona. "Mr Whiteside is a stable, motingent man," Hynek says, "and there is no doubt of hishon-

eary I am sure he is describing exactly what he saw "

But Hynak, an old intend of Whiteade's con-m4ax, a comsensative Chroage attorney, does not buy the idea of an extraterrestnal code "I have to put this incident down to the paramormal," Hynak says, "It seems included to psychic phenemerice, polengeness, and that sort of thing."

Others valce greater doubts. Says space scientist James E. Oberg, a noted debunker of UFOs, "It isn't the explanation I draith so much as the report."

Whiteside immedif feels the incident ments actual, "White an read," he belavos, "is an organization with stations all over the world to frash lights in this code at high. NASA would be perfect for it they might attract UFOs and begin to tak with them Just thme write worders they could give in a commentant magazinerth".

Despite several latters from Whiteside and an inquiry from his local congressman, though, NASA has shown no interest in such a pringram.—OWEN DAVIES



#### KIRK WAS BORN HERE

The tiny rown of Riverside, lowa, population 826, has declared itself the future birthplace of Captain James T Kirk

In a sense the idea correst from Sar Track-creator, Gene Rocklonberry, himself While dreaming up his charatters, Rocklehberry described a small lown in lows as the third millionn at lows able of a lactional starsho paper of a lactional starsho paper of a lactional starsho paper of a lactional starsho captan Pelang up on that herrow, GV councilman and Tracker? Storw Miller decoold this constructions joints britplace in his own hometown of Neverside would attract tourists and boost the local economy

Toward that end, the local community cub plans to eract a statue of Kirk and has changed the name of its annual summer fastival to Treklest. The town is also selling where this make messas T-shirts and buttons, at well as vals of "Captain Kirk, Drif from the future beth to the total the total to the total of the total tota ate, behind the barber shop

corrie all the way from Texas to visit the site," Miler enthuges, "and a lot of the Star Trak-fain clubs will be visiting here. They wear full underms including phasers, and splstme conts."

But despite the potential for profit, Betty Lowe, the spile Republican on the aity council, thinks the entire plan is a "wild, liberal, harebranied scheme" that could turn Reveale into a choop "tourist trap" and a haven for "assorted" weirdds."

And Paramourn Hobares, which owns the nights to Star Tink, has warned the lown against executing a statue of Captain Kirk. Miler nonotheless, maritains his resolve and stand's firm. "The spanion taire night now," ha says, " is to actual's harmourn's plant of see what hey olutif and see what hey of ---Eine Milahara.

Tve always wanted to ble,a natchine "

-Andy Warhol

"With word and dead we insert ourselves into the heman world, and this insertion is like a second birth."

---Hannah Arend

"What is called science loday consists of a haphaxard heap of information, united by hothing "

-Lev Talston

### **POISON CURES**

Incomonal cultures around the world still proxo folk remodes more highly than a tinp to the doctor. But according to Florida egodemologist laftery Sacks, who published a report on folk-remody death, many of these home crimedice contain danger. Dusly high, cometmes latal, smouths of lead.

In one recent case, for exempte, the dash of annumenth old Ganegevite, Floode, boy beffice invegetations with the parents, mmgants from India, handed over three home medicines. All contained lead, with the highest amount in a brownish powder called ghasard Mixed with water and honey, the "hone' had been given to the infant daily.

In yet another case, 24 Vietnameso children lwing in Minnisöta had dangerously high levels of lead in their bidod, at the rock of their trouble were various home remadies, including a red in remadies, including a red in and orange powder called my-bo-eh, usad to bring down fever. And hnally, officate report hat Mexican-American children (wang in Colorado, Carloma, Michigan, and Wisconsin flave been poisoned, scorellines azarcon, an orange powder thorteasco dermissi – end often contains 70 to 90 percent fleet

"The danger with contaminated folk remedies," says Backs, "is that they are often used for the vory symptoms—womding diarrhea, constipation, and abdominal perio—that indicate lead perio—that indicate lead perio-that indicate lead perio-that indicate lead perio-that indicate lead

All progress is based upon a universal innate desire on the part of every organism to live beyond its income."

"Man has never understood how enthropomorphic he is." —Johenn Wolfgang von Goethe



### ANTIMATTER



#### LEGACY OF THE SPHINX

The nation, hat-man monitor known as the sphure was not among the creatures creating to writer Archory West, the famous some soulptict at Glas could be a survour of the great floods that reverged Egypt between 15;000 and 10,000 as it into fiscery is correct, adds West, author of The Traveles Key to Ancient Egypt, then aphilars with have to rewrite Egyptian history as we know thate.

It has long been assumed. West explains, that the pharaph Chephreen built the around the time he constituted the scored pyramidstudied the scored pyramidstudied the scored pyramidscored by the score of the poulptice terrally looks of them the pyramids suroundary it. To explain the seeming contradictors in fact, sampties have resemity vious wear, including twofoot-deep channels cutting through its walls, to water rather than wind

The webs: West believes, come from the great Boods "It that's so,' has acids, "then Expytain onvitation could be a fat date than we think. In fact, if knowledge from this civitation survived the floods, it could explain why Expytain outhine bare tables asmed so tapidly "Expyt opment," West notes, "but a leggey"

This theory, however, is depicted by University of Lourwite geologist K Lal Gar, who says fait the divasibility water came not from the floads but from meming-dew. When the spinor, acobs ant right," Gaun toplarity, "atmosphere, modure condenses on its surface, detactiving saits in the skine. A surfue, the miciulume evaporates and the astor crystallow, creating pressure that disentegrates the mark." West, however, argues that the erosion of the sphirix is unique, a vestige of prepytamid days —Carol Fletcher

"Look for the other half who walks beside you and is wha you aren't "

-Antonio Machao

Between living and creating there is a livid fang. Guess what " —Antonio Mechadic

#### CANCER AND MEDITATION

A few years back Teras prysocan O Carl Simorton made the extraordinary clain that canoer outld be optitiolied, even cured through moditation. His program, now available to patients around the country is based on the notion (Talk concerterbon will give the minunal system the cinical boost. It needs to fend of indection and circease

Recently, however, herrabiograft and oncologist. Welgos I. Sampson has challenged the Stronoton research contending that there's no physioogical way to explain the claims. There en't much solid evidence inking cancel to the immune system, Sampson declares, and it is thus. "highly unlikely that thying to boost the immune system through vague, hypothesizade mechanisms starting with the mind would be successful."

Moreover, Sampson says, the Smorton procedure makes the patient feel guilty about his or her disease. If a person is capable of curing an illness, he notes, then the petson might feel résponsible for its formation in the limit place. The technique he adds, encourages peterns to harbor unreelistor expectations about the passibility of a cure. And the marketing of the method "is in all ideationed a soft-core have of averaging."

"But Smorton dragnoss, Postive expectancy his a desrable impact on the quality of the and on the course of headsease," he cause. The supportive literature is much stronger than implied by the ontice. What is needed is more funding for research in this important lek! "—D. Seatt Rogo

"Experience, does not ever err, it is only your judgment that errs in promising itself rocuts that ere not caused by your experiments."

-Leonardo da Vinci

"And if there had been more of the world, they would have reached it "



### ANTI&MATTER

#### APACHE FAT

Today's meteorologists use anetwork of computers and satisities to prodich furncense, earthquakes, and ordinary storms. But according to seventy-year-old Gordon technique based on the changing patterns of bear fail may be more accurate than this arsenal of technology

Wirresit, a readerful of Ner Mexoc's Sacrimento Moun bire, learned about Apach weihtg Ionacating some 50 years ago, after betinend ing an Indian garrak water whose encestors had files transform Learne bladders workgunktion, the window claimed, with the feronocus onstaught of humcenes, the turbulence of earthquakes, and the genite entwer of a summer's day

Currous, Winsett deeded to fil a glass privit boar fat and test the technique himsell Today, some 50 yrors later, he has found past hims for the range of atmoshiers and pact ogical events. Votcanocs, sor instance, cause the fat to form 8 oone And nuclear expotions literally cause the fat to take on the shape of a mushroom cloud

In fact, Wimsatt says he has accurately predicted not only twaters and humcanes, but also more than 400 earthquakes, including those that accompanied Mount St Midanes autocompanied Mount

And his research, based on readings of 200 pars stored on his windowsill, indicates that the technique works with fat from chickens, wild turkeys, mountain sneep, seals, South American snapping turtles, and humans

San Dres Tott Her star, Three vanetes, Wirraalt points out, are not easily accessible out, are not easily accessible in the Masken But world of the Studies I has croubled the Association Star Star blubber, and the E Pass, Toose, soo Tatlied her some failed by its mette The numan? An E Paso resuent who donated some for removed during surgery following an anab accelerit

The man calls every once in a while, Wimsatt adds, just to see how his fat's doing.--Poly Summar

"Insects, why cry? We all go hat way."

### TEEN POWER

When objacts began flying around Tima Reachs Cacambas, Orick home fast year, some psychic investigators claimed the teenagor was demonstrating strong psychakinetic (PK) abulty (see Antimatter, April 1985). Bit when a videolaped TV segment stawed Tris pulling the cord of a "flying" lamp. skeptos insider of he was nothing more than a stelgishchand trickster.

so to prove her validity. Tima (ngith has recently been participating in controlled expeniments at a lab, near Chapel His, North Carolina. Though the lab incasts it remain amonymous (it is atraud of scaring away grant monoy for transitional research), one of the scientific saves the experiments were a success

According to biomedical cinglinear and neuroscientist Steve Baumann, researchers implanted microslectrodies into norve céls from gant ses skugs Then they took the cells and hooked them to an amplifuer that monitored distance that monitored

Using her PK abitty, Baumenn says, Tina actually managed to slow down the firing pattern of the cells. "We didn't pick up a signal from the an encould of twentythree seconds," he says "Normaty it would entil a signal overy second or two."

Further evidence of Time's Proteibly comes from Jeanrice Lagic, who followed Tins around during ther four days of tests at the lab. To make sure she head Tina under observation at all times, Lagie, a chinade peychologias with the Psychical Research Foundation, in Oraget Hill, even tabled the youngeter into the batmicom 'I was holding onto Tina, and at of a sudder hiner was a nonce, and a the air," Lagle says "A container of air freshener on the other side of the bathroom had crashed to the floor."

An even more abletting oncoder accurate the last days of the appartments, as an opprend to laws with subtracting on the submentation of the subdects, including a netmethology works. The nest objects, including a netmethology works. The nest objects, including a netmethology works. The nest objects and a networks build each in the next soon? The subdect has the version of the subdect has the version of the sub-dect in the next soon?

Nonatteless, socialogist Marcola Tuzz, director of the Center for Sosenthic Anomalos Research is alsoptical "There are two issues here, the psycholoretic statif and the effects on the oblig", he says "When frieze people are ready to becoment and replicate their research, fil be designed to reaven it "Sharry Baker





apportionment has been done, but the question of how to share such limited resources as tools or animals remains unanserved. The numbers of people involved maken is acomplicated scheduling problem in some farm communities anrecomputer helps decide who gets to use the water buttias on Wednessity, for example. The same machines also ad in coordinating the jobuna ad latimet of non-eaded hields.

While some witages are organizing their twis with a personal computer, many parts of Chira are still overwhelmingly poir and backward. When Deng Xiaoping visited his native Schulan province, considered one of the more forward looking, ihe was moved to sars as he watched peasants working the noe helds with the same wooden plows that had been used for cartinues.

Even in the more sophisticated urban areas, some beckwardness provisils. Any body tamlier with American research tactiing institute of Electronic Technique Application, he biboardary where Christi first IBM compatible personal computer, the Great Wall four, was developed. A visitor walks up many dark and harrow starwage and taken. Their research area is minanylift flur a developitier sciantists at work. Their research area is mining over beat-up wooden desks. Their mission is to create a new generation of Chinese computer technology

Our of label Me this the Chrises hops to timing in a new age of technology. To enter that godient eral, the government has record related to scientific provides, and concentrated on a handful of world-class projects building a manned space program, for instance. New, according to Wu, schoology, Commission, "We will engrhasee applicat raiter than handframes, softwater stame fram handframes, softwater stame frame handframes, softand frame weakst.

Another part of the plan is to import advanced equipment and to seek out foreign partners to bring in new technologies. In the last two years, computer firms like Burroughs, Wang, Hewlett-Packard, and Gould have all made multimition-dolar joint-venture arrangements to establish their own computer factories in China.

Altrough Chinese scientist' skills at engrecring hardware aurpass their software capabilities, last summert a surphising new venture, called the Shanghai Software Consofturi, was formed With join headquare ters in Shanghai, China's biggest city, and San Jose, Calfornis, the company's 30 Chinese programmers will write IBM, Apploand Tandy-compatible applications soft-



ware for export to the American market. Computeriand has won tentative approval to open the country's first retail computer stores. And IBM is gearing up for a major entry into the Chinese marketplace

And there are other signs of rapid change in a nation notorious for its centuries-old ties to elegant tradition.

 Academic aclientists who want to study obscure subjects have been given more freedom to proceed into the murk, even when the immediate payoff sint ourden. Recently, for example, a group of researchers began antical inteligence. Officially, the governantical inteligence. Officially, the governnot bureaucrais, to detormine the course of future scientific inquiry.

 Hundreds of new periodicals have begun to appear within the last few years, some devoted to such once-taboo topics as UFOs.

 Military researchers have begun to go to work on civilian needs. Computer designers who work for the military, for example, are now employed in civilian factorias, where they work as consultants.

 Spending for research and development has risen from 0.7 percent of the gross national product to 1 percent this year. And the rate is due to continue its steady rise, to 1.2 percent, next year

Chinese scientists are suddenly being treated like superstars, lonized in magazines and on tobitisticn Public opinion even lad claim to the exploits of An Wang, founder of the Wang Laborationes computer company in Messachusetts, biocause he was born in Shangell. The fact that he is a bilionaire American capitalist doesn't seem to have dimmer his alory.

 Native-born researchers who now live abroad are encouraged to return to their moherland to visit or teach. Every year, about 100 to 200 answer the call. Often, they are given a herrö's velocime, complete with a personal audience with Deng Xiaoping or other state leadors.

But scientists alone, experts in China told ms, will not be able to pull the country out of the past. One such expert is Li Paoheu, the thoughtful and energetic spokesman for the Chinese Future Society, a man sometimes considered the Alwn Toffier of his country. During a remarkably candid conversation in the bar of the Chinese Journalists' Association, he said recent structural changes and policy shifts weren't enough And he outined an even more radical set of changes that he said would have to take place. Assemble teams of specialists to work on breakthrough projects: then when they are finished, redeploy them for other projects, Li suggested Improve communication between people working in the same field. Get rid of high-ranking officials who have achieved their positions more from political clout than technical competence

Li propounds a touch of what some of his countrymen would still consider heresy, a Chinese version of a free-market economy. Although he believes that Chinese workers



When I was working in the oil fields, I used to get depressed about being paid by the hour and constantly strugging to feed my family while others were striking it rich. Not being able to control my own destiny really got to me.

One day I saw a Page ad about a man who earned \$4.154.46 on just one Seamless Spray order-without investing a peopy of his carp. I wrote try Eres information. And am Lobal Lobal Recording a Page Dealer was the best move I ever

What impressed me from the start was the unimited impressed me norm die start was die unimited number of Seamless Spray prospects. Schools, Hospitals and Commercial buildings of all types don't have any choice but to spend a small fortuge to renew their leaking roofs.

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are motivated more by patriolism than by material incentives he anniauris a recent reform that allows on foregoing to some as part consultants to industry. And he supports apother reform that encourance research institutes to commercialize their findings-in other words to sell just as Western companies do, on the open market

The state's motive is to reduce its subsidies to the country's 2,200 scientific institutes. By forcing them to become independont, the accerment hones it will all down on the institutes' bloated internal bureaucracies and encourage them to develop income-producing relationships with agriculture and industry. So far, nearly 100 research organizations have succeeded in becoming fully independent. But the process is agonizioniv slow and the results raise some upexpected problems

The Electronics Techniques Institute, in the city of Hofer for instance, achieved financial independence with relative pase party in 1984. For the first time, its engineers and technicians were allowed to elect their own director and choose their own research proacts. After development computer softwarp for the mining industry, the institute soon had so much cash coming in that it paid off all its debts, hired ten new engineers, and began saving money for future research

But with its success came political comnications. Local tax collectors-taking advantage of unclear tax laws-began to bleed the institute of all its income, around that its newer software programs were really only variations of the same basic product and therefore should be taxed with the higher rate for mass-produced commodities rather than the rate for scientific research. The institute. reported one Chinese newspaper, was driven to the "brink of collapse" by the pressures of the jealous local tax authorities

As it gropes its way into the Information Age, China has been no more successful at solving another problem that plaques the computer industry uniform stanciards. Despite having a strong, centralized state that sets standards for many other facets of life, the Chinese have to deal with dozens of conflicting and incompatible technologies

Take the task of Chinese-character processing the equivalent of our word processing. The Chinese language is unhelievably complex. While our typewriters have a 26letter keyboard, a standard Chinese typewriter keyboard has 2 000 keys. And those represent only the most frequently used characters. True Iteracy requires between 5,000 and 10,000 characters And each character is made up of as many as 20 different strokes, or lines. To date, scientists have devised some 200 different software systems for character processing, none of which comes close to the efficiency of Eng-Jish Janguage word processing

Where they are available, computers often stand idle at night simply because those who need them can't obtain authorization for afterhours use. To an impatient generation of young Chinese-especially those trained in the West and accustomed to 24-hour availability—such obstacles seem like another of the old guard's ploys to keep knowledge and power out of the hands of intellectuals and scientists.

For guidance in facing such problems, many Chinase medicitude have turned to the writings of Avin Toffler. A translatedand cellicid-cellicitude of the 1980 bostseller. The Thard Wave, is now circulargi widely in durine of initialitia, second wave development and move right in to a thrift-awave end of the technology to able to the use of the technology to the been informational method and wave and the been information of informations are seen of informations.

lution." To many Chinese academics and planners who have found Marxist dogma incapable of helping China move switty and smoothly into the modern workt. Toffier's theories seem particularly entbcing.

Charas more traditional development strategies for both nural and industrial areas have been tragically disappointing," says Toritier "But in high technology, they see a possibility of achieving score of the goals of industriatization without negative side effects, like over urbanization

The melaphor live used of waves of change's and unfamilar to the Chanses. The notes in commenting on the varaccusness with which some Chinese intellectuals have absorbed his concepts. "It's much like their own dialechcal view of history There's a real ecoclifical methor in China

that allows the third wave to snap neatly into their reality."

A visiblight documentary based on The Thord Wave is currently the rage in migor ditais offeng many Chrises that fills glingless of Shoon Valley's wondrus factories and products. A follosin vocabulary has come into common Chrises partines, and sven conservative. Man-suitad Chrises officials have been haard dropping such thind wave Tofficiarine as "electronic cottags," technoreals," and "consume".

Not everyone is pleased with this new wave Initially some Chinese officials werted the videotape banned. Finally, they agreed to a compromise Rumor holds that Deng Xiaocino himself engineered the agreement; The tape could be shown but only to small groups of intellectuals. And it would be followed by a critique of the ideas it presented their counterent Marxem.

What is point the valuescape classies a versional apposition is Western leacheropy and the aken technology that accompanies also and the mitilions of younger party members who gained influence during the Cultural Revolution. As incently as list legal blast address arguing dist Christia open door pately kin "signals application" from the West Revolution operated stated gains were cutting of this siylish hardox of younger authing of this siylish hardox of younger authing of this siylish hardox of younger and the signal application the gains were cutting of this siylish hardox of younger puters Here, amidist the country's first aufinetic skyline of 50 story skyscrapers, biuejeaned factory workers hang out, blasting their cassette recorders and smoling Maribotos. The town has more intailed computers per capita than any other in China, and an experimential unversity will soon open. Its goal is to do for Shenzhen what Stanfod once did for ShLoor Valley.

How does this future look? During one of his trips to China. Ed Lee, chief executive officer of Pro-log, a conculer components manufacturer visited both Shenzhen and more traditional Chinese factories. Alter completing one tour of a government-run factory, a member of his group discovered that he had jointhis tradicase behind and went

back into the plant to retrieve it. As ha stepped inside, the American noticed that factory employees. who had been working frantically when the four went by guit their frenzied activity once the visitors had wolked out the date Given the opportunity to visit a factory in Shanzhan where the workers were assembling boom boxes and radios for J. C. Penof stoping back into industrious the production lines really were. This time the frantic work nace was The reason Lee

frantic work pace was still going on The reason. Lee says, is simple. Unlike the old factories, where workers raceive fixed salaries, those in the special economic zone are paid by pecework. If is an airangement that seems to work wall. "They earn six times the average wage in Ching "Lipe says."

### BEING KNOWN AS A NUMBER CAN BE A VERY PERSONAL THING.

JF 1222146 took to feature. The advantage of the advantage registration number on the back Lafe for your both of the took Lafe for your both one bit of your both one the supervision of Thomas Bowram, Awaser Sollman, and that the distillation was approved personally deventage Alexer Sollman, and that the distillation was approved personally deventage Alexer Burrough a direct descendant of our founder before it was allowed to leave the distillers.

Does it help to know all this? Yes. That number is a vital part of Beefeater Gin's quality control.

Because the number is Mr. Bowman's personal signature. And Mr. Burrough's, as well

And any artist is at his best when he has to sign his work.

> For ther part, the new leadership of Dang Xaoping, Perreit 20a 2yang, and the brain Inst around them argues that a high tech revolution can be managed so China can have Westernskyle schnological growth and still meintain its identity. To make any progress, they know they must encourage some measure of democracy, individuality, creative diversity, and enterconscription.

REFEFATER\* CIN

The Crown level of England

The fuluré of Chran can best be loreseen in Shenzhen, a region described as a "spo cal economic zone" near Hong Kong Shenzhen, an experiment in the fee-franket idee that was spocificatly desgred to a' tract foreign investment and lechnology produces such lechnology-intensive products as Sonly Tintions and Sindar com"Nou will find some orintesm in other parts of Chuna that what we are doing here is capitalistic," says a young Shenzhon official Indeed Chuna's leaders are worried that innovation that correst too fast and too soon will create poolems ("They want rand change but without luture shock," says Tollfer.)

But China is supposed to be a revolutionary country, explain the of cical. "What we are doing hete is making economic and technical revolution Sol say for those critics. We are the real revolutionaries." Summing up this program is caproach to the technological revolution: a manager in Shen2hon quoties and Grimese provem "You're out to cache mice, it doesn't matter if you use a black act or a with ecel." "Ou

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### WATER WITCHES

CONTINUED FROM FAGE 42

believes that "dowsing is a gift that you shouldn't use for profit."

At least one scients: physicst Zabo, V Herrafk, has dowold considerable study to the traditional forms of dowarg. As ayoung man, he bocame faconated with dowarg when he saw a pesant in his native Caechcoloxialax welching a rod. Later, teaching at the University of Missouri and serving as science arviver to the U.S. Army's Advanced Material Concepts Agency, he protect the physiomerion Harvak, now retired and lung in Lorton, Virgina, believes the lavb dowarg is electomagnetism

In this earliest experiment, Harvalk Kunzh hart when he stepped across a live electrical write, a dowarg rotri in his hand twisted. The aversing research of a Frend hybridst (Vise Rocard, director of the physics laboratory at the 5ook Normal's Superiour, in Panely had convinced Harvalk that water llowing underground causes sight changes in the earths magnetic field, which in turn influences the dowang rod.

As a lest, Harvälk connected two bursot water pipes to battories. The current flowing through the pipes created a magnetic field that iose or fell as he dialed the current's amperage up or down. Visitors to his Viginia home found themaèves holding a dowsning rod and marching across the electrified pipes, while the physicist fiddled with the current About 80 percent of Harvalk's guinea pigs detected the current whenever it was at least 20 milliamoeres.

The test commodel ipseud that downers detect changes in the earth's magnetic field, caused by anything from seeping water to overs. But a second researcher questioned this, saying that the reaction is in the downer, not the rod

In 1977 Br, Jan Kerta, who vas hera in physicologist all Kell University, in Monfreal, set up a test of his own. By attaching more than the set of his own. By attaching on the vasis holding. Metha allowed hat a dower's arm muscles contract, helt as excit before the od plas. The opportunit demonstration of plas. The opportunit demonstration of the set of costead kitchen knites have boon used—serves mesha as an indicator, Riek encedion an atal. While mast above as a policy about the patholing mast above as a policy about the patholing in the set of the section of the patholing and tails give a source uses. The view for the set of the set of the section of the set of the set of the section of the set of the set of the section of the set of the

Some dowains, he adds, disponse with rode and galget entriefy. They rely on physical sensations, such as lingly pains. Dwiners have reported such reactions as a serination of being tripped, chills, twitches a feeling like red-hot knives penetering the seles of their elect, convulsions, and wheeing. Some even say they throw up when they pass over a waler ven.

But Merta's demonstration, while it sug-



gests that a dowsing reaction does exist, fails to isolate the dowsing mechanism. And that is what Harvatik has set out to locate

By wrapping parts of a dowser's body in magnetic shielding and then testing the dowser's shifty to locate a magnetic field. Harvalik says he's made a remarkable discovery if the area between the dowser's seventh and twellth ribs is magnetically shielded the rod does not dip. Harvalk next refined his experiments, asking dowsers to walk through a high-frequency racio beam with various parts of their anatomy shielded by metal foil. He discovered that the dowsing reaction ceased when the subject's kidney area was shielded. Eventually, Harvalik pinpointed what he believes is the dowsing sensor the suprarenal plands which all alon the kidneys and produce such hormones as adrenatine and noradrenaline

Later, using metal headbands, Harvalik proported what he calls a second dowsing sensor in the middle of the licehead. This sensor, he has dicided, is located near the preadiging in the brain or perhaps near the preadiging in the brain or perhaps near the lighting gland. The prineal gland's procese function has thus far eludou bologists. Some mystice associate with the Third eye.

While Harvalk's expansents have not statted a hild wave, or even in ripple, in scaence, they do suggest that dowsing is based in the physical world, electromagnistic radiation and certain glands. But his work assumes that dowsing is a bona fide pheromeron. Recent controled subjes suggest that hereis title validity to dowsers' claims of bona gable to inful where water lies.

Magician James Randi has repeatedly challenged dowsers to prove their abilities in a controlled setting. In 1979 he offered \$10,000 to the diviner who could locate water running through a series of pipes planted underground for the purpose of the trial. Endingers, surveyors, and a lawyer wtnessed the proceedings, from the laying of the pipes to the testing of the dowsers. Of the four contestants who tried to trace the path, not one succeeded. Three years later, backed by a purnalist and a millionaire, and adding \$10,000 of his own money to the prize, Randi offered \$120,000 to anyone able to produce the right results in a second dowsing contest Again, all 11 of the participants failed "Each one agreed to the terms of the trial ahead of time and considered from to be fair," Randi explains "Afterward, when they learned they woron't right, they offered a million excuses "Sunspots interfered," one said. Another dowser claimed the problem was that Jupiter was in Sagittarius

Banch is not the only one to hold such triats During a test held at Boston University severall years ago, in 40 attempts, Severgiv located water only ministimes. He disregarided his poor showing saying that under serious conditions, he would have been successful

And what of the claims of hidden springs being discovered, the testimonials of satisfied customers? Are these findings merely coincidental? Or is there a logical explanation for dowears results in the liat?

I think that in most cases the dowser has

a pretty fair knowledge of the geology and hydrology of an area, based on personal acpertence, "asys Ronald Tank, professor of geology at Lawence University, in Apploton, Wisconsin Eugene Patten, chief of the groundwater branch of the US Geological Survey, agrees "Some dowsers are just good emprinced hydrologist, he saw.

Although this may explain some of the success downers experience. It car's account for the times immering files from Harmon have located buned condults, or explain how solders in Vietnam anifect out land mimes. There may be a danger in shutting our minds to such missifiers

Sciencials cupit to be alort to what other proprice can sale to "No just carfind discourt practical experience because there and "no accepted explanation for somethers," says Robert Brambi a backmanner at the University of Minnoset As an undergraduate, 20 years ago Brambi apart summers working with agies comparisy's poption repair cow An aging forman taught thin to locato bacthe indiruce acception of the solution bacthe indiruce acception of the solution bacunmapped lines. Of ocume time a leaded the use, but most of the time it worked."

As a gasture to open-minidedness. I visted the Amenican Society of Dowsers headquarters and fined my hand a civining. Sevigny affered me one of his civining rock a plastic, V-shaped gizmo. He showed me how to grasp the two ends or the V palms up and then twist my wrists cutward to bend the clastic, terraing the rod.

"There's a ven of water running under that corner of the room—why don't you try dowsing for it?" Sevigny asked.

Feeling not a little loom, I waiked across the floor, bearing the dowing nod like an offering to the gods of zamines. "Concertation on the quester vou?ro asking the nod --Where is the water won? "Serugny said." (Cound mysell concentrating on what my old physics professor, a cantankrous Alabaman who heat an impressive unibler of synonyms for asinne would say. I crossed the recom whose a duwer from the nd.

"Dowsing is a gift, but not everyone who has it knows it. You do need practice," Sevigny said "For now, let me lend you some of my power with the rod."

Hig greaged the left prong of the V with his with any aphthand. Then he grapped any field prong, with my aphthand. Then he grapped my free hard, completing some sereit buorcuit. Like the orientatic Blatch Casardy and the Sundance Kid, hends Casardy and he poss, Sovery and I machhed across the poss, Sovery and I machhed across the floor. Near the comis far corner, the rold abudy further on my hand

It fell as if something alive had jerked the red, like the stinke of a 20-pound samon. A few steps farther, it straightened load. I time it again, on my own, and this liter if arceal forme, too, athough feebly, as if 1d hocked only a suiths. Still, twas unnering. But then I through if arcs because you tense your arm miscles. No map's

And yet ... DO



calmly, "I want to thank you for explaining it all, Mr. Ringer. I feel a little foolish for having bothered you and your staff like this," He made himself smile for the man.

'That's quite all right.'

That night, where he head her treating too have set down and second an availant ter the second time without nutring her, her too have a set of the night of the second miles away. There, the doctor setted her They did not understand. They did not upser her medication, and watched her They did not understand. They did not upser her medication, and watched her the did they said, and where he finally the ther in the toopid, his doughter was broaking normally agan—but only broaking normally agan—but only therative cases the the

He stood in front of the bedroom mirror.

In the left hand, to hold a laser-and today large outhow with elencer and today large outhow with elencer and today large with elencer and today. The large with as million lumane ready to go the high prevention and the second second part of the second second second second part of the second second second second registration of the second second second second second second registration of the second second second second second second second second registration of the second s

It took him forty-five minutes to make his way from the oil wells to the zoo's perimeter. The moonlight useful while he set the charges at he wells, was worthless in the shadows of the wilderness zone.

Setting the charges had gone smoothy, but it had taken tirth-six munules, not lifteen. The two-meter chara-link fonces with smgle-strand outriggers werend wered for disturbance, and the wre cutters had gone through them. Nike butter What had galayed thm was he own hands, fingers abapeng the charges setting the capes and receivers. For fifteen years his hands had touched nothing, but softwere, leasibility studies, monthlies, and proposals, not FDX and Pentoles and laceng gord.

When he reaches Zanie Öne—Ine zoros pormeter, the first lence—Le stopped in the shadows of an ancent eucalyptus to catch his breath. The scont of this tree fitted him. burning. His body ached. He hadn't used if in twerty year—ence the dim racquebbail days of his youth. The equipment and he howay of younger meaning much more great than his over the hils of long wars he had never been to.

The three-meter chain link with its six-

stand outragers and genotend distubunce sensors was dark, but he darkness was doephen. There were lights this would have been approximately like a sum if the memory and the sense of the sense of the base considered perioditing near the main galax, where this bridge and road accessed and any sensors of that kind would have to take floadilt. The road would have microwise floadilt, the road would have include mean in dire would be CCT cam-

He stipped the startight goggles on, and the right turned green, the green ghost of the table to right turned green, the green ghost of the tensor in term of him. From this utility belt he undipped the power culters and the transmitter, intel on the fence's cement agree, he is cured the balt in the knee Reading the transmitter's tace with his fongers, he is cured the baltion for the fert well and passed. The outper termbled wildly in the neith thank the balanch of the See Drese.

When the puched it, the dekonston hall a lobineter away shock the earth under him screaming its way up through the gosphone transiducers in the lence to the mininoing station another histmeter away To these montrasts would asent the permieter lence was being assauld simular executed would be another to the screen the state of the other state screen the state of the other state would be accented.

As the ground shook, he sliced easily through the chain link

He scrambiad through tearing his has builds. The earth plowed green in the paggles. and beyond the bare zone with the buried geophrome—a minimizer of what once kept the two Berlins spart on the other green ghost of the second fance. It is buried assours ending three meters from it he had to keep the earth shaking under this for the seconds. His fingers found the second button, and even as he began to un, germed it with all there strength.

Under him the geophones screamed, the monitors got word of another explosion within seconds, and he was through the sensors, past them, only a meter now from the second green fence.

Localing most of the information had been easy. The literature was there if you knew where to lock—in doctassified Army field manuals, "survivalist" books and tapes, magazines and videotexts for law enforcers and adventurers—all obtainable through catalogs

But before locating this information, there had been one important question. Which security system did the zoo use?

An acting assistant supervisor of operations for his firm, he had quelty called for a review of alternative security systems-Lists of testimoniais for intrusion-detection systems became available, and on the sixth day he had found the Los Angeles Zoo under "total geophone systems."

The certail incrintion station had ensist, a helpad for check and chase just outside Zone One and a Ceeran & 7-Vue can interpact papelity from a nearly air akens of annealed mylar. Nin alloy superstructures and insulation doubling as theids—all werd for infraus detector intronsite, contradict operatives, catalos o the system. But 'intrusion' was not sobge 'Uke any hip-security facility has considered the proverbal known may be approximate in the part of the system main seteme structure, and informative registructure and information and the contain and the proverbal known main seteme structure, and informative registructure outs were channed dark by computer

The vet and feeder hours were the key, if he had misjudged too much or if the monitors failed to ignore random sensor phenomena during the explosions, or if-

He was at the fence, the one that carried no sensors. It was only a physical barrier, there to buy time for an armed response force deployed to the point of penetration.

He cull the fence, look a breath, struggled through, and began trating lowerd the service road that glowed green fifteen meters inside. Beyond the road he could see ghostly green landscaping winthing in the night from guils of wind, and there, beyond the landscaping, towering domes the same ghostly green.

He looked back once at the oil litres now lancing the sky and moved toward the trees, the trees that looked so much like a jungle from someone's dream

At the edupe of the landscapmy, the focus the lead priced up, the head including audiently like an animal in this check. The blacks filled the via showe hm, and he dropped to the ground, preseng the face that the earth, head has been han and when turble earth, head has been an advertight and the second second second there were no searchlights, and now the outdown was pass, listing in other work of the second was pass), listing in other work of the second was pass), listing in other work of the second was pass). The second second the second was pass, listing in other work of the second was pass), listing in other work of the second was pass), listing in other work of the second was pass).

He got up, tasting dirt, and ran. He hugged the landscaping where geophones were worthiess. He avoided coment tarman, handrails, posts—anything that might be wired with one of the five technologies all security systems used. He passed the first dome running all acrouch, ignoring the pain in his chest.

He passed three domes, heading east, gnoring the pains everywhere.

Stopping, confused, he checked the digital map on his watch. The domes were identical. Those he chose had to be the right ones, or all was lost.

The monkeys, he thought. The monkeys and the aviary. No. It was done torty-four the deer family. The visitor's brochure had been clear enough.

He moved to the nearest dome, crouched in the darkness of the ghostly as ONN landscape, and studied the termac path that led path thin to three other domes thirty, study, and one hundled meters away the woold wait the minutes. He was goddy had to make himself thrirk. The volts, the vests, they would og about ther business detonations or no detonations. Ires or no intog—and pressure mists builde dersions and invasible barrier detectors would be off for forty-five minutes.

Now ...

There were two figures approaching two versis in lab coals, two green creatures with sithery green skin the color of chameieors in the ambient light of the moon Both men carried small bags, and the little ground lights along the path fit up before them to show the way. The two creatures disappeared around the bond

He ran awkwardly to the next dome, slowing as he approached the door There, hands shaking, he installed the microre corder by the gnll. Then he moved into the shadows of a large pepter tree and walled,

> He unslung the matte-black laser-aimed Ruger Minr with the folding stock and the thick silencer.
> He held it before him, marveling at the violence of his shaking.

Istering to the rise and fail of the far sirens, the hammering of his heart, watching the glow of the sky over the wells.

When at last the two tigures appeared on the path, it was from the opposite direction, and he saw they were a different pair. The new green creatures stopped at the door of the dome. He did not breathe

They spoke—one, then the other—ther voces multiad. Then the door slid open, and they went inside When the door slid shut he trotted stifty from the shadows, grabbed the recorder from its hiding place, aimost dropped it and ran

The tarmac path was dark here, the ground lights wate off. He knew there was no one inside this dome. They might appear any minute but at least he wouldn't find someone already inside. As he slowed to a troi, he rewound the tape.

At the door-the pressure mat asleep under him--he hestated, hands shaking, then pushed the access button by the tamitiar grill. A tone sounded. Frantically he started the tape shoving it at the grill.

"Bernard Robert Lyman," the tape said, staid protessional, and then a second voice—tilp, cockier, "Cohen, Benjamin Daniel, Doctor "The door purred open

He could barely move his legs. The adrenatine made them wobbly, beyond his control, but he moved them, got inside, removed the startight goggles and put on the mfrared ones now.

In the goggles the world became hell

Green ghots gave way to gram, burn in jorms tion rightmares. He was in a ted junget, the trees a rain forest reaching totion and the trees are the start of the second moral a coling firmedia the trees, simalier morang laxity through the trees, simalier shapes fitting glowing with the free of shapes fitting glowing with the free to our heat. Solvin he unstang the matteblack laser-aimed Ruger Mini with folding stock and their solven heat of the blow him, manyoling at the volence of his 0 win splang. Hear can you do the?

He made himself think.

He thought of his daughter, his daughtens mother and of himself.

He scanned the red rain brest for the heavy shape he had seen first. The anmals he chose would have to be large at least in intensive-care units, other Weise What he did would have no meaning. An adult be shung weighed one-hundred-fitty kilos: they needed intensive care.

Whatever it was, it wasn't there now A sloth, a large primate, two primates mating in the clark, an infant clinging to its mother you took her away, Lawrence Beckman.

Now she is dead. This is how it happens

 He raised the Ruger's stock slowly to his shoulder and there it was \_\_as if waiting\_\_ the red shape stalking high in the trees above hm.

Trembling, he aimed. He aimed again, the red dot of the laser clear on the body He fired. He fired again.

As the heavy thing fell through the trees, he turned in horror and ran The pressure may just inside the door sensed him, the door whispered open, and he was out free, sick, full of despair. There were eleven bodies left—eleven

He ran through hell

The next dome held another rain forest, a vision from an ancient Gustave Dore ilthograph, lost paractes, inferio. This one teemed with miniature life but with nothing large enough. The rain forest hissed closed behind hm, and he fled.

Bernard, Robert Lyman Cohen, Benjamin Daniel, Doctor

In the third dome he found no primeval forest but instead individual cells with conndors he could run through Placytas he could break anmals that could not get away from him. There were enough animatis here, predators, primates all in special cells. Thank God: His work might be done soon. Predators. Carnivores

In the goggles he could see two animats asleep together, their heat making one living thing. The animats begain to siti, waking as if somehow water. Something about them made him think of morkeys though the could not be sure. Waen I it better not to be? Wasn't it better to think only of red tievr forms with faces from ingtimates? Wasn't this how it had been for millenniafor men just like htm? If the eves were too much like a childle, the face like an old woman remembered, a wfe, a brother, they would never doub But they had always done it-the buttons, the bomb bays, the faceless faces, the proy always "the enemy." Warn't the how it had shears haan?

Now there is a child who has neither

Nearly dropping the heat knife, he cut a hole in the Plexicilas just large enough for the barrel of the scope and silencer. Bile mee in his throat

Now there is a child who has neither world

He inserted the Rugar. He knelt. He squinted through the goggles at the red. waking shapes, broad faces returning his state now and he fired.

The report of the weapon was a sighthe kick a bullet in his shoulder, which he deserved, and the animal fell writhing to the floor. It was screaming hideously

He staggered back in terror, jamming the barrel in the Plexiglas, dropping it, backing up, backing up. Where had it come from-the screaming? He had heard only silence in his dreams. Somehow he had forgotten that what he killed-the eleven the twelve-might how! at him or mean or cry or scream until the red, red heat of their hodies forloct at last into eternal night

But the animal that was screaming was not faction, and now its mate was up scrambling back in terror, just as he wasaway from the sound, from the smell of fear. and somehow he was firing. He had the Buger up and aimed, and he was firing

It took three rounds. The mate law on the floor of the cage made a single sound. and was still.

But it, too, continued to glow, and the anner of that light terrified him more.

he screaming would not end

What have you done?

He felt little emotion now. There was work to do. He had twenty minutes or all was lost. He had calculated everything to the

He ran the tape again, and enother dome admitted him, and he did it.

He shol-someone shot-what looked ike a water bulfalo, was unable to find its mate, found instead a wingless bird with long legs. He-someone-shot it quickly trying not to see it, imagining instead small countries, monsoons, rice paddies, bamboo thickets, and shadowed highlands.

Someone shot a doplike thing that howled at an invisible moon as it died, and as a face leapt up behind his eyes-from that howing, from a park, from a moonhe made it stop, made it go away. He thought of his daughter. He thought of his wife Of the pandas, waiting

He shot two nameless things in the last cells of that dome and was gone.

Later, he would remember entering the next two domes, but what he killed thereif he killed anything-he would not remember. It would seem to him later that he would not be able to remember their shangs they sounds

It was the seventh dome he would remember-pightmare after pightmare flashback after flashback, even in the dayfight years later. Even as he entered it ha understoori somehow that this would be the end of the kifling, that he would leave it that he would make his way across the service road to the eastern fences, penetrate them muckly, and the two remaining charges would cover him

This is how it bannens. This is how

As he entered the seventh dome-the one that would give the two children of Ching a home, that would keep his daughter on this earth with him-he fell thankful that it held on kingle on rain forest where he could feel wild, ancient blood racing through him and wonder why why This one held only cells, intensive-care cell after cell, and he was thankful

But as he entered it, he knew something

Lts feathers were all cone: its head wobbled gently: its rantor beak mottled and flaking: its talons stiff with arthritis: something moved across its face and eves.9

was wrong. The red shapes in the tail cages were birds, large birds

Was if the way they sat agant on the artificial limb? Was it something he sensed but could not see, something beyond the googles' red glare? Was it something that whispered to him from the scales on their legs, the feathers, the pointed tongues he knew were in the darkness?

There were two of them, of course. Male and female. He removed the googles and water for his eyes to adjust. They did not There was no light here, only darkness, the beginning and the end of all things

He could sense them only a few meters above him now They were hunkered on the limb, not touching each other. He knew this. He had seen this in the googles.

They're sick he realized

How could he kill them like this? How could be do it this way?

He took the small flashight from his belt and aimed it where he knew they were

When he saw the first bird, he froza, My

This is how it happens. This is how

As the beam of light struck the dving bird, he knew he should never have done

did given events that followed but he is should have kent the googles on sholl them in the darkness, never used the little ight. The feathers were nearly gooe. The head wobbled gently The value ractor bask was motiled and flaking from some depage and the dark talons were arthrit. ically stiff on the limb. Something crawled all over its face, the beak, the dry evesor was this his imagination?

Slowly be moved the light down the limb until he found the female

A little smaller, her coloring like the male's despite what people believe she sat frembing, plive but if

Habapetris leucocentralius

He remembered the man saving it. though be badn't understood it then

Leuco cephaius The white head. He knew that head as well as anyone. Like evenues be had level with it every day of his waking life-the coins, the bills, the stamps seals clutch of arrows e plurbus unum. This was, after all, the bird-the precision-the one they had chosen two centuries before for the face of their nation

that their children's children might grow up knowing it every day of their waking irves in a world like this

Because Washington and San Diego and the others didn't have room-that was what the man had said.

Now there is a child who has orother

This is how it happens. This is how

" He thought of See Chee. He thought of himself, of his wife, her people, of wats and the deaths of sons, of littered parks and vellow moons, of the world and the mess they had made of it. He thought of the pandas last of all, and only then because he understood what they meant, what it all meant. He saw it clearly, and as he aimed he knew he would not be caught, that he would make it into the eastern interzone. over the buried sensors there. That the charges would go off like the Fourth of July. that he would wander free in the wilderness for hours and make his way back to an empty house. That he would sit with his daughter before their living-room screen in the months ahead and listen to the story of how the pandas found a home (the "terrible coincidence' of it), that her breathing would not stop again, that she would grow up, get married or not, have children, live on into a future where some decole loved and some did not, and where her own children would have all the animals-old and new-that the bright new sciences of their world could make

He saw it all clearly, and as he did, understood what he had become

When he shot them-when he saw their vallow beaks reck up mass wide that it was at last over, the sickness and shame-he asked for their forgiveness, and the eagles gave it, and he knew he was shooting them out of a father's love DO

The poem on page 44 is translated from the Aztec by Jerome Rothenberg, from Shaking the Pumpkin Doubleday & Company, 1984

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### MOZART

CONTINUED FROM PAGE 72

said, "that guy could really paint "

Tonette cracked off a square of Hershey's chocdate and ported to the magazme." I wen't the leather blain." she aad. "Mways, when I am a gri, my goddarin mother, she keep me in the goddarm consets. She thnik my what-you-call, my shoulder blade she kut too much."

Rote leaned back across her sold highs and patted her bottom reassuringly. He felt worderfully stuput, a week and a half of obsessive camality had reduced him to a euphone animal. "Forget your mother, baby, You're with *me* now You want ze goddamin leather blini. Leath for you."

Toinette licked chocaite from her fingertips. "Tomorrow we go out to the cottage, okay, man? We dress up like the peasants and we make love in the hedges just like noble strages."

Rice hesitated. His weekend turlough to Paris had stretched into a week and a haif, by now security would be looking for him. To hell with them, he thought "Great," he said "I'll phone us up a picnic lunch. Fole gras and truffies, maybe some terrapin.

Torriette pouled. "I want the modern food. The pizza and burnlos and the chicken friad." When Rice shrugged, she threw her arms around his neck. "You love me. Rice?"

"Surve you?" Baby, I love the very roles of you." He was drank on history val of corrico, conteneng under him like some great black motorcycle of the imagination. When he hought of Pans, Ister-oot quickness might have been, a sky-year-oid Nagoleon munching Dubble Bubble in Corsco, he felt like the archarged Michael on speed.

Megalemania, he knew, was an occupational hazard. But he'd get back to work soon enough, in just a few more days ....

The phone rang. Rice burrowed into a plush house robe formerly owned by Louis XVI Louis wouldn't mind; he was now a happik diverced lockamith in Nice.

Mozart's face appeared on the phone's tiny screen. "Hey, man, where are you?"

"France," Rice said vaguely "What's up?

"Trouble man. Sutherland flipped out, and they ve got her sodated. At least ax key people have gone over the hill, counting you." Mozart's voice had only the faintest trace of accent left.

"Hey, I'm not over the hill. Til be back in just a couple days. We've got what, thirty other people in Northern Europe? If youre womed about the quotas

"Fuck the quotas. This is sensus. There's uprisings: Comanches raising hel on the rigs in Texas. Labor strikes in London and Vienna. Realtime is pissed. They're taking about pulling us out."

"What?" Now he was alarmed.

"Yeah Word came down the line today They say you guys let this whole operation get sloppy. Too much contamination, too much fraternization. Sutherland made a lot



### COMFORT COOLER

By the glass, 2 az. Southern Confort, ½ lorge fresh lime. Florida gropefruit juice, Pour Southern Comfort over ice in a toll cooler glass. Add juice of lime and fill with grapefruit juice, strring gently. Mellow for half minute os frost builds on glass.

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For o free copy of Southern Comfort's newest recipe guide, please write to: Recipe Booklet, Dept. GF, Box 12427, St. Louis, MO 63132. of trouble with the locals before she got found out. She was organizing the Masonstas for some kind of passive resistance and God ionew what alse."

"Shit," The fucking politicals had screwed likup again. It wasn't enough that he'd busted as getting the plank up and ontine, now he had to clean up after Sutherland. He glared at Mozar, "Speaking of traterrization what's all this we stuff? What he hell are you doing calling me?"

Mozart paled "Just trying to help. I got a rob in communications now."

"That takes a Green Card. Where the hell did you get that?"

"Uh, Isten man, I got to go. Get back here, will you? We need you." Mozart's eyes flickered, looking past Roa's shoulders. "You can bring your little time-burny along if you want to But hurv."

"I oh shit okay." Rice said

Rice's hovercar hulfed along at a steady 80 kph, biasing clouds of dat from the dectyh ruted highway. They were near the Bavarian border Ragged Alos Juteo into the sky over radiant green meadows. Iny picturesque farmhouses, and clear, vivid streams of melled snow.

Tray of just had their first argument. Toprotection as developed or a Green Card, and Rice had tord her he couldn't dot. I He offered her a Grey Zadr space hard would get her from one branch of time to another without letting her visit Ragitime. He know her due to case signed: if the project pulled cut, and he wanted to take her with him He wanted to do the decent thing, not leave her behnd in a world winnow Herstwe and Vorones.

But she wasn't having any of it. After a few lotometers of weighty silence she started to squirm. "I have to pee," she said finally. "Pull over by the opddamin trees."

"Okay," Rice said: "Okay"

He cut the fans and whired to stop. A herd of brindled cattle spooked off with a clank of cowbells. The road was described.

Rice got out and stretched, watching Tonette climb a wooden stile and walk toward a stand of trees

"What's the deal?" Rice yelled. "There's nobody around. Get on with it!"

A dozen men burst up from the cover of a ditch and rushed him. In an instant they'd auroundied him, leveling fiinflock pistols. They wore tracers and was and lace outflod highwaymar's coats, black domino masks hid their faces "What the fuck is this?" Fice asked, amazed. 'Merid (reas?"

The leader ripped off his mask and bowed ironically. His handsome Teutonic features were powdered, his lips rouged. "I am Count Axel Ferson Servant sir."

Rice knew the name; Ferson had been Tomette's lover before the Revolution. "Look Count, maybe you're a little upset about Toinetta, but I'm sure we can make a deal Wouldn't you really rather have a color TV?"

"Spare us your salanic blandishments shi" Ferson roared. "I would not soil my hands on the collaborationist cow We are the Freemason Liberation Front!" "Christ," Rice said. "You can't possibly be senous. Are you taking on the project with these popguns?"

"We are aware of your advantage in armaments, sir. This is why we have made you our hostage" He spoke to the others in German. They ted Roc's hands and husted him into the back of a horse-drawn wagon that had copped out of the woods.

"Can't we all least take the car?" Rice asked Glancing back, he saw Toinette stting devotedly in the road by the hovercraft

"We reject your machines," Ferson said "They are one more facet of your godlessness Soon we will drive you back to hell, from whence you came!"

"With what? Broomsticks?" Rice sat up in the back of the wagon, ignoring the strik of manure and noting hay. "Don't mistake our kinchess for weakness. If they send the Gray Gard Army through that portal, there won't be encouch left of you to fill an ashitray."

We are prepared for sacrifice! Each day thousands flock to our worklivide move-

Over the rattle of gunfire he could hear the whine of VTOL jets, bringing in the evacuees, as the Roman centurinons led Realtime personnel into the tunnels to safety.<sup>9</sup>

ment, under the banner of the All-Seeing Eyel We shall reclaim our destiny! The destiny you have stolen from us?"

"Your destiviy?" Rice was aghast. "Listen, Count, you ever hear of guillotines?"

"I wish to hear no more of your machines." Ferson deslured to a subordinate "Gag him."

They hauled Pice to a farmhouse outside Satzburg, During fifteen bone-jarmig hours in the wagon he thought of nothing but Tonettels betrayal. If heid promised her the Green Card, would she setthawe learthim into the ambush? That card was the only thing she wanted, but how could the Masonistas get her one?

Ree's guards paced resilessly in front of the windows, their boots squeaking on the loosely pegged floorboards. From their conslant references to Salzburg he gathered the some kind of sege was in progress

Nobody had shown up to negotiate Rice's release, and the Masonistas were getting nervous. If he could just gnaw through his gag. Rice was sure he'd be able to talk some sense into them.

He heard a distant drone, building slowly to a roar. Four of the men ran outside, leaving a single guard at the open door Rice squirmed in his bonds and tried to sit up

Suddenly the clapboards above his head were blasted to splitters by heavy mechinegun fre. Grenades whumped in front of the house, and the windows exploded in a gush of black smoke. A choking Masonsta Med high inflock at Ros. Before he could pull the trigger a burst of gun/fre threw the terrorist against the well.

A stort, heavyset men in tak jecket and beather pants statival into the morn. He stripped goggles from his stroke-blackend face, roveshing Ortimat eyes. A pair of greased bracks hung down his back. He randed an assault if for in the corok of one arm and wore two bandblass of greatedsrander an assault if for in the corok of one arm and wore two bandblass of greatedsto be tho ope income factor man. He smalled of sweat and erroke and backy cured leather "Wo are Roc?"

Rice could only nod and gasp for breath

His resource halled him to his feet and cut his repeat that beyond: "I am Jebe Noyon. Trans-Temporal Army" He loxced a leather flask of rancid marce mikinto Ricce's hands The smell made Ricce wait to vomit. "Drink" Jebe measted. "Is kourniss, is good for you! Drink. Jebe Noven fells vou!"

Rice took a sp, which curdled his tongue and brought bile to his finitiat. "You're the Gray Cards, right?" he seld weakly

"Gray Card Army, yes," Jebe said "Baddeshass warnors of all times and places Only five guards here, 1kil them all'I. Jobo Noyon, was chief general to Genghis Khan, terror of the carth, okky, man?" He stared at Rice with great, said eyes "You have not heard of me."

Sorry, Jebe no."

"The earth turned black in the lootprints of my horse "

"I'm sure it did, man "

"You will mount up behind me," he said, drapging Rice toward the door. "You will watch the earth turn black in the tireprints of my Harley, man, okay?"

From the hills above Salzburg they looked down on anachronism gone wild

Local soldiers in waistoots and gates lay n blooch heaps by the gates of the refinery. Another battalion marched forward in formation, muskets at the ready. A handful of Huns and Mongols, deployed at the gates, cut them up with orange tracer fire and watched the survivors acatter.

Jebe Noyon laughed hugely "Is like siege of Cambeluc! Only no stacking up heads or even taking ears anymore, män, now we are chilized, okay? Later maybe we call in, like, grunts, choppens from Nam, nepaim the sonof-a-briches, far out, man.'

"You can't do that, Jebe," Flice said sternly "The poor bastards don't have a chance No point in exterminating them."

Jebe shrugged <sup>11</sup> forget sometimes, olay? Aways thinking to concuer the world He revived the cycle and scowled. Rice grabbed the Mongol's stinling flak jacket as they reared downhill. Jebe look his deep pointment our on the enemy, learing through



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the streets in high gear, deliberately running down a group of Brunswick grenadiers. Only panic strength saved Rice from falling off as legs and torsos thumped and crunched beneath their fires

Jebe skidded to a stop inside the gates of the complex. A jabbering horde of Mongols in ammo belts and combat fatigues surrounded them at once. Rice pushed through them, his kidneys aching

lonizing radiation smeared the evening sky. around the Hohensalzburg castle. They were kicking the portal up to the high-energy meximum, running cars full of Gray Cards in and sending the same cars back loaded to the ceiling with art and jewelry

Over the rattling of gunfre Rice could hear the white of VTOL jets bringing in the systeuees from Africa, and the U.S. Roman conturions, wrapped in mesh body armor and carrying shoulder-launched tockets, herded Realtime personnel into the tunnels that led

Mozart was in the crowd, waving enthustastically to Rice. "We're pulling out, man! Fantastic, huh? Back to Realtime

Rice looked at the clustered towers of pumps, coolers, and catalytic cracking units. It's a goddamned shame," he said "All that work shot to hell

"We're losing too many people. Forget it, There's plenty of eighteenth centuries.

The guards, sniping at the crowds outside suddenty leant aside as Bice's hovercar burst through the gates. Half a dozen Masonic fanatics shill clung to the doors and pounded on the windscreen Jebe's Mongots vanked the invaders free and axed them while a Roman flamethrower unit gushed fire across the gates

Marie Antoinette leapt out of the bovercar. Jebe grabbed for her, but her sleeve came off in his hand. She spotted Mozart and ran for him. Jobo only a few steps behind.

Wolf, you bastard!" she shouled. "You leave me behind! What about your promises you merde you pig-dog!

Mozart whipped off his mirrorshades. He turned to Rice. "Who is this woman?"

The Green Card, Wolf! You say I sell Rice to the Masonistas, you get me the card!" She stopped for breath and Jebe caught her by one arm. When she whried on him, he cracked her across the jaw, and she drocoed to the tarmac

he Mongol focused his smoldering eves on Mozart, "Was you, eh? You, the traitor?" With the speed of a striking cobra he pulled his machine pistol and jammed the muzzle against Mozart's nose. "I put my gun on rock 'n' roll, there nothing left of you but ears, man."

A angle shot echoed across the courtvard Jebe's head rocked back, and he fell in a heap.

Rice spun to his right. Parker, the DJ, stood in the doorway of an equipment shed. He held a Wather PPK. "Take it easy, Rice," Parker said, walking toward him "He's rust a grunt, expendable

You killed him!"

"So what?" Parker said, throwing one arm around Mozart's frail shoulders "This here's 106 OWNI

my boy! I transmitted a couple of his new tures up the line a month ago. You know what? The kird's number five on the Billhoard chart! Number five!" Parker shoved the gun into his belt. 'With a bullet

You gave him the Green Card, Parker?" "No." Mozart said. "It was Sutherland."

"What did you do to her?

"Nothing! I swear to you, man! Well, maybe I kind of lived up to what she wanted to see A broken man, you know, his music stolen from him, his very soul?' Mozart rolled his eves upward "She gave me the Green Card. but I quees that still wasn't enough. She couldn't handle the guit. You know the rest

And when she got caught you were alraid we wouldn't pull out. So you decided to drag meinto it. You act Tainette to turn me over to the Masons. That was your doing "

As if hearing her name, "onethe moaned softly Rice dight care about the bruises, the dirt, the rips in her leopard-skin inans. She was still the most opropous creature held

Mozart shrupped. 'I was a Freemason cope Look man they're very incool I mean. all I did was drop a few hints, and look what happened." He waved casually at the parnage all around them. "I knew you'd get away

You can't just use people like that?"

'Bullshit, Bips! You do it all the time! I needed this siege so Realtme would haul us out! For Christ's sake 1 can't wait fifteen years to go up the line. History says I'm going to be deed in fifteen years! I don't want to die in this dump! I want that car and that recording studio<sup>(\*)</sup>

"Forget it, cal." Boe said "When they hear back in Realtime how you screwed things up here-

Parker laughed. "Shove off, Rice. We're talking Top of the Pops here Not some penny ante refinery." He took Mozart's arm protectively "Listen, Wolf, baby, let s get into those tunnels. I got some papers for you to sign as soon as we hit the luture "

The sun had set, but muzzle-loading cannons if the right, pumping shells into the city. For a moment Rice stood stunned as cannorballs clanged harmlessly off the storage tanks Then, finally, he shook his head. Salzburg's time had run out

Hoisting Toinette over one shoulder, he ran toward the safety of the turnels DO

Logh Kentedy J Ichari Kentelita Drog 12 piece 113.

### EARTH

It got to the point that we couldn't even go out on the land to work, to maintain trafs or harvest timber for lear of problems from the

Ranger Paul Wheedon-who himself has been fired upon at least three times while patrolling the 100-square-mile area-paints a wild picture of an isolated wilderness newly dotted with enormous marijuana plantations, elaborate (and illegal) two-story homesteads, and rotting vehicles inddled with builet holes

The area, he says, was festooned with vicious booby traps-everything from spike pits and animal traps to land mines and dynamite. "The New River area got so bad," he says. "that we finally had to close it down When hikers called up and asked if they could go in there, we recommended that they stay away After the word got out, they lended to stay away voluntarily

In 1984 the Earest Service decided to ficht back. In cooperation with local authorities, they initiated an armed patrol of the New River area, coinciding it with a media campaign to let the growers know they were there The constant vigilance appears to have turned the tide

"The crowers just nicked up and moved out." Wheedon says "Now a person can hike and hunt and fish as much as he wants. The area is safer than it has been in ten years.

Wheedon thinks that some version of the New River program could serve as a model for other public areas with the same problem Other civil leaders think law-enforcement policies should be even tougher Citing last year's CAMP (Campaign Against Martuana Planting) in which state and local authorities joined to raid more than 100 clantations and destroy more than 100,000 plants, Cimolino says, The only answer is to do what were doing. Eradicate maniuana and get it out of our county

But State Senator Keene, a longtime proponent of legalization of marijuana, dis-

Programs like CAMP," he says, "operate on a Vietnam-type theory that if you inflict enough casualties on the enemy, they will withdraw But I suspect that this kind of actwity will only entrench the prowers who remain and cause them to arm themselves even more beauty

"It doesn't seem to me as if legalization of mariuana is in the political cards 1 he savs. "but obviously, if you had a legal crop that could be protected by legal means, none of this violence would exist

Keene's thinking seems to have found at least some support from the growers themselves "Legalization," says one veteran grower, 'would change everything. Prices would grap to simpst pathing, and that would get rid of the real criminal element. Then, he says, "the government could treat us fike it treats any other American farmer. Pay us not to grow DO



### PHENOMENA

The quastion is while fee before us a single effly, compand of housans's of defaurch and the second second second second second test as provides calculated by mostally ( but a branch of the second distance second distance d Here comes Mr. Halley's Cornet and a flight on a powered parachute



By Scot Morris

In 1692 an English astronomer published a bizarre theory that the earth is hollow. with an outer shell just 500 miles thick and riner shells having diameters the size of Mars, Venus, and Mercury. He believed that each sphere could support life and that the earth's interior might be constantly illuminated by a glowing gas. Since it was known that the earth is flattened at the poles, it stood to reason that the outer shell would be thinnest-perhaps completely open-at those points. After a spectacular aurora borealis display in 1716 this scholar suggested that the northern lights were caused by light escaping from the earth's

Great scientists sometimes make great blunders. When they do and redeem themselves in other areas, posterity forgives and forgets. That's why Edmond Halley is remembered as a great astronomer, not as a hollow-minded opploaist

Halley (pronounced 'hal-ee) helped design Royal Greenwich Observatory and established the first Southern Hernisphere observatory, from which he cataloged more than 300 stars. He was a longtime friend of Isaac Newton's It was Halley who encouraged Newton to write up his theories on the laws of motion. Halley published the resulting volume. Newton's monumental Principia Mathematica, at

There was some question whether Newton's laws of motion applied to cornels. those "outlaws of the skips" that seemed to come and go unpredictably Halley was struck by the similarity in reports of cornets sighted in 1456, 1531, and 1607 and the comet he had seen himself in 1682. He decided that all these sightings were of the same cornet, which was returning at intervals of 75 or 76 years. It had a closed orbit and was visible for only a brief portion of it when it came close to the sun

He predicted that the 1682 comet would return in 1758-the first application of Newtoo's laws of motion. He didn't live to see it (he would have been one hundrod two he died at eighty-six, in the centermal year of Newton's birth), but the solar wanderer reappeared right on schedule and has been known as Halley's Cornet ever 112 OMNI



Halley's Cornel (dashad line) will pass through Aquanus. Watch with a Meyer startrame

since. It came again in 1835 and 1910, and it has already been sighted heading our way for its 1985-/86 return engagement

Halley's Cornet won't be visible to the naked eve until January, so why are we featuring it now? Because September is the month to familiarize yourself with the right sky and in particular with Aquanus, the constellation in which the cornet will first appear a few months from now

The cornet will be farther from the earth than it was in 1910, so it is not expected. to put on quite as spectacular a show-Also, its first appearance will be down near the barizon (10\* above the barizon in porthern latitudes, 30° above in southern, as shown in the (flustration above). You will want to know just where to look it will be visible to the naked ava, but it isn't expected to be much brighter than an average star, so don't expect it to dominate the night sky Binoculars will give you a better view than was possible at the time of Galileo, and even a small telescope will put you at the level of vesteryear's royal astronomers in Greenwich Observatory

This month. Aquarius is at its culminabon-the highest point it gets in the night sky some 20° to 40° above the southern horizon for U.S. viewers. That will occur at about midnight in mid-September

Aquanus is the "water carner" constellation because an ancient consect-thedots pattern showed a running man holding a vessel with water splling over the sides. It's a faint, complicated constellation The small group of stars marking the man's head are the easiest to find. The two brightest stars are at Aquarius's neck and hips-fortunately they lie along the line Halley's Comet will be traversing during its first naked-eye appearances

Ben Mayer, an indefatigable amateur astronomer in Los Angeles, has recently published Starwatch (Pengee, 1984) and Halley's Cornet Finder (Perigee, 1985). both boons to any serious amateur comet watcher. In Starwatch he outlines two clever original ideas. One is a method by which amateur astronomers can use an ordinary SLR camera and a standard 50mm lens to detect comets. Simply take



The author waves on a lirst-try tlyby is Snyder's paraplane the safest way to fly?

two photos of the same area of sky, a night or two apart, and then proper the photos on a "bink comparater," which allows one to detect any object that has changed positions. If you want to try this, now is the time to shoot your reference side of Aquarus, which you can use a few months from now to actify any newcompri

The second is an ingenous "poor man?" constellation indentifier called a subframe to make one, takes a were cost hanger, all nout mo a rectangle, and them stretch a parted of paster. Act one ways over it use write Layer Paper hyperetire commton fluid or luminous into make spate in the transparent ways overepriving to the strans in the constellations—larger space to have the clayer availer space to domine regin, and have use white space space regin, and have be white space against the masker deraption the sky.

Halley's Comet should first become visible to the naived eye between January 5 and 10. People with binoculars will be able to see it before that, and people with telescopes, before that The first photographs by amateurs were taken last February. The first sphing through a big observatory telescope was made almost three years ago—in October 1982.

Where should you be in early January? For best comet watching, sout out a high dark location away from city lights and pollution. Start looking to the southwest about an hour after sumset, directly above the point where you saw the sum go down

For the rest of January and February, Halley's Comet will be invisible as it sets for northern observers and passes behind the sun. In March and April it will appear again, this time in the marring sky, about an hour before sunnse.

Mayer is backing a crive to keep the Mount Wison observatory, above Pasadens, California open for just a few months past is scheduled closing date. If he is accessful, this histon telescope will be able to transmit live polures of the cornet to TV vewers around the work, and an invaluable sequence of shit photos will be taken that can later be assembled into an animated film of the cosmic event. To voice your support for the "Halley's Comet— Live from Mount Wison" project, write to Comet, Omri, 1965 Broadway, New York, NY 10023-5965.

### PILOTING A POWERED PARACHUTE

You don't see many round parachules anymore: Domina Jaibert patented his square "parafol" design in 1964, and it has since shown up be'nind those thril-inde bosts in Rie and Acapuloo and among the biggest and haghest-flying lotse ever made (see Gamsa, June 1983 and Warch 1984). Jaibert s patent ran out in 1983, and the parafoli is now public domain

The latest development is the paraplane, Steve Snyder's aircraft for Everyman Underneath a large parafol hangs a glorified go-cart with a roll cage and two counterrotating propellers

When Bying There are only two controls left-right (with your feel) and up-down (with your left hand). If you don't want to change course, there is nothing for your feet to do, and if your shinds to do, eitherso you can relax, wave or shoot pectures.

This paraplane has a join "instrument panet" — a mine and a decal. The menet tells you whether or not you have a full caropy above you, the decal is an anspreed gauge, with the needle permanently at 26 miles per hour. You cannot go faster You cannot the gandet moves out in finor 10 the anspression of the second second second and the panen need. Carbing descending, and the panen need. Carbing descending, of those level the anspresed ta 26 minh

How sale is it? The paraptane can't stall or apin if the worst thing should happen and both engines give out, you are still on a steerable parachute. You may have a rough landing, but it probably wor't kill you. Snyder tels me that of more fran 3000 trained picts, he has not yot heard of an inpur vas serous as a broken bone.

The parapiane sells for less than \$4,000, and disassembled. It fits into the trunk of a midstee car. No license is required to fly one. For information, write to the Parapiane Corporation. 5801 Magnolia Avenue, Pennseuken. NJ. 18109 DOI

