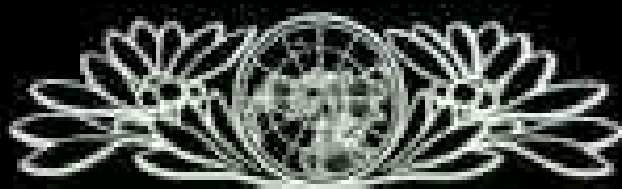


VOL. 170, NO. 4



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NATIONAL GEOGRAPHIC

October 1986

DURING CHILDHOOD most of us enjoyed at least one relative or family friend who would drop in for a visit and inevitably pull some little surprise out of a pocket or bag that excited our imagination. At the GEOGRAPHIC we still thrive on such visits from friends and contributors.

The late Louis S. B. Leakey came only when he had a new "oldest" anthropological discovery in his pocket. His widow, Mary, and son Richard have enhanced the family reputation for exciting surprises.

Last fall Richard and his associate Alan Walker, of the Johns Hopkins University School of Medicine, pulled this cast of a 2.5-million-year-old hominid skull from a bag and set it on my desk. Alan had found it in pieces near Lake Turkana, Kenya, on a dig supported by the National Museums of Kenya and the National Geographic Society.

It would be wrong to use the popular conception that a "missing link" had been found in the study of human origins. There really is no chain—only a lot of links.

Ironically, this skull may complicate rather than simplify the evolutionary lineage. It is of a branch of the australopithecine group named *boisei* by Louis Leakey after a 1959 discovery in Olduvai Gorge, Tanzania. It's a primitive specimen with a massive jaw and one of the smallest brains of any hominid measured.

Its ancient date indicates that the *boisei* branch split off from the other australopithecines much earlier than previously thought. For whatever reason, *boisei* seems to have lived out its time on earth and become extinct about a million years ago; it is not considered an ancestor of humans.

The ridgelike sagittal crest across the peak of the skull to which jaw muscles anchored is the largest ever found. "The protruding jaw with its massive muscles and flat hammerlike teeth would have been a powerful crushing machine," Alan said, "indicating it was a vegetarian, since meat eating requires sharper cutting teeth."

Not many visitors can top surprises from East Africa, but there are plenty who can match them. We hope that by passing along the best of them the GEOGRAPHIC enters your home every month as an old friend to excite your imagination.

Wilbur E. Garrett

EDITOR



Are the Soviets Ahead in Space? 420

Methodically building on experience, the U.S.S.R. boasts an ambitious space program that in some respects surpasses our own. Science editor Thomas Y. Canby reports.

New Nations in the Pacific 460

A U. S. trust territory transforms itself into three new countries and a commonwealth, with America as godparent. Carolyn Bennett Patterson investigates the metamorphosis of these far-flung islands. Photographs by David Hiser and Melinda Berge.

The Dutch Touch 501

The people of the Netherlands successfully cope with problems that might swamp a larger nation with a less practical approach. By Bart McDowell, with photographs by Nathan Benn and Farrell Grehan.

Wall Against the Sea 526

The Dutch cap an ambitious 30-year engineering project with the giant Oosterschelde surge barrier to protect a major estuary. Larry Kohl tells how it will work.

Red Deer: the Ancient Quarry 538

Whether the prize of an English hunt or the product of a New Zealand farm, red deer have long been important to man. British zoologist T. H. Clutton-Brock assesses their global status today; photographs by Jim Brandenburg.

Studying Scotland's Deer 556

Dr. Clutton-Brock describes a 14-year research effort on the isle of Rhum.

COVER: Cosmonaut Leonid Kizim walks in space outside the Salyut 7 station. Photograph from Tass.

THE NATIONAL GEOGRAPHIC MAGAZINE
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A Generation After Sputnik

ARE THE SOVIETS

By THOMAS Y. CANBY
SENIOR ASSISTANT EDITOR

Colonist in space, cosmonaut Col. Leonid D. Kizim has spent more than a year in Soviet space stations. He embodies his nation's unflagging pursuit of a space program in some ways more successful than that of the United States.

Cosmonauts have logged more than twice the flight time of U. S. astronauts. Three cosmodromes launch a hundred rockets a year—five times the U. S. average—carrying satellites that serve science and a vast military establishment. Like the Americans, the Soviets have seen disasters—and like the Americans, they correct their problems and doggedly rocket aloft again.

1988



AHEAD IN SPACE?



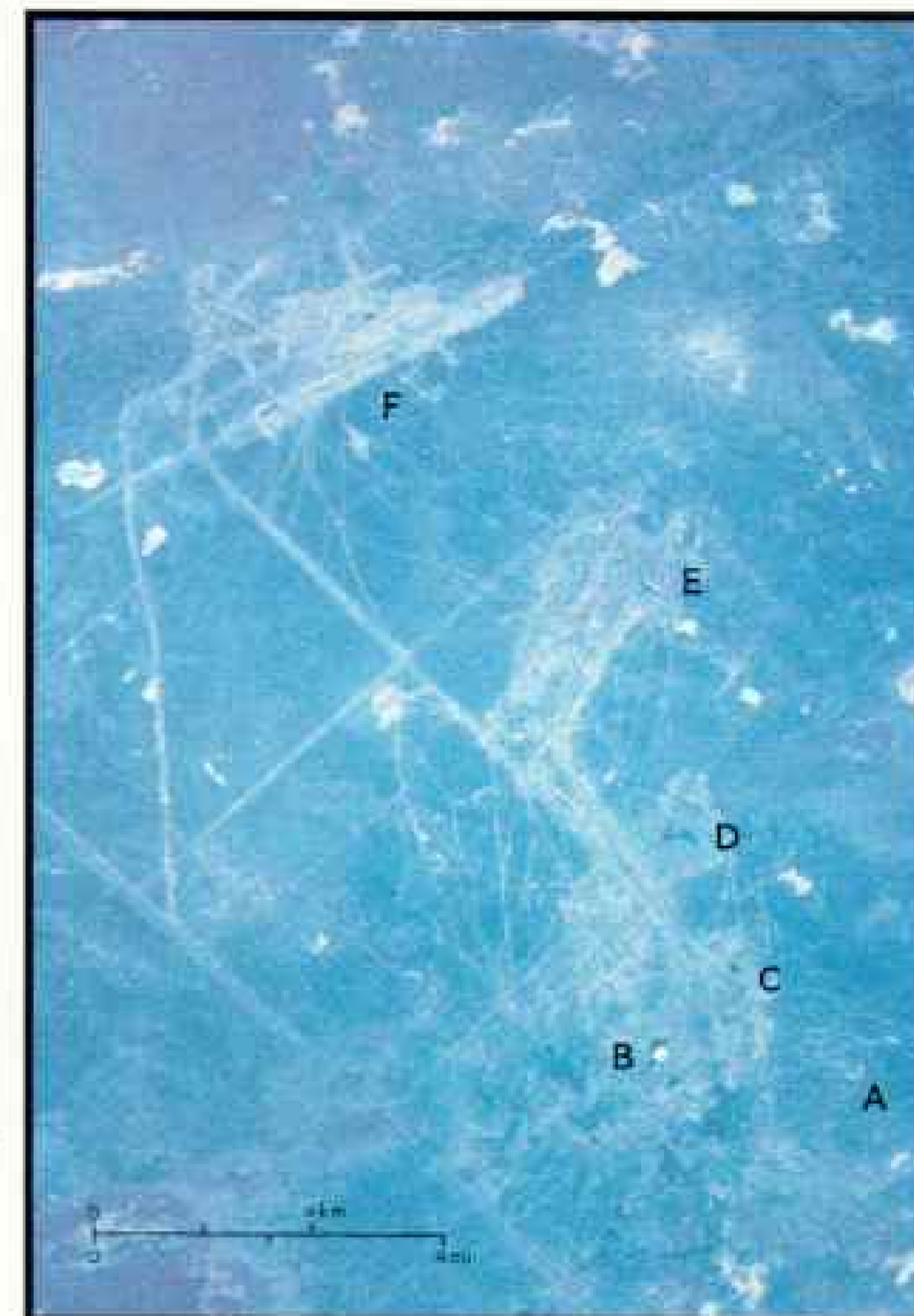




SPACE VIEW OF A COSMODROME

A vast complex for assembling and launching rockets sprawls across the Kazakhstan steppe in a satellite view of the Baikonur Cosmodrome (left). As large as nine Kennedy Space Centers, it is off-limits to Western observers. The pad that launched Yuri Gagarin into history in 1961 still sends crews to the Soviets' two orbiting space stations. From Baikonur depart probes to the moon and the planets, and satellites destined for geostationary orbit 22,300 miles above the Equator. Leninsk, a city of some 55,000, houses spaceport families; the green of irrigated fields shows up red in this false-color image.

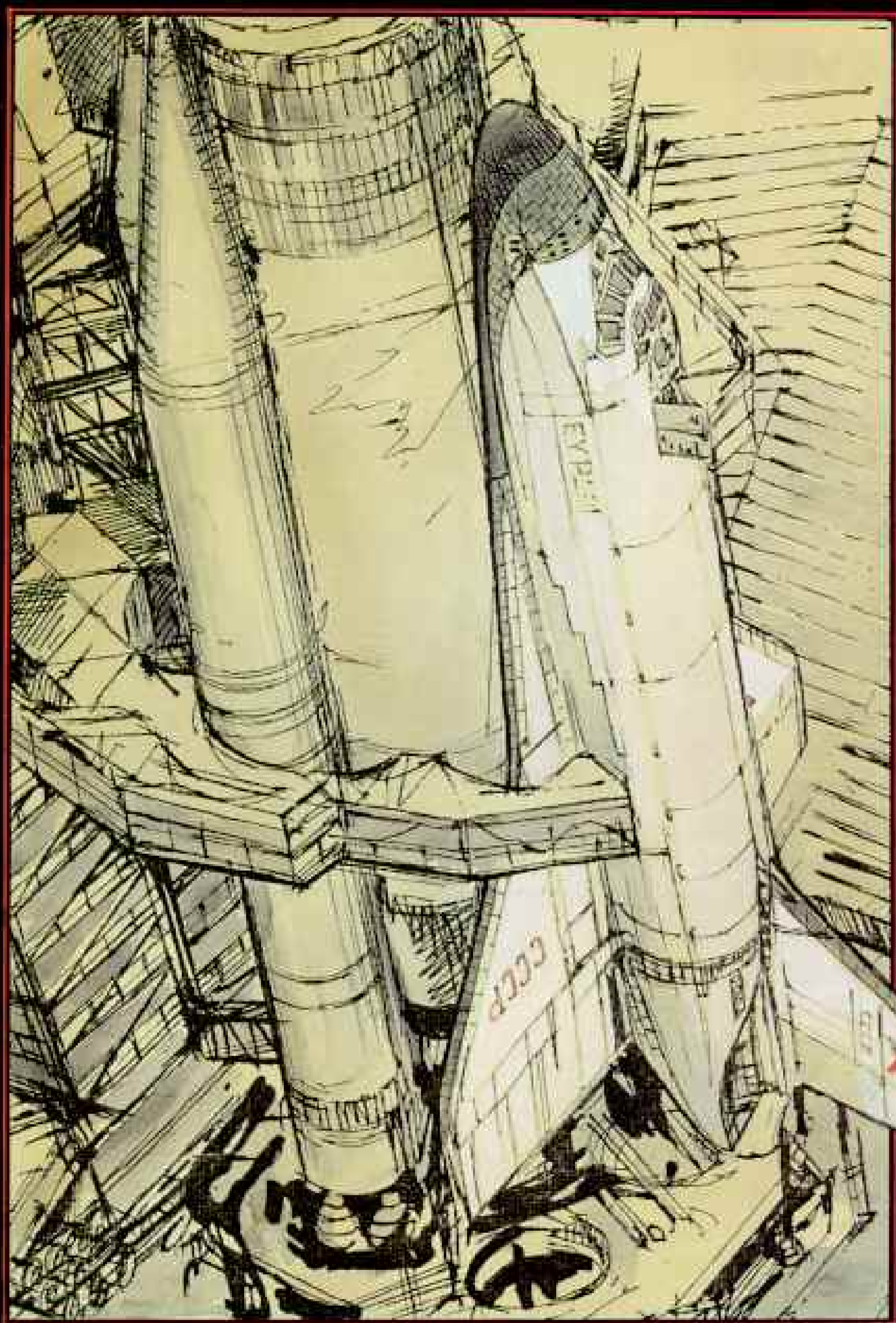
Baikonur's busy heart becomes clearer in a photograph made from a U.S. shuttle (upper right). These pictures and a lifetime of study enable Soviet space analyst Charles P. Vick to identify probable details of Baikonur's anatomy.



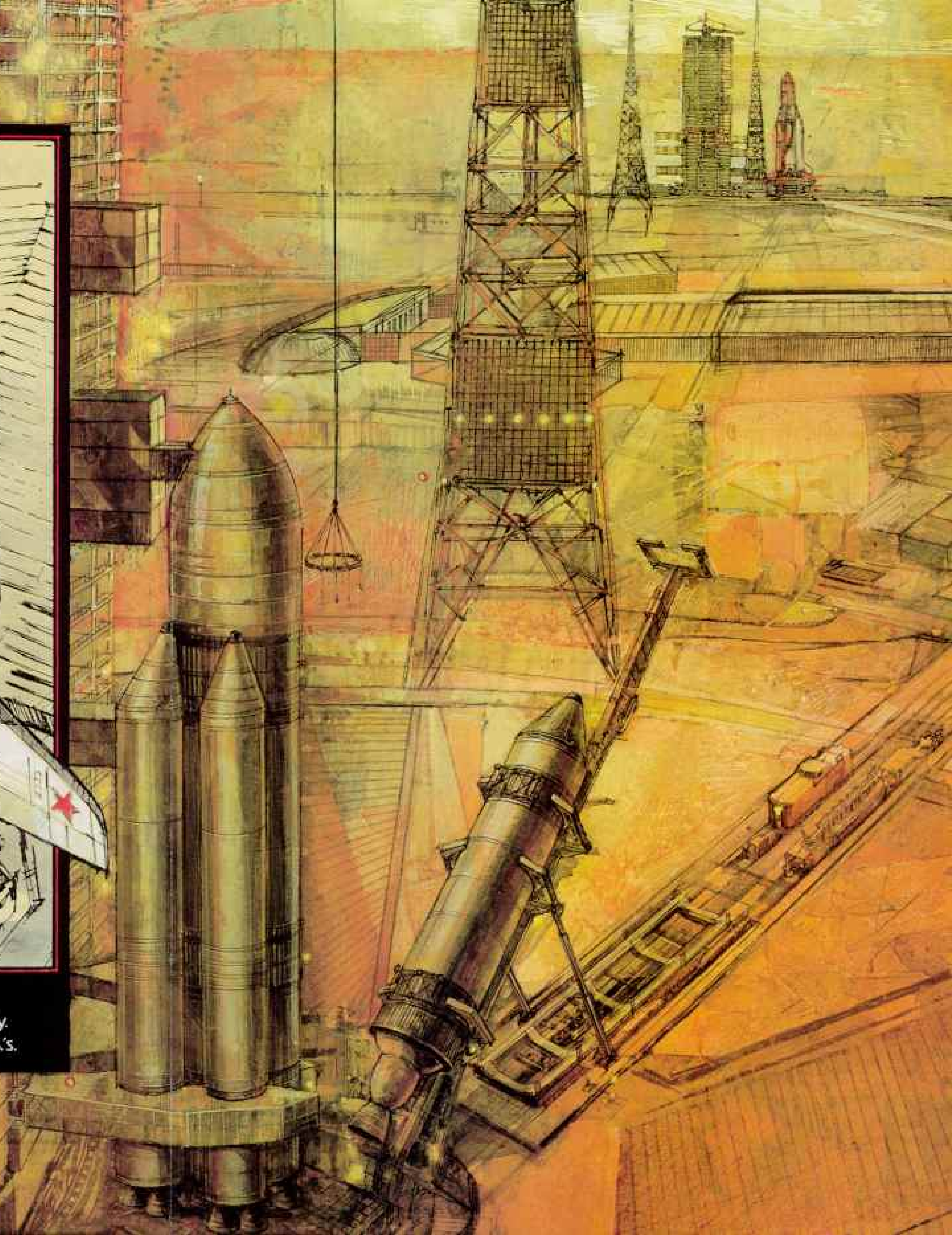
EGGAT-GENERAL ELECTRIC SPACE SYSTEMS DIVISION (FACING PAGE); NASA (ABOVE)



Core of the cosmodrome, photographed in 1983 from the U. S. shuttle Columbia (top), occupies a small portion of the huge complex (map and facing page). The letter A marks the pad that launched Gagarin; B, the booster assembly building; C, a medium-lift launchpad; D and E, launch facilities for a Soviet shuttle and heavy-lift booster (a launchpad explosion near D in 1969 crippled Soviet plans to walk on the moon); F, the shuttle landing runway. Other lines show roads, railroads, pipelines, and power lines.



New to the Soviet space arsenal, a shuttle stands mated to its enormous rocket. Neither has yet flown operationally. Experts believe the still secret shuttle improves on the U. S.'s.





THE MIGHTIEST ROCKET PREENS FOR FLIGHT

Glimpse of the future unfolds in this painting of Baikonur as technicians prepare the world's most powerful booster for lift-off. Western experts say this awesome scene could become reality in a few years when the new Soviet heavy-lift rocket becomes operational.

A locomotive has rolled out a rocket-shaped payload container, which may hold a space station module. Jacked upright, it will attach to the mammoth rocket, with its four strap-on boosters. At lift-off the ribbed fire pit will channel a blast one-third as great as that which leveled Hiroshima.

The heavy-lift rocket will also launch the Soviet space shuttle; the mated vehicles stand to the east, upper center. At upper right a rocket rises from the pad that launched the original Sputnik.

PAINTING BY BARRON STOREY,
FROM DATA PROVIDED BY C. P. VICK





TAKEN FROM SOXFOTO (LEFT), SHUTTER

Poised for a manned flight, an SL-4 rocket at Baikonur (left) will rotate on a turntable for proper aim after the jawlike gantry has risen to clamp it steady. A similar rocket thunders at lift-off (above) between towers designed to divert lightning.

FOUR TIMES this steel-nerved cosmonaut has ridden a Soviet rocket into space. Now, counting down for an extraordinary fifth lift-off, he clutches the tuft of grass he will carry with him aloft—the Soviet space traveler's traditional symbol of a safe return to earth. For this mission in June 1985 will be the most difficult and dangerous his nation has attempted.

The goal of mission commander Vladimir Dzhanibekov and crewmate Viktor Savinykh is the stricken Soviet space station Salyut 7. The preceding February, while temporarily unmanned, the 22-ton flagship of the Soviet space program suddenly lost electric power and began tumbling in a slowly decaying orbit. The two cosmonauts will attempt to dock with the writhing leviathan and then restore it to life.

Behind this bold undertaking stands the accumulated experience of a spacefaring nation second to none. Sixty times manned spacecraft have soared heavenward from the immense Baikonur Cosmodrome in Central Asia, the same spaceport from which Yuri Gagarin won a foothold on the new frontier 25 years ago. Soviet space pioneers, and passengers they have carried aloft from 11 other lands, have logged 12 years of space travel, amassing a record of solid achievement and spectacular firsts. By contrast, the United States, in 55 manned missions, has accumulated less than five years of space experience.

This sustained, successful drive to colonize space overshadows a vastly larger unmanned program. Thundering aloft from Baikonur and two other cosmodromes, some 90 unmanned rockets a year give the Soviet Union a total launch rate five times that of the U. S. Some of these rockets carry satellites for civilian communications and navigation and for monitoring weather and earth resources. Some hurl cleverly instrumented probes to neighboring planets and other celestial targets. The vast majority carry aloft military hardware: satellites for surveillance, for electronic eavesdropping, for tracking U. S. carrier fleets, and for supporting the ground forces of the U.S.S.R. and its allies.

To support this immense effort, the U.S.S.R. employs some 600,000 personnel, equivalent to the U. S. effort at its peak in

the mid-1960s. The Soviet space budget approximates that of the U. S.—the equivalent of about 22 billion dollars for 1985, but probably double the U. S. commitment in terms of gross national product.

With space triumphs have come disappointments and disasters: at least five cosmonauts killed, planetary probes that crashed onto their targets, rockets that exploded on the launchpad, a lost race to the moon. After each setback the cautious Soviets withdrew into the murky secrecy of their system to correct their error, then emerged to resume a program that, in most observers' opinions, shows far greater consistency than that of their U. S. rivals.

To report on this crusade to conquer space, I made two trips to the Soviet Union. Not to Baikonur or the nation's two other launch sites; these military installations are off-limits to virtually all the world's press. But my hosts conducted me to places few Westerners see. And they showed immense pride in a program that serves as a showcase of their nation's technological achievement.

AT BAIKONUR Cosmodrome, morning sun floods the Kazakhstan steppe as Dzhanibekov and Savinykh roar skyward on their mission to save the crippled space station. Normally they would home in automatically with radar and dock in a single day, guided by their capsule's computer and by colleagues at Flight Control. But with Salyut wallowing dead in space, the cosmonauts themselves must maneuver their Soyuz T spacecraft to the intricate final docking.

"We visually acquired the station, and I could see it slowly rotating," related Major General Dzhanibekov when we met in Moscow after the mission. "At a distance of three kilometers we saw our courses were diverging, and I took control from the computer—after all, a machine is only a machine. Savinykh called out ranges as measured by a laser and an optical device. I guided the Soyuz, using special control handles we had installed at the right-hand window.

"At a range of 200 meters we paused. We could see the solar panels pointing askew. We circled the station, training our television camera so we and the ground crew could study the docking mechanism."

Dzhanibekov began stalking the rotating hulk, calculating its movement so he could pounce and dock without wasting his craft's scanty fuel supply.

"But we found ourselves looking right into the blinding sun," the cosmonaut recalled. "We bided our time until the two craft moved into earth's shadow, into the night." For this the crew carried special night-vision optics.

"I gradually positioned the capsule to rotate with the Salyut. Then I moved in . . . closer . . . closer. Suddenly we felt the two vehicles lock solidly together—docked." Below them at that moment spread China.

Now new uncertainties loomed. Had the defunct space station maintained atmospheric pressure? If not, the mission must fail. If atmosphere remained, would it be poisoned by an electric fire? In that case too they must return to earth defeated.

"We took a chance and opened a valve in Salyut's hatch," the general told me. "I held up my finger and felt air rushing into the station. Pressure fell in our capsule. Then the flow stopped; the station still was tight.

"We put on oxygen masks and moved in

to check the air. Savinykh thought he detected contamination. I lifted my mask and breathed. The air was stale but not toxic.

"When the air hit my face, I realized how bitterly cold the station was. Moisture from my exhalations froze in a tiny cloud around my face. Ice was everywhere—on the instruments, control panels, windows. Mold from past occupations was frozen on the walls."

They felt an incredible silence. With no motors or ventilators whirring, this frozen mote in space was perhaps the planet's quietest inhabited spot.

"We bundled up in fur-lined suits and hats until we looked like babies in a Moscow winter. With flashlights we explored the ship.

"Water in both storage tanks was frozen solid. This worried us. We could work for days without food but not without water." If necessary the cosmonauts were prepared to drink coolant water drained from their space suits.

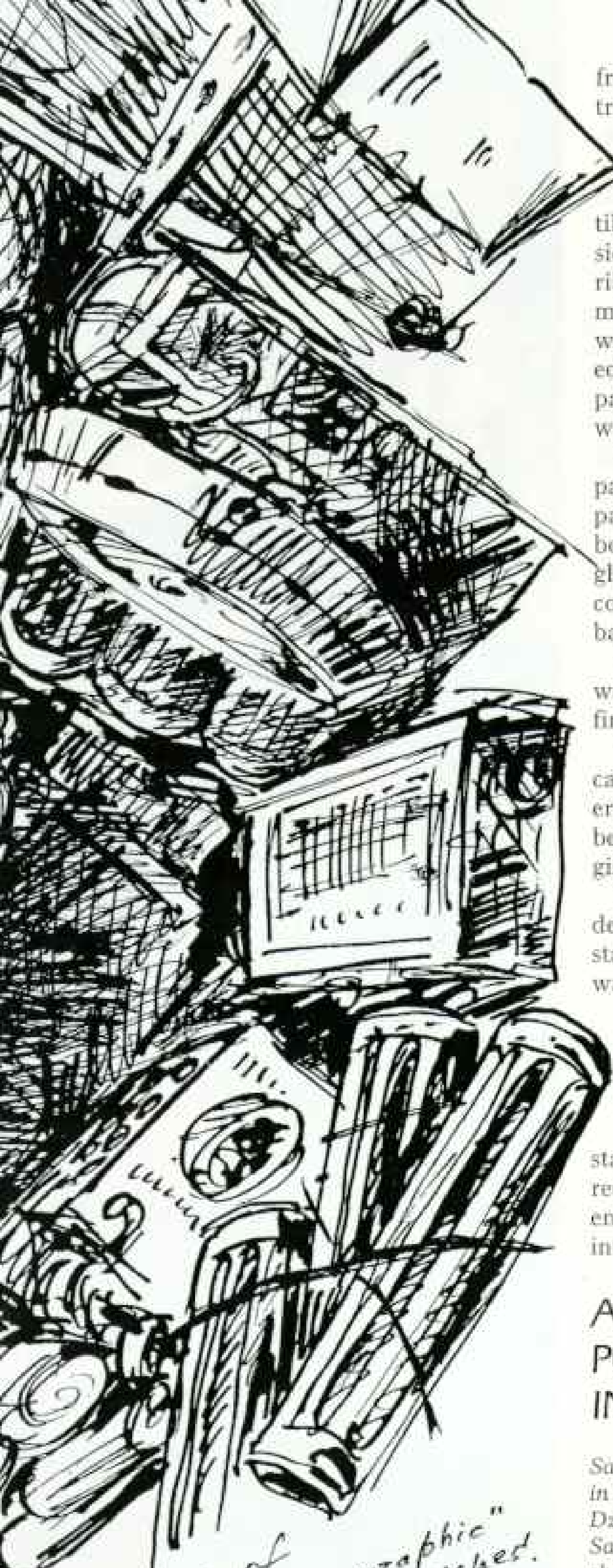
"We could not tell Flight Control how cold it was, because our thermometers went only to zero degrees Celsius. So we spit on the wall and timed how long it took to



TASS FROM SOVIETS

With eight round-trips to space between them, Georgi M. Grechko, left, and Maj. Gen. Vladimir Dzhanibekov share the joy of return to earth in September 1985. General Dzhanibekov spent 110 days aboard the Salyut 7 space station.





To readers of
"National Geographic"
with very warm wishes.
Dzhanibekov

freeze—ten seconds. From this, Flight Control calculated the temperature to be about minus 10°C (14°F).

"The first thing was to recharge the batteries to restore heat, light, and ventilation. We raised the shades on the sunlit side to admit a little sunshine. Still it was terribly cold. We could work only the 40 or 50 minutes that the station was in sunlight; when it entered earth's shadow, we retreated into the space capsule. Our feet suffered painfully; it helped to rub them together as we worked.

"To charge the batteries, we had to bypass the normal connections to the solar panels. We found extra electric cables on board and cut them to length. Without gloves our hands got stiff, but with them we could not do much. We hooked up the first battery, and saw the voltage rise.

"Everything started to move forward. We were able to charge a second battery, a third, finally six of the eight.

"Without the ventilators to circulate air, carbon dioxide from our exhalations hovered around us like a big ball. Our heads began to ache, our arms and legs grew sluggish. We felt sleepy and limp.

"We switched on the power, hoping. Suddenly the lights turned on and ventilators started whirring. We realized the station was saved. We had worked nearly 24 hours—it was time to sleep."

Salyut's ice age gradually receded—and an epoch of flooding began. As ice melted, the humidity rose into the 90s, and the hapless cosmonauts were constantly clammy. "We fought it for a month," recalled Dzhanibekov. "Finally the station entered longer periods of sunlight, and the interior began to dry."

A COSMONAUT PORTRAYS A CRISIS IN SPACE

Salvaging the crippled Salyut 7 is depicted in this pen-and-ink sketch by General Dzhanibekov. Here he and Viktor Savinykh repair electric equipment for charging dead batteries. Fur-lined suits shield them from bitter cold that left ice on bulkheads and control panels.

SLOWLY the two spacemen settle into a life-style built on lessons learned from a history of ever longer missions. In 1978 cosmonauts exceeded the 84-day record set in 1973-74 on board Skylab, the short-lived U. S. space station that in 1979 descended in a fireball over Australia.* In 1984 three cosmonauts, including a medical doctor, orbited a record 237 days. It was after their departure that Salyut 7 failed, necessitating the rescue mission by Dzhhanibekov and Savinykh.

Despite their damp surroundings on Salyut 7, the two cosmonauts desperately need drinking water. An ample supply arrives 15 days after they entered the station, borne by a Progress supply ship, an unmanned space freighter resembling a Soyuz and guided to Salyut by Flight Control. Its development marked a revolutionary advance in the Soviets' ability to maintain their space stations economically for periods of years.

Broadcasters air an interview with the orbiting duo—entertainment that thrills space-worshipping Soviets. Comparing the U. S. and U.S.S.R. programs, Dzhhanibekov states, "The Americans will go back to space stations . . . because without stations space cannot be conquered."

And indeed the space giants took divergent turns at a fork in the road to the stars. As the U. S. focused on development of the shuttle, a reusable system of space transportation, the Soviets pursued a manned presence in space stations, relegating the trip there and back to throwaway Soyuzes.

Aboard Salyut a daily routine sets in. Arising at 0800 hours, the men take the first of the day's four (Continued on page 438)

*The author described its missions in the October 1974 GEOGRAPHIC article, "Skylab, Outpost on the Frontier of Space."

Two crews make a crowd in Salyut 7 when visitors arrive in 1984. The host crew, commanded by Colonel Kizim, lower right, set a record of 237 days in space, a step in the Soviet goal of staying aloft long enough for a mission to Mars—as long as three years. The visitors include General Dzhhanibekov, left, and Svetlana Savitskaya, left center, first woman to fly twice in space.

1988







Engulfed in dust and the smoke of its braking rockets, the Soyuz T-6 spacecraft lands in a Kazakhstan field (left) in 1982. The parachute slowed its approach until a meter off the ground, when an antenna-like probe made contact, signaling retro-rockets to fire; paired craters mark the impact (below). Ground crews quickly tilted the capsule upright, then erected a support structure.

Returning from Salyut 7, the Soyuz T-6 carried a crew that included Jean-Loup Chrétien, a French cosmonaut who flew with the Soviets as part of their



international ride-sharing program known as Intercosmos.

Opening Soyuz 35 in 1980 (right), a recovery team pulls out Valeri Ryumin; he and Leonid Popov, seated at left, returned weak but healthy after 184 days in Salyut 6. Several cosmonauts have died in accidents during return to earth.

The Soviets have 12 man-years of data on the effects of prolonged weightlessness on the human body and mind. Experience indicates that work performance may decline after stays of more than four or five months.



ERIC FREED, SYSTEMS (FACING PAGE AND BELOW), TASS



meals—pork, cheese, honey cake, prunes, and coffee. Turning to Salyut's array of 85 scientific instruments, they begin six hours of work: observing earth's surface, conducting technical experiments, working with the station's astronomical and medical equipment. Tea breaks and two more meals ease the grind.

The daily chore they loathe: two hours of strenuous exercise on Salyut's jogging treadmill and stationary bicycle. If they slack off, Flight Control will nag, because in an environment without gravity muscles atrophy with appalling swiftness. With each exercise session the cosmonauts generate an envelope of sweat that they try futilely to towel off. Every ten days they shower, a complex process that consumes an entire day.

After a supper that might include cottage cheese, assorted meats, bread, dessert, and

tea, the men visit with their families on two-way television or talk with athletes and entertainers—diversions arranged by a psychological support team that oversees the mental health of the lonely spacemen. Then at 2300 they tuck into sleeping cocoons fastened to a wall and hope for sound sleep, a rare luxury in an alien environment in which they can never entirely relax.

In mid-July the crewmen load trash and wastes into the Progress. The freighter silently slips its docking latches and moves away, to plunge back toward earth and incinerate in the atmosphere.

In one of many biological experiments, the cosmonauts plant cotton seeds in ingenious little greenhouses that simulate gravity and earth's geomagnetic field. Earlier crews struggled with limited results to grow plants in an environment that knows neither



1985 FROM SOYPOIS

Gravity's heavy hand flattens Vladimir Kovalenok and Viktor Savinykh after 74 days in Salyut 6. Despite daily two-hour workouts on a treadmill and exercise cycle, long-duration crews are too weak to walk on their return and can find even the weight of a bed sheet uncomfortable. As with U. S. astronauts, in flight about half the cosmonauts suffer motion sickness.

up nor down. Healthy vegetation could be essential for recycling air, water, and wastes and providing food for longer flights, such as a three-year round-trip to Mars.

On July 21 the cosmonauts receive another Progress visitor. Along with fresh food, water, and fuel it brings another greenhouse and new space suits—indicators that the men will soon venture outside the station to work.

The cosmonauts revel in newly arrived photographs and video films of their families, looking at them again and again. They play recordings of earth sounds—of falling rain, rustling leaves, singing birds. With the absence of gravity they have gained an inch in height. They have grown accustomed to the station's fetid atmosphere but not to the awkward hygienic facilities, which substitute a vacuum for gravity in handling human wastes.

The first cotton planting fails, and the discouraged gardeners sow again.

Donning their new space suits, the crewmen open the hatch and emerge. Their goal: to install more solar panels on the underpowered station. Using tools designed for their clumsy gloves, they erect structures to hold the panels, then hoist them with lines, like seamen unfurling a sail.

In late August they load trash into the second Progress. Flight Control fires its thrusters to adjust Salyut's orbit. The freighter departs for oblivion in the atmosphere.

The gray-thumbed gardeners, twice defeated by reluctant cotton seeds, exult to see sprouts emerge.

A RED-LETTER DAY: the arrival of a Soyuz bringing three comrades! Docking latches click, the hatch opens, and the crewmen embrace Vladimir Vasyutin, Georgi Grechko, and Aleksander Volkov. Dzhanibekov and Savinykh offer their guests bread and salt, traditional symbols of Soviet hospitality even in space.

For a week the five cosmonauts share the crowded cylinder, conducting experiments, the hosts familiarizing the newcomers with Salyut's welter of equipment. Grechko studies the pollution of the atmosphere, which he compares to a dandelion's fragile seed puff, so easily blown away. Each day

Dzhanibekov wears a special vacuum suit that stimulates blood circulation in the lower body, a sign he will soon be feeling earth's gravity—going home!

Using themselves as human guinea pigs—a frequent and unloved chore—the men employ a small medical device to study acupuncture points for reducing the discomforts of living in zero gravity. They experiment with electrophoresis—isolating pure materials for lifesaving drugs—possibly an early space-based industry.

ONE HUNDRED TEN days after entering the frozen station, Dzhanibekov bids farewell to Volkov and Vasyutin and his faithful crewmate Savinykh. With Grechko he boards the Soyuz he arrived in. The transition marks the first time successive crews have manned the station without interruption—a historic landmark in the permanent occupation of space.

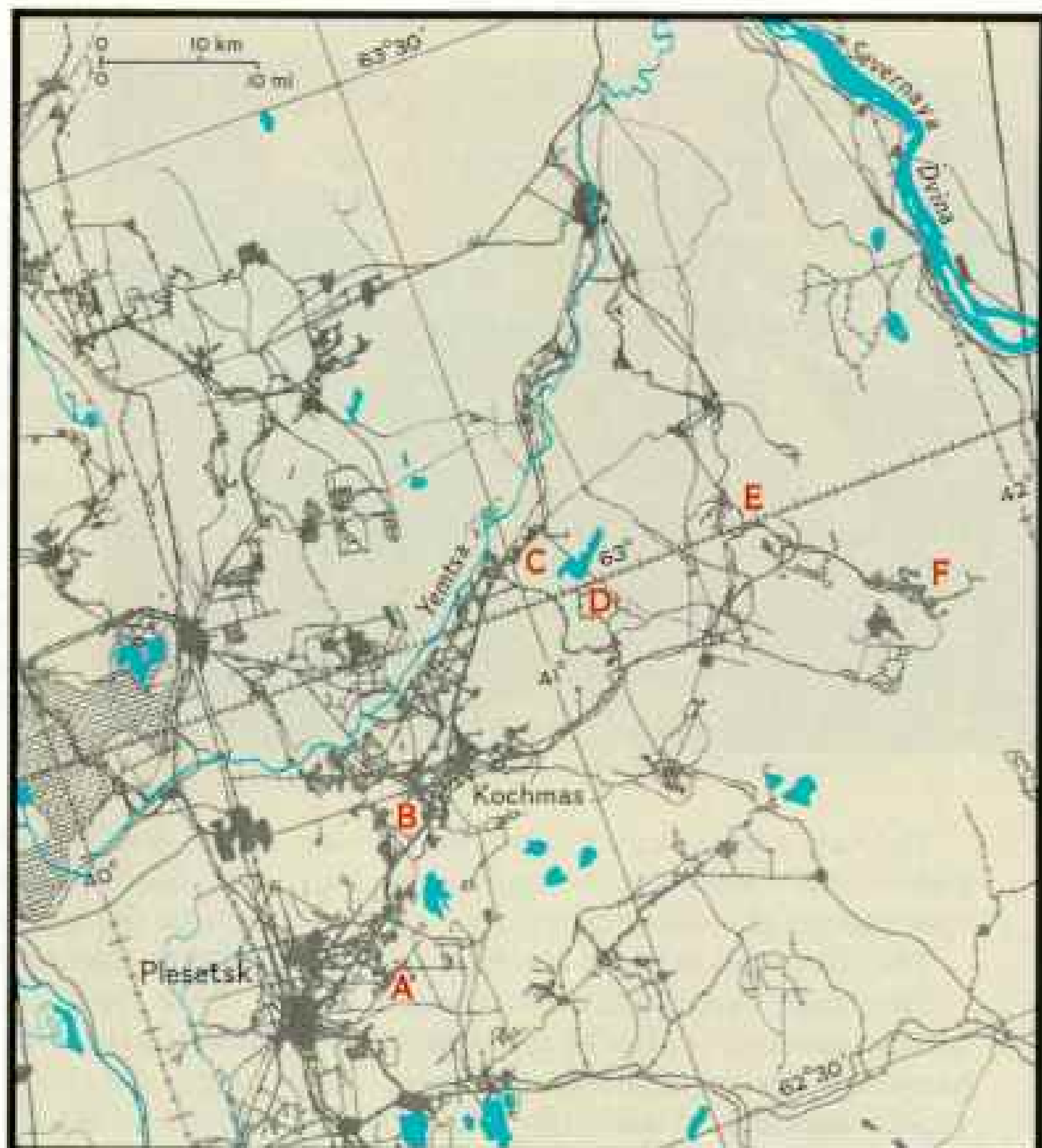
Their capsule begins the looping voyage home. At 9,500 meters a red-striped chute joltingly slows their descent. They bump onto the Kazakhstan steppe, and a recovery team closes in. Like other long-duration space voyagers, Dzhanibekov is weak; a stretcher carries him to a medical vehicle. "Mother Earth is punishing me for leaving her for such a long time," he observes.

On board the Salyut, Vasyutin, a 33-year-old space rookie, takes over as mission commander—a role he will fill only briefly.

Soon Vasyutin, Savinykh, and Volkov receive their first robotic visitor—a module almost as large as the station itself. In it are three tons of fuel and five tons of cargo, including more scientific gear—signs the men will remain aloft many months. Equipped with its own solar-energy system, such a module can fly independently with a space station, serving as an astronomical observatory, an industrial plant for processing alloys and pharmaceuticals, or a giant greenhouse for producing food and oxygen.

Savinykh, scrutinizing earth's surface, discovers promising oil and gas formations in the mighty Pamirs range in Tajikistan. From the springtime of his arrival he has watched the fields and forests take on the deepened green of summer, the hues of autumn, and now the gray presage of winter.





SOVIET-GENERAL ELECTRIC SPACE SYSTEMS DIVISION, MAP © C. P. VICK

THE WORLD'S BUSIEST SPACEPORT

More than a thousand payloads have soared into orbit from Plesetsk, a military facility set among forests, lakes, and peat bogs 800 kilometers north of Moscow. The cosmodrome also serves as a launch site for many of the 400 missiles tested each year—40 times the average U. S. test figure.

Plesetsk began as a launch site for military missiles, chosen for its isolation, rail line, and relative nearness to potential U. S. targets. Total secrecy cloaked its operations. Then in 1966 the Soviets launched a satellite into an orbital path never flown before. This triggered the curiosity of Geoffrey E. Perry, organizer of the Kettering Group of amateur Soviet space analysts.

Mathematically tracing the satellite to its origin, Mr. Perry announced to the world the new cosmodrome's location—18 years before the Soviets acknowledged its existence.

Capitalizing on unclassified U. S. satellite imagery made earlier this year, analyst Charles Vick has lifted another veil from Plesetsk. In his interpretive drawing (above), the letter A marks Plesetsk's airport. A military research and development center, B, stands near Kochmas. The hub of the complex borders the Yemtsa River along line B-C; here stand perhaps a dozen launchpads. Silos holding ICBMs—both operational and for testing—lie along line B-D-E-F.



NATIONAL GEOGRAPHIC PHOTOGRAPHER STEVE RAYMER (ABOVE); PAUL D. MALEY (FACING PAGE); PAINTING BY NATIONAL GEOGRAPHIC ARTIST WILLIAM H. BORG

Spaceships passing in the night, *Mir* and *Salyut* flew above Washington, D. C., last April (right). With such time exposures, Houston resident Paul D. Maley monitors many Soviet satellites. A cadre of amateur sleuths worldwide provides much of the available public information.

At the U. S. Space Command (left) in Colorado Springs, a monitor shows *Mir*'s orbit. Alert for missiles fired from Soviet silos, mobile launchers, and submarines, the Space Command tracks some 6,000 space objects, including 150 active Soviet satellites.

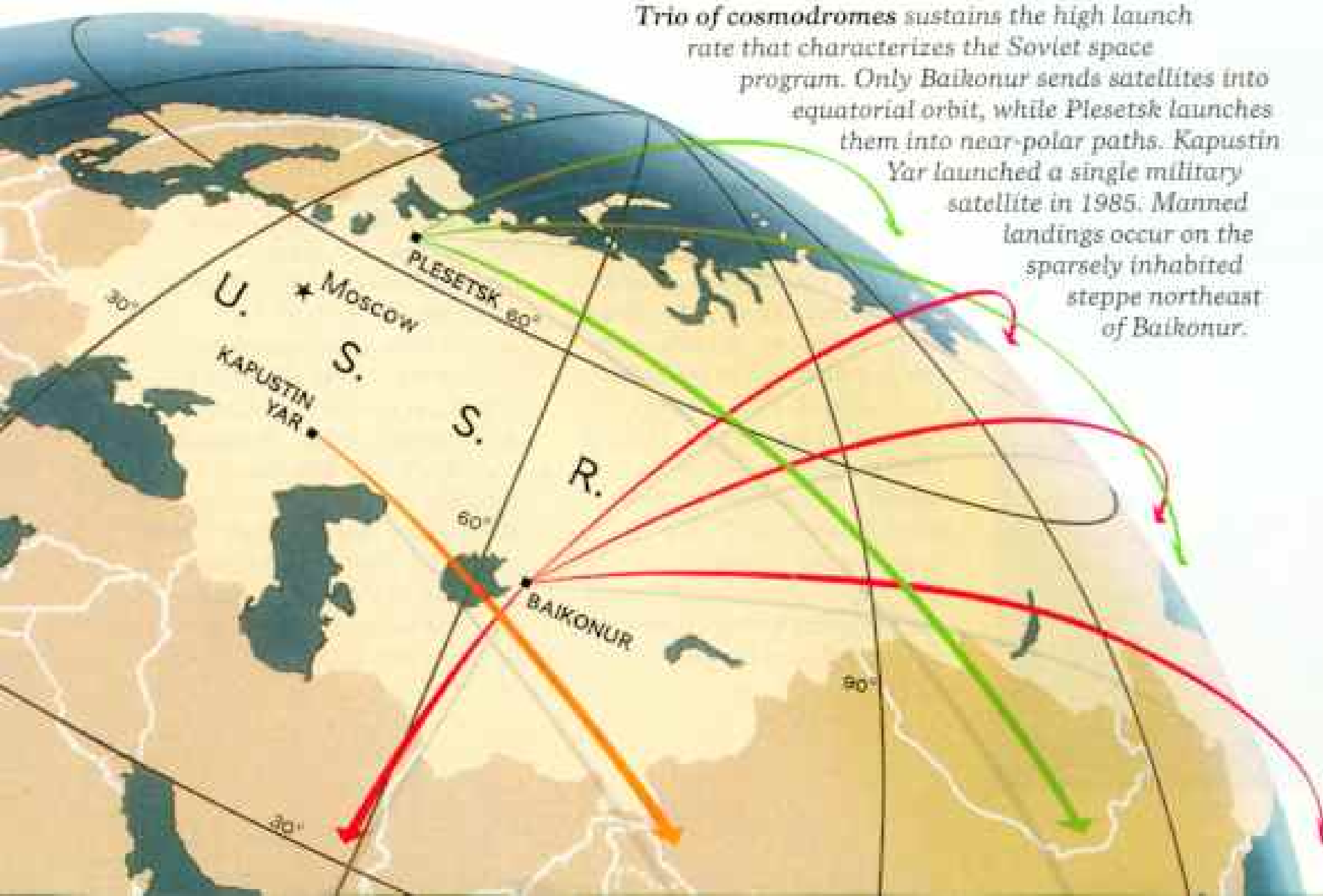
The new crew members have brought a green thumb. The tiny greenhouses burgeon with sprouts of onions and lettuce.

They have also brought trouble.

Soon after Vasyutin takes command, his crewmates observe that he is behaving abnormally—"tense, a bundle of nerves," Savinykh confides in his diary. Racked by fever, he remains all day in his sleeping bag. Increasingly the work load falls on the experienced but mission-weary Savinykh. He and Volkov persuade Vasyutin to consult with the ground. Around the world Soviet

space-watchers eavesdropping on *Salyut* transmissions detect scrambled signals; they assume the conversations concern military matters, the usual cause for secrecy.

Back from Flight Control come recommendations from Academician Oleg Gazenko, the U.S.S.R.'s top space doctor. Vasyutin's mood improves, but anxiety permeates the mission. In the long history of Soviet manned flight, with its rigorous psychological and physical screenings (even a tooth that can cause trouble is pulled before lift-off), illness has never curtailed



Trio of cosmodromes sustains the high launch rate that characterizes the Soviet space program. Only Baikonur sends satellites into equatorial orbit, while Plesetsk launches them into near-polar paths. Kapustin Yar launched a single military satellite in 1985. Manned landings occur on the sparsely inhabited steppe northeast of Baikonur.



a mission. To have to abort would be both costly and a blow to morale.

The scrambled communications continue, heightening the interest of Western observers. Savinykh and Volkov begin to deactivate the station. On November 21 the three disappointedly enter their Soyuz taxi. Savinykh closes the hatch on the station that he and Dzhanibekov had entered with such hardship 167 days before.

Their capsule descends through a wintry sky and thuds onto the bleak steppe. A helicopter whisks Vasyutin to a nearby town, then an airplane bears him to a Moscow hospital. Later, word spreads that the youthful cosmonaut has suffered a severe inflammation, perhaps pneumonia. Savinykh and Volkov are weak but healthy. The nation lavishes praise on their accomplishments, which include 400 scientific observations and the photographing of 16 million square kilometers of earth's surface.

TO LEARN THE ANATOMY of the complex Soviet space organism, I visited key facilities clustered around Moscow. At Kaliningrad, a northern suburb, my hosts took me through Flight Control, an electronic nerve center incongruously carpeted with Oriental rugs. An immense video screen showed the orbital track of Salyut as it circled earth every 90 minutes. Since February that screen has flashed with a second blip, moving with Salyut—the new space station Mir. Similar in

size, Mir bristles with six docking ports compared to Salyut's two, permitting it to host as many as four large modules.

In another suburb I toured Star City, the campus-like training center for cosmonauts. Here some 50 military pilots, about half the cosmonaut corps, enjoy pleasant housing and well-stocked shops that contrast sharply with spare facilities available to ordinary Muscovites.

"Another 50 or so cosmonauts are civilian engineers; they occupy the center only when training for a specific flight," said Rex Hall, a London analyst of Soviet space activities whose specialty is the cosmonauts. "We think about ten of the total are women."

I followed Gen. Georgi Beregovoy, an illustrious cosmonaut and the center's commanding officer, past training simulators for Salyut and the Soyuz space taxi. Nearby an enormous water-filled tank held a Salyut mock-up; here cosmonauts work submerged in simulated weightlessness. Another room held a centrifuge, used for spinning the cosmonauts to help condition them for spaceflight.

"Their training is much more rigorous than American astronauts'," said Mr. Hall, "but less so than earlier, when no one knew what the cosmonauts would face. Then they were subjected to violent spinning on the centrifuge, intense heat for 24 hours while wearing space suits, ejections from MIG aircraft in flight, parachute jumps, two-week confinements in (Continued on page 447)

BUILDING ON SUCCESS

50 M

To orbit more than a hundred payloads a year, the Soviets employ proved boosters. All but two, the Protons, derive from ballistic missiles; all burn liquid fuels. These Charles Vick drawings incorporate available information and inferences taken from general rocket technology.

Not shown: a projected heavy-lift rocket and a medium-lift booster now being tested.

40 M

Four strap-on boosters fire simultaneously with the core engine in this single-stage rocket.

The Voskhod spacecraft could carry as many as three cosmonauts into orbit. It had no emergency ejection system.

A launch-escape module caps the Soyuz spacecraft; during a 1983 fire on the pad the system saved two cosmonauts. Perforated flanges stabilize the module's brief flight.

30 M

The circular hatch in the Vostok spacecraft permitted the pilot to eject in an emergency.

20 M

10 M

SL-1

1957 to 1958
1,327 kg to LEO*

The world's first ICBM, the SL-1 launched Sputnik in 1957.

SL-3

1959 to present
6,300 kg to LEO

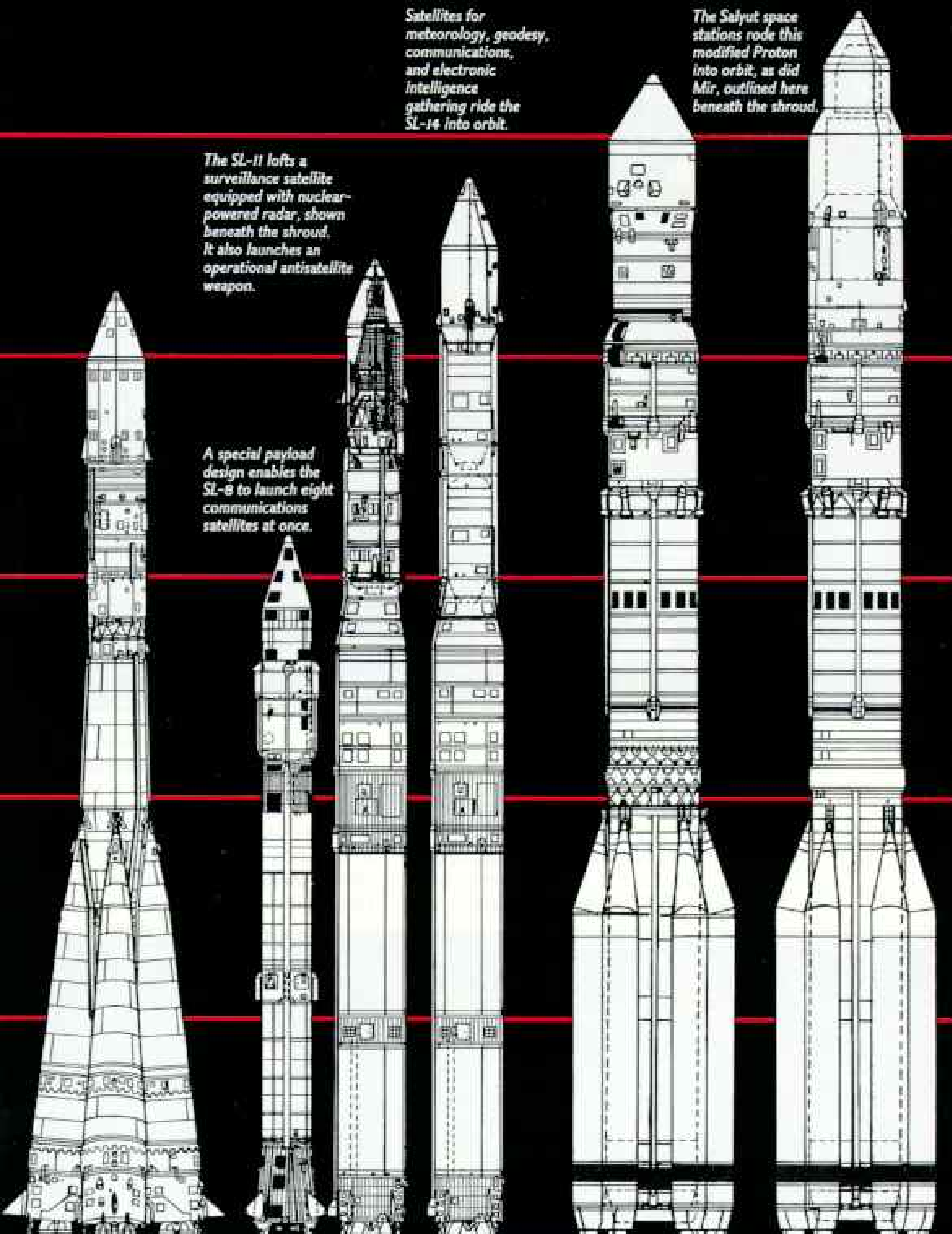
In 1961 this booster carried Yuri Gagarin aloft. The second stage injects the spacecraft into orbit.

SL-4

1963 to present
7,500 kg to LEO

Typifying Soviet economy, this modified SL-1 launched Voskhod manned capsules until their obsolescence and still carries reconnaissance satellites. The reliable Soyuz series of spacecraft—taxi to the space stations—have all ridden the SL-4.

*Lift capability to low earth orbit.



Satellites for meteorology, geodesy, communications, and electronic intelligence gathering ride the SL-14 into orbit.

The Salyut space stations rode this modified Proton into orbit, as did Mir, outlined here beneath the shroud.

The SL-11 lofts a surveillance satellite equipped with nuclear-powered radar, shown beneath the shroud. It also launches an operational antisatellite weapon.

A special payload design enables the SL-8 to launch eight communications satellites at once.

SL-6

1960 to present
2,100 kg to elliptical orbit

A third stage gives extra lift for launching communications, early-warning, and planetary payloads.

SL-8 SL-11 SL-14

1964 to present 1,700 kg to LEO
1966 to present 4,000 kg to LEO
1977 to present 5,500 kg to LEO

This family of rockets was adapted from intermediate and long-range ballistic missiles. The SL-8 is comparable to the U.S. Thor-Delta, while the SL-11 and SL-14 compare to the Atlas-Centaur.

SL-12

1967 to present
2,100 kg to geostationary orbit

Mightiest of operational Soviet rockets, the Protons have been advertised for commercial launches. The SL-12 has four stages.

SL-13

1968 to present
19,500 kg to LEO

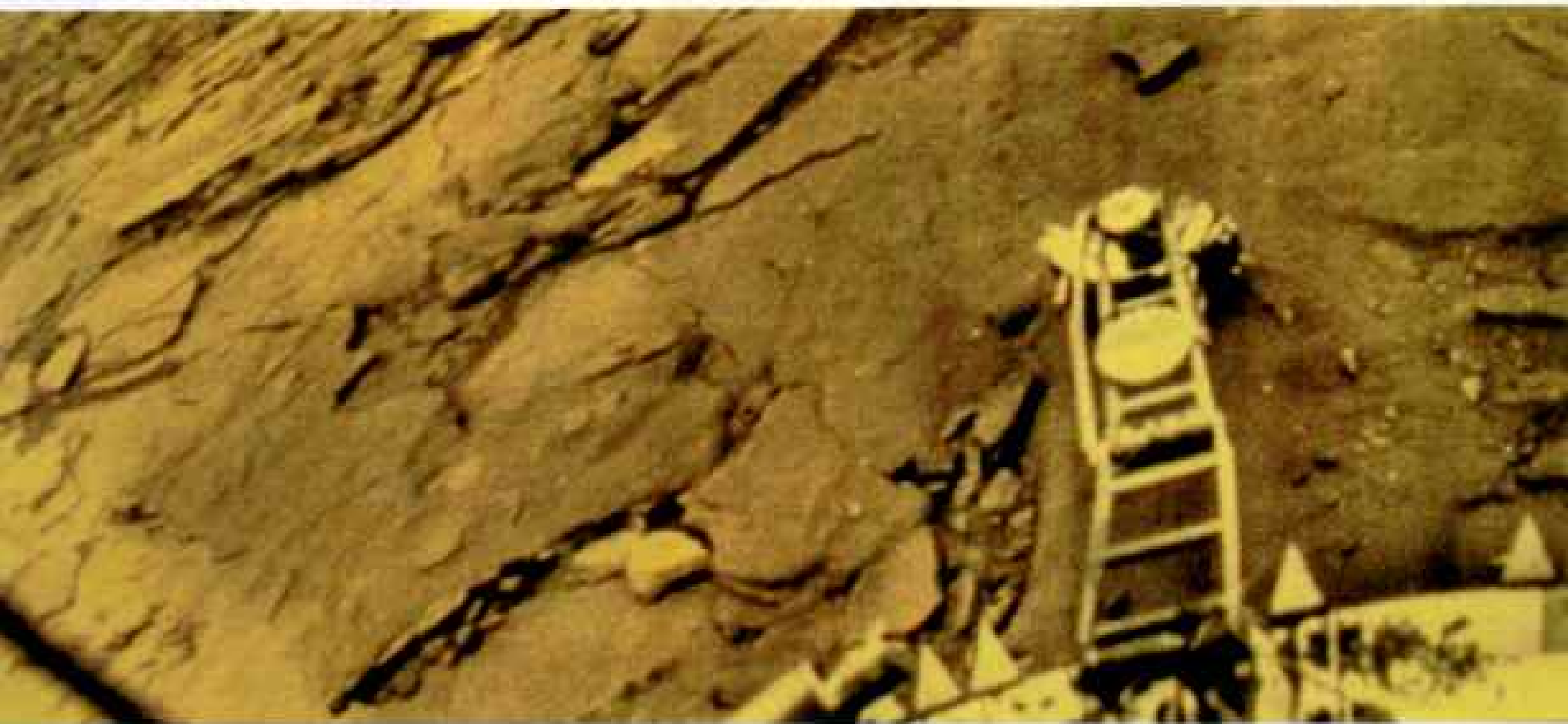
With about a sixth the lift of America's discontinued Saturn V moon rocket, the three-stage Proton outlifts the U.S. Titan 34-D.



STEVE RAYMER (ABOVE); 1988

Biggest draw in Soviet museums, the paraphernalia of space exploration attracts throngs at Moscow's Exhibition of Economic Achievement (above). Satellites and planetary probes line this gallery; another features replicas of the U. S. and U.S.S.R. spacecraft that linked in the 1975 Soyuz-Apollo project.

Soviet space science has reached a pinnacle in studies of the torrid surface of Venus; 13 spacecraft have descended successfully through the planet's corrosive atmosphere. Venera 14 sent back this surface picture (below) in 1982 despite temperatures of 470°C (880°F).



isolation chambers. We believe several trainees died from stress."

General Beregovoy spoke of the space program's large user community—the hundreds of organizations that benefit from space activities. I visited a few: Intersputnik, the small Soviet-bloc version of the worldwide Intelsat communications network; the meteorology office, whose director said space observations had sharpened forecasting by perhaps 20 percent; the earth resources office that processes imagery as sophisticated as that from U. S. Landsats.

EXCEPT FOR the cosmonauts' uniforms, the biggest user remained unseen: the Soviet military establishment. Subordinate only to the Communist Party apparatus, the Ministry of Defense and its Strategic Rocket Forces—the elite of the armed services—direct a far-flung empire of design bureaus, manufacturing centers, and launch sites.

"Of the 98 missions of 1985, two-thirds were military, and many more had dual roles," according to Nicholas L. Johnson, a leading Soviet space analyst with Teledyne Brown Engineering. Each January he publishes a meaty review of the preceding year's activities. Selective combing of his *Soviet Year in Space 1985* reveals much:

January: On command from military planners in the Kremlin, a six-ton spy satellite changes orbit to swoop low over the

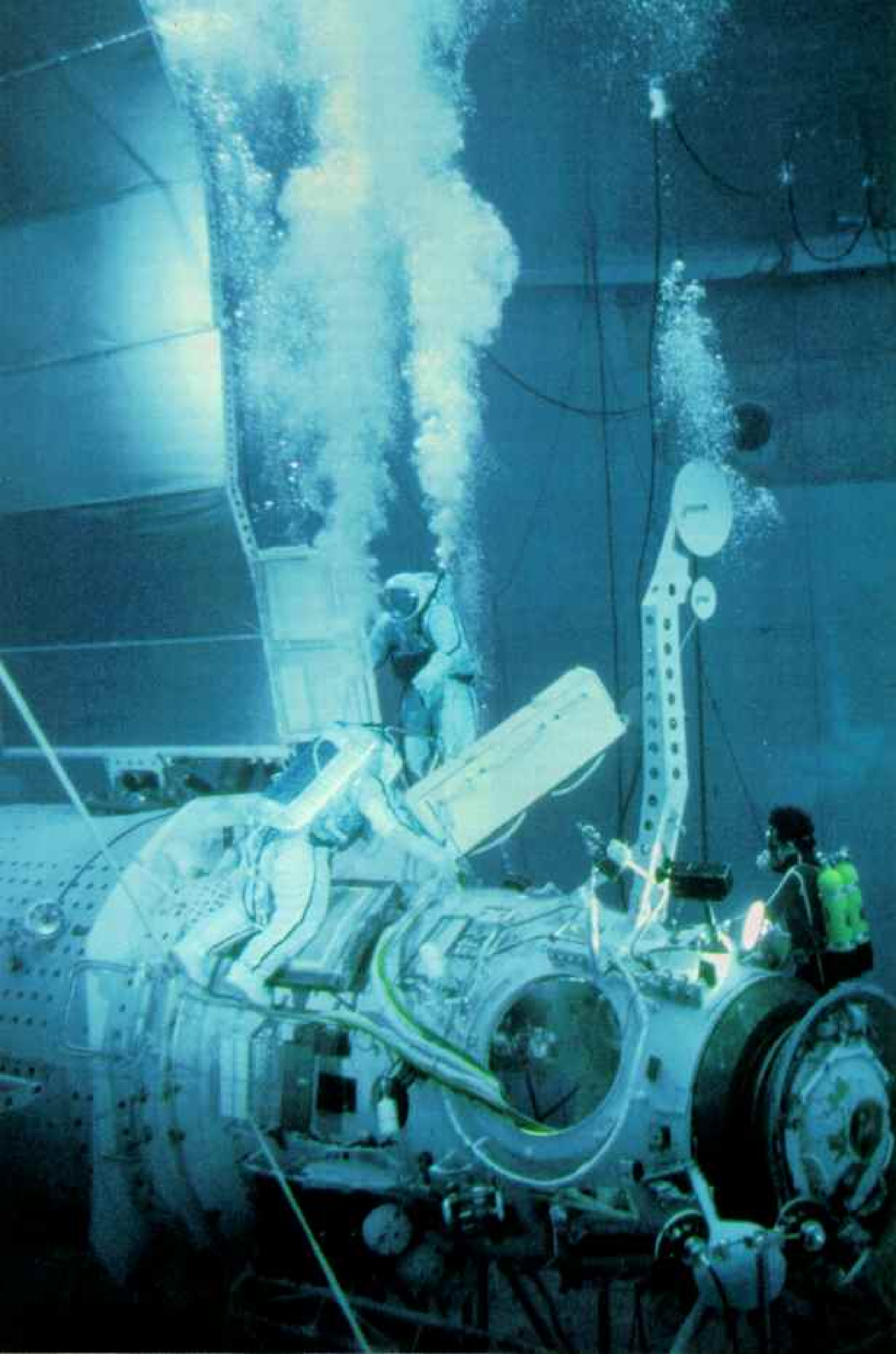
Iraq-Iran battlefield; three weeks later Iraq, a Soviet ally, launches a major offensive. From Baikonur a satellite known as a Gori-zont lifts into geostationary orbit; there it joins other satellites that relay television signals and the backup hot line between the Kremlin and the White House.

February: A mystery satellite, one of several for the year, goes into geostationary orbit; observers speculate that it is a new type of military communications satellite. U. S. radar observes the strange death dance of a radar ocean-reconnaissance satellite, or RORSAT: On command from the ground a nuclear reactor that powers the satellite separates and is propelled to a higher orbit, where it will park for centuries with its radioactive wastes. (In 1978 a similar satellite turned rogue; ignoring commands to separate, it tumbled out of control and spewed a swath of radioactivity across Canada's Northwest Territories.)

March: A new-generation spy satellite goes up, and it will function for 207 days—a record for the usually short-lived Soviet orbiters. In an intriguing multiple launch a rocket carries up eight communications satellites and dribbles them into orbit. Authorities announce the death of Venera 15, which for a year and a half made radar maps of Venus; a companion satellite, Venera 16, still scans earth's sister planet.

April: The Soviets orbit an ocean-surveillance satellite designed to garner





electronic intelligence from U. S. fleet communications and radar signals. Such EOR-SATs, along with the nuclear-powered RORSATs, give the Soviets a capability unmatched by U. S. space hardware.

May: To watch the Israeli evacuation of Lebanon, a spy satellite dips low over the action. Three navigation satellites join the U.S.S.R.'s two constellations of civilian and military space navigation aids. Several carry devices to relay distress signals from ships and aircraft as part of an international search-and-rescue apparatus; already it has saved an estimated 600 lives worldwide.

June: A large photoreconnaissance satellite, heading from South America toward the U. S., suddenly breaks up; experts deduce that the Soviets triggered a destruct mechanism in fear it might land on unfriendly soil. An early-warning satellite rises from busy Plesetsk Cosmodrome; it is one of seven sent up during the year to detect U. S. ballistic-missile launches. VEGAs 1 and 2, scientific probes that will rendezvous with comet Halley, drop off robots to analyze the hot soil of Venus and balloons to sample its atmosphere.

July: A space-age Noah's ark departs Plesetsk carrying wildlife for biological tests: two monkeys named Vernyy and Gordyy, ten rats, 1,500 flies, iris plants, and ten newts—each with an eye lens and a foot removed. On landing a week later, the newts show that regeneration took place as quickly as on earth, providing insights into how human injuries might heal in space. The placing of monkeys in near-polar orbit suggests that humans soon may follow.

August: Two nuclear-powered RORSATs enter orbits that enable their radar to follow NATO fleet exercises.

September: Ten reconnaissance satellites look down—the largest number ever.

October: Twice the Soviets send up three rockets in a day—17 launches during this busy month. On orders from the ground the nuclear-powered RORSATs that observed NATO ships send their radioactive payloads into higher parking orbits.

November: In a lull following the October launch frenzy, only five satellites go up.

December: An electronic spy satellite as big as a bus climaxes a dozen launches for the month, 98 for the year.

Weightless in water, cosmonauts rehearse extravehicular activity at Star City, their training center outside Moscow (facing page). Here they install solar panels on a Salyut 7 mock-up.

Svetlana Savitskaya tests an arc welder during the first female spacewalk (below). She "demonstrated the stamina and strength of a man," declared colleague General Dzhanibekov.



NOVOSTI PRESS AGENCY (LEFT); TAGE

TO SUSTAIN this busy launch rate, the Soviet Union relies on an assortment of time-tested rockets. They emphasize Soviet policy of shunning exotic hardware in favor of the simple and reliable, while steadily improving on it. Invariably their vehicles have been powered by liquid fuel rather than by solid propellants such as boosted the ill-fated shuttle *Challenger*—propellants that cannot be tested before flight or turned off once ignited.

"Their workhorse rocket is the same that launched the first intercontinental ballistic missile in 1957," notes Charles P. Vick, a foreign-technology analyst with the Space and Rocket Center in Huntsville, Alabama. "It's sent up over a thousand payloads."

In the mid-1960s he and others observed that the Soviets were sending up big payloads—bigger than their known rockets could lift. Assembling scraps of data, Mr. Vick in 1973 published a tentative look at the Soviets' Proton rocket, still their most powerful operational booster.

Western observers learned that engineers were developing an even larger rocket. Rumors mounted. But data was sparse, and as usual the Soviets said nothing.

In an obscure Soviet book Mr. Vick discovered a sketch of an unfamiliar launch gantry. From the construction of the gantry he painstakingly re-created the design of the rocket that would be married to it—



the Soviets' supersecret heavy-lift booster.

"This one defeated them," he notes. "To achieve lift-off, they clustered some 18 engines for the booster's first stage. The engines had to fire synchronously or the rocket would vibrate until it tore itself apart.

"The first test exploded on the pad at Baikonur, leaving a scorch mark that was visible on satellite imagery. The second ripped apart 12 kilometers up. The third rocket climbed nearly 40 kilometers, then ripped apart. Only now do the Soviets appear to have a viable heavy-lift rocket."

Despite the Soviets' cautious advance into space, they have known disasters. A rocket exploding on a Baikonur launchpad took scores of lives in 1960, according to James E. Oberg, a manned-spaceflight expert with the U. S. shuttle program. Seven years later Vladimir M. Komarov, pilot of the first Soyuz, became the world's first space fatality when a chain of mechanical failures caused the craft to tumble on descent.

In 1971 the first Salyut crew, returning after a triumphal mission, descended gently

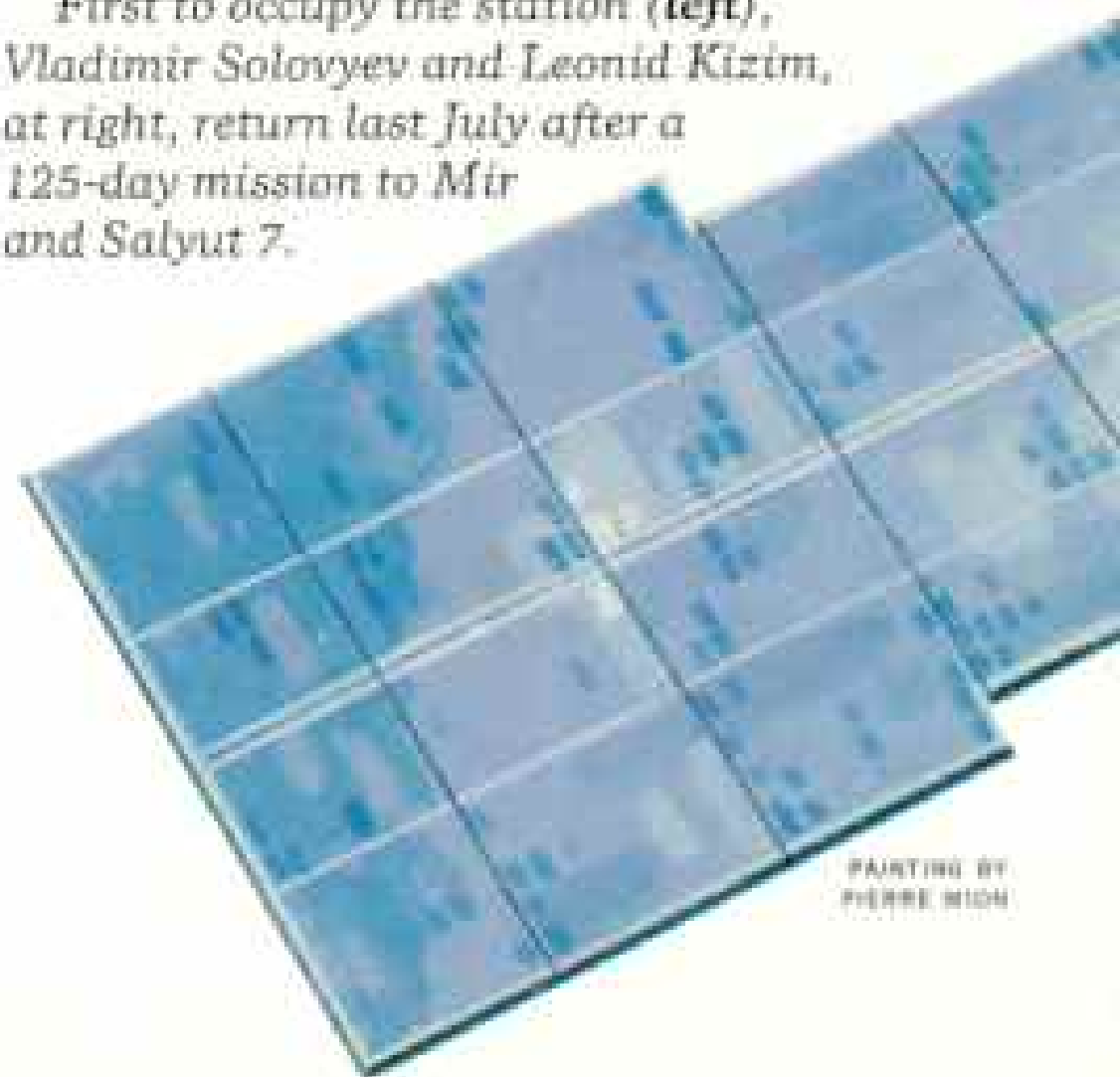
MIR CORE OF A SPACE COLONY

Mankind's permanence in space may begin with the Soviet station Mir, Russian for "peace." Launched February 1986, Salyut-size Mir boasts improved control and operations systems, expanded crew space and—most significantly—a forward docking adapter equipped with five ports.

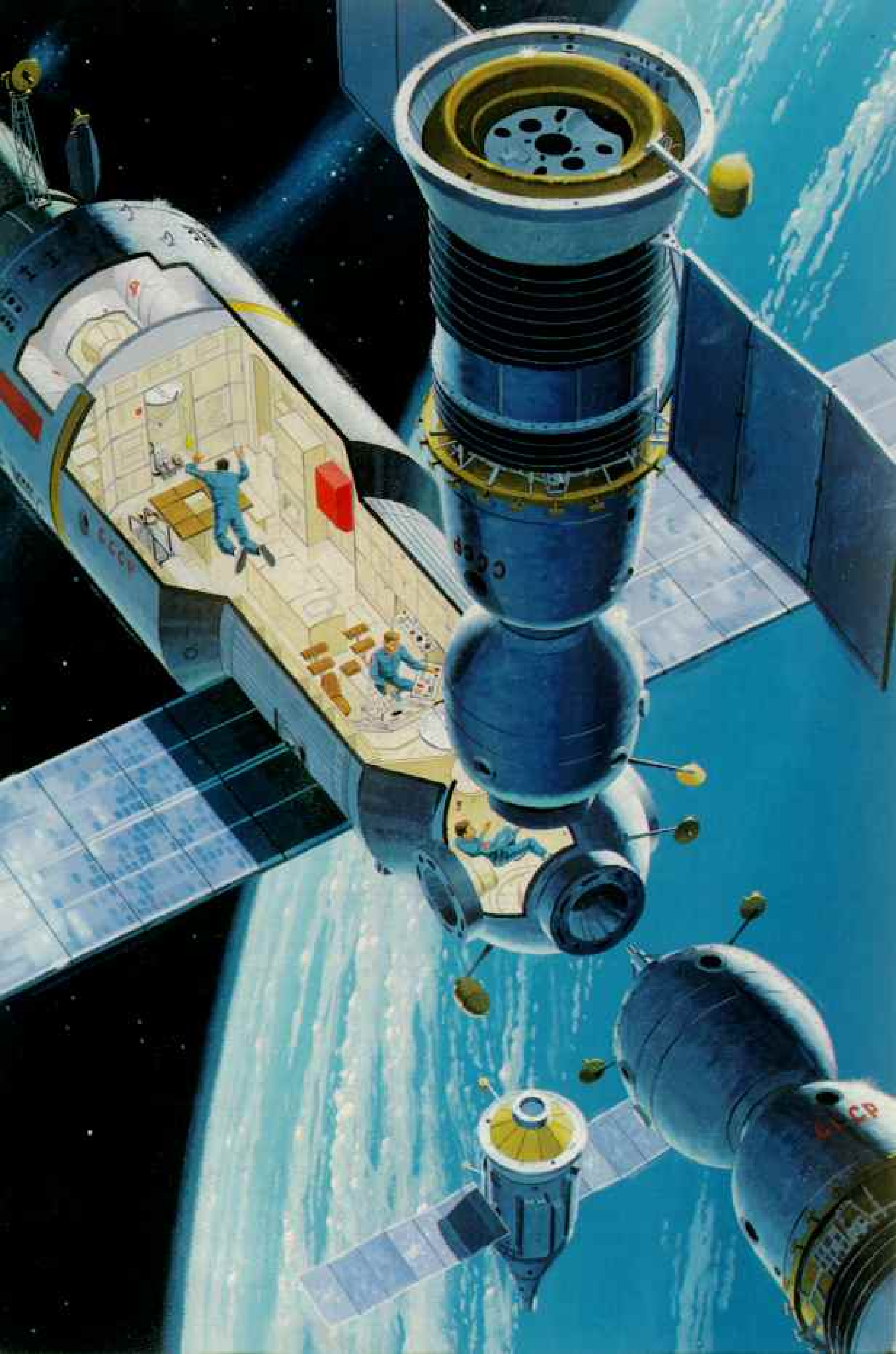
Here, four craft—all already in use—deploy at the station. A Soyuz TM space taxi has docked vertically. A second TM departs the forward port as a crew member inspects the docking seals. Flying in formation, lower, is a large module, nearly the size of Mir itself. Equipped for manned and unmanned operation, it could house experiments for astronomy, materials processing, or horticulture; periodically it will dock with Mir. At the station's stern rides a Progress freighter.

Inside Mir a cosmonaut monitors the control station while another floats toward his compartment with sleeping cocoon and porthole—gracious living by space standards. A treadmill for jogging stands at the cosmonaut's left.

First to occupy the station (left), Vladimir Solovyev and Leonid Kizim, at right, return last July after a 125-day mission to Mir and Salyut 7.



PAINTING BY
PIERRE HIGN

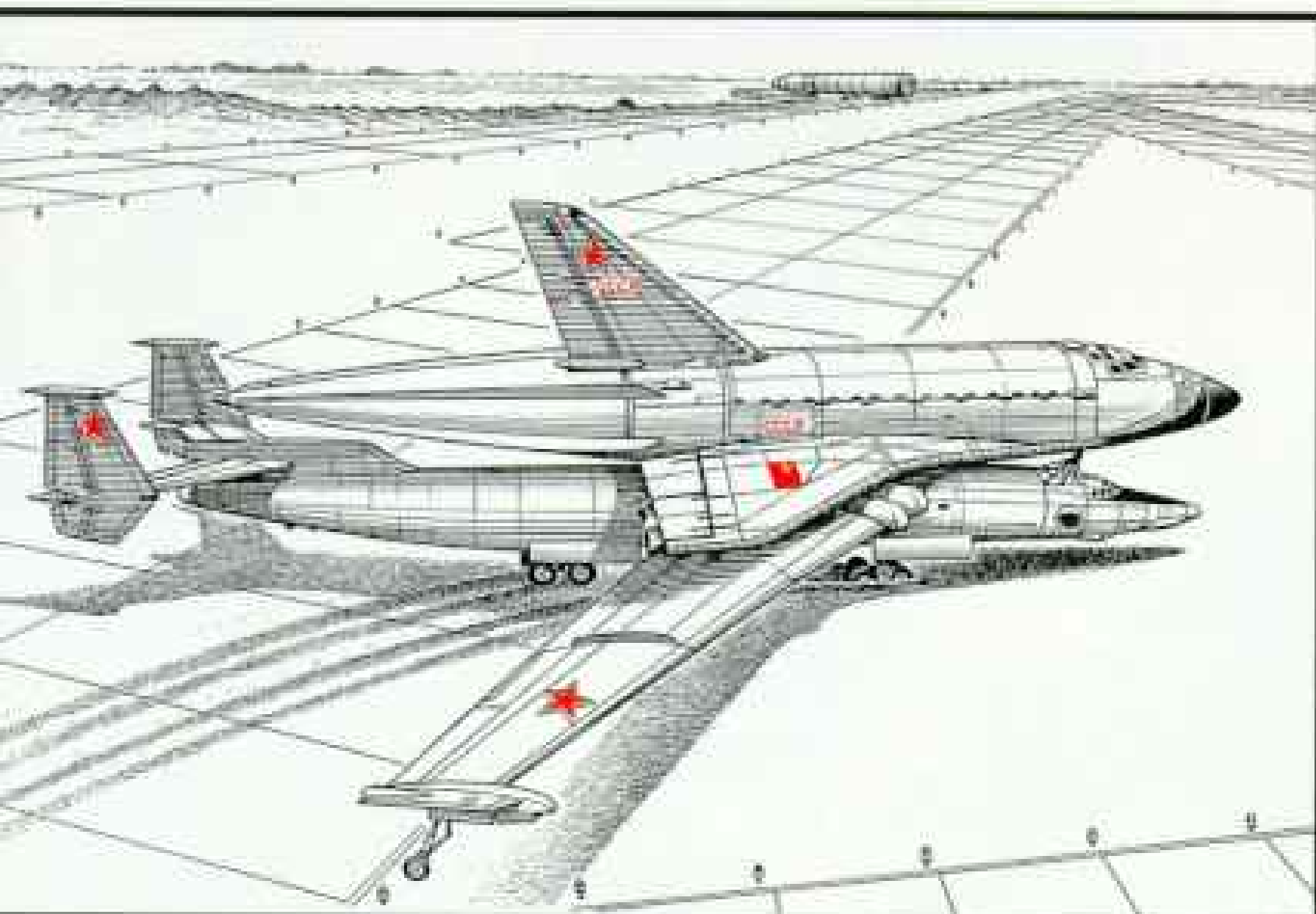


Mystery craft swings aboard a Soviet vessel (right) after being fished from the Indian Ocean. The dunce-cap cone, extended after touchdown, holds an electronic locating device. Experts debate whether the spaceplane is a test craft for materials and aerodynamics, a model for a larger personnel ferry—or a vehicle for antisubmarine weapons.

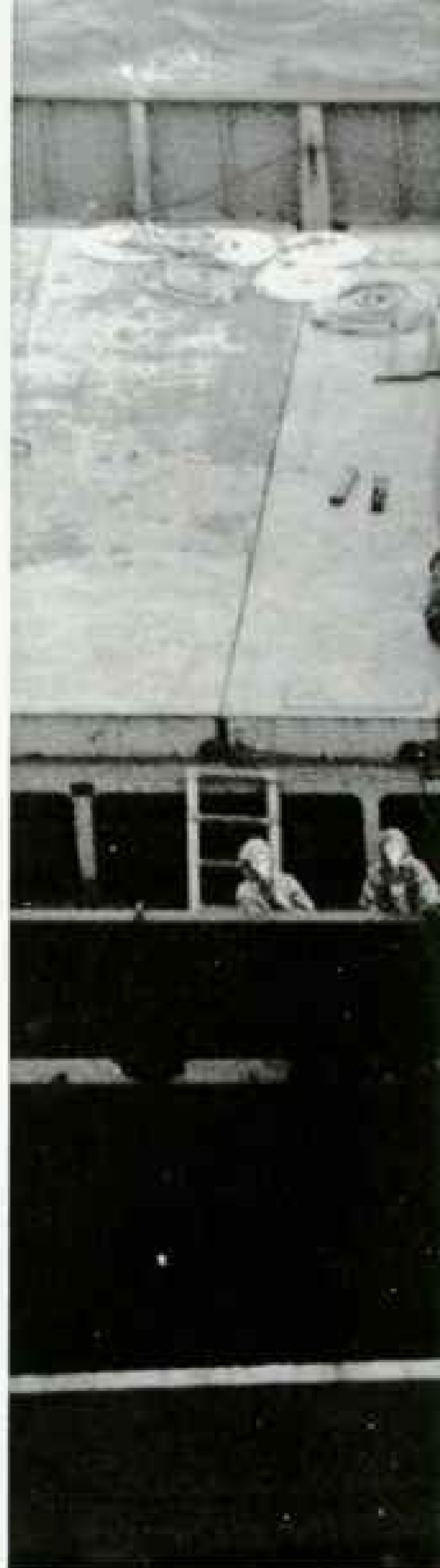
Skidding off a runway at Ramenskoye (below), a Bison bomber carries the Soviet shuttle after a piggyback flight test. This sketch is based on reports of a satellite photograph taken of the

accident before the Soviets could conceal it.

Though similar to the U. S. shuttle, the Soviet craft enjoys design advantages, according to experts. Where the U. S. craft carries main engines and much fuel, the Soviet shuttle has only small engines for orbital maneuvers; main engines ride the heavy-lift rocket. This will enable the Soviet shuttle to carry a larger payload. Many experts also believe the Soviet version is equipped with additional air-breathing engines that will unfold from the fuselage for greater maneuverability in landing.



DRAWING BY DAVID MELTZER AFTER C. P. VICK, AUSTRALIAN DEPARTMENT OF DEFENSE (RIGHT)

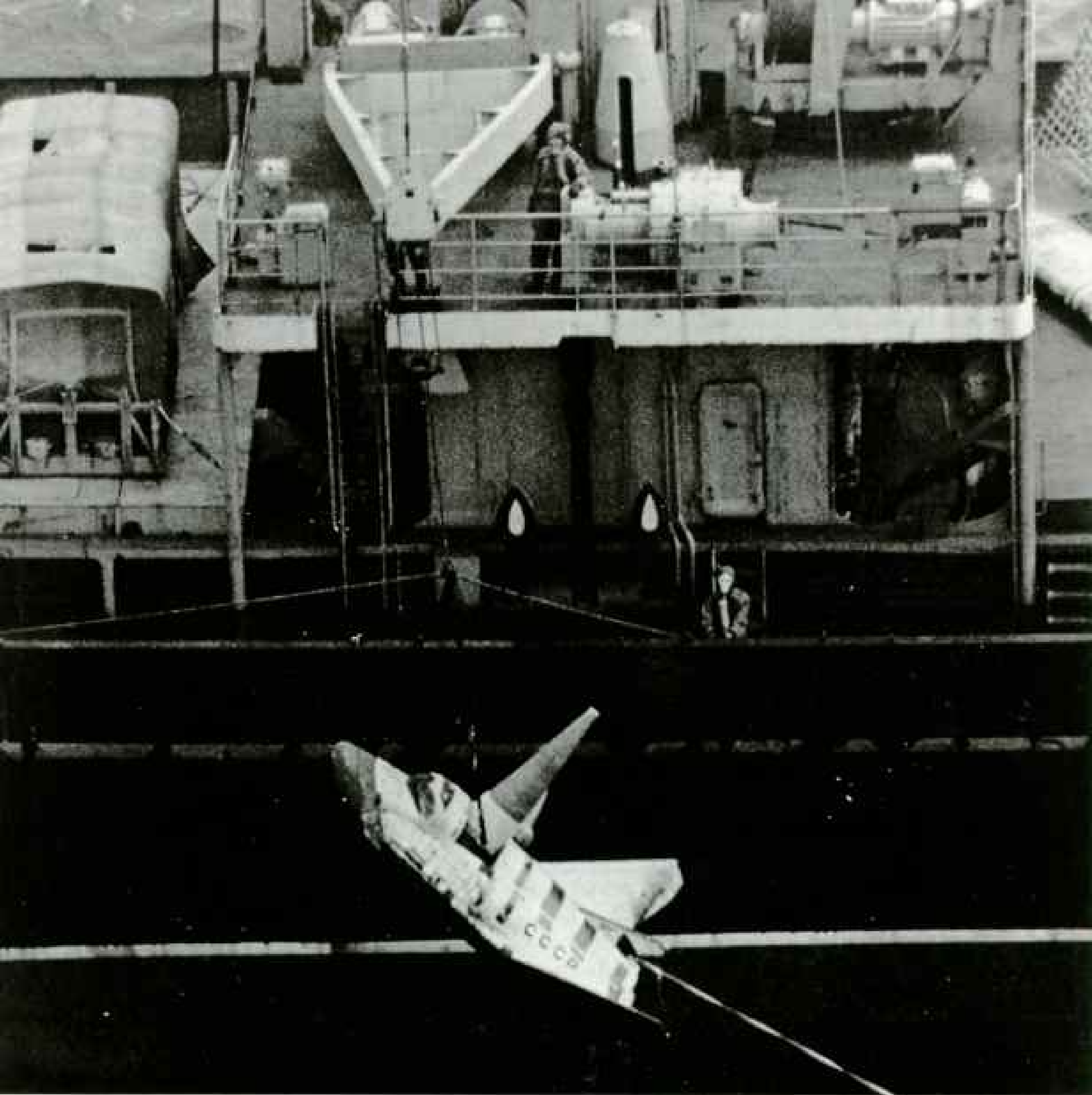


in their Soyuz. Recovery crews opened the hatch, and the three men stared from their seats—dead. A defective valve had permitted their atmosphere to escape.

In 1983 a rocket stood on a pad at Baikonur, poised to hurl a two-man Soyuz crew toward Salyut 7. Suddenly launch crews saw flames leap up the rocket shaft; with horror they realized the fire had destroyed the automatic switch for the escape system. Now controllers in two different stations had to order it to fire simultaneously. Seconds passed. Flame enveloped the rocket. It exploded in a massive fireball—just as the

escape capsule shot upward. At one kilometer it slowed, a chute emerged, and the men landed, shaken but unhurt.

Charles Vick, Nicholas Johnson, Rex Hall, and James Oberg belong to a loose confederation of analysts who, spurred by the challenge of Soviet secrecy, devote time and immense ingenuity to penetrating and publicizing the U.S.S.R.'s space program. One center for this benign espionage is the English town of Kettering, an hour by fast train north of London. Its leader is a retired physics teacher named Geoffrey Perry, who two decades ago started a worldwide



network known as the Kettering Group.

"Every satellite transmits a distinctive sequence of beeps; the beeps and their frequencies indicate the nature of the mission," explained Mr. Perry of his sleuthing. "We also depend on your U. S. Space Command in Colorado Springs." Every day it reports on the orbits of all space objects, including the 150 active Soviet satellites. "We look for *changes* in orbits," said Mr. Perry, "things out of the ordinary. Then we know the Soviets are up to something. For example, I've been following a reconnaissance satellite that sends back information by television.

They've been moving it up and down like a yo-yo, looking at trouble spots."

INSIDE tunnels honeycombing Cheyenne Mountain, the Space Command maintains a vigil of awesome sophistication. In large measure it is a monument to the Soviet military presence in space.

Three times already, on the day I entered the mountain, an alarm had shrilled and a red light flashed in the Missile Warning Center. Three times the warning was relayed to Washington, D. C., and a command center in Canada, partner in standing

sentry over the U.S.S.R.'s 1,400 ICBMs and 62 missile-laden submarines. All three alarms were ICBM tests, detected by U. S. early-warning satellites.

Early in the space race the U.S.S.R. and the U. S. began experimenting with anti-satellite measures—rockets and other devices for destroying the other side's orbiters. In 1968 the Soviets tested a killer satellite that closed on its target and exploded, disabling the prey with shrapnel. A score of tests followed, with about half successful; then in 1983 the Soviets announced a test moratorium. Meanwhile the U. S. had responded with an antisatellite rocket borne by an F-15 fighter; it was fired three times before Congress put tests on hold in 1985.

In 1983 a Royal Australian Air Force unit photographed Soviet seamen recovering a small space plane that had splashed down in the Indian Ocean after a single orbit. Four such flights have now been made. Some experts believe the space plane could be a test model of a larger vehicle to ferry personnel to Soviet space stations. Others suspect it is a missile carrier that could drop out of space onto U. S. carrier fleets.

ON A RAINY DAY in Moscow I visited a great gray structure housing the Space Research Institute. The facility had a worn look, as did its less-than-new computers. Worn, but not tired. For here a galaxy of scientists directs a vast panoply of space programs for exploring the earth, the moon, and points beyond. Reflecting the hospitality of its personable director, English-speaking Academician Roald Z. Sagdeev, the institute has fostered warm international cooperation during the chilliest of international climates.

During the moon race the institute sent a procession of vehicles to that great goal—lunar flybys, lunar orbiters, lunar soil samplers. While Apollo 15 astronauts were exploring the moon's Mare Imbrium, the robotic rover Lunokhod-1 was analyzing soil samples only 1,000 kilometers away.

The red planet beckoned, and the Soviets sent forth a succession of probing spacecraft, each laden with tons of equipment. Two missed the planet entirely. Two crashed on the Martian surface—accidents U. S. experts fear may have introduced

earth microbes to the Martian environment. Four other probes making the long journey met with only partial success.

In 1988 two huge Soviet vehicles will again venture to Mars, to study its enigmatic moon Phobos. If everything goes well, small landers will descend, then hop about in great kangaroo leaps, chemically analyzing the surface.

The institute's greatest successes were to inhospitable Venus. Time after time Soviet robots have raced through the solar system to overtake the planet, groped downward through its searing gases, and soft-landed to photograph and taste-test the scalding soil. "The missions are a remarkable testimony to Soviet capabilities," observed Dr. James Head of Brown University, a leading U. S. planetary scientist who has worked cooperatively with Soviet counterparts.

Cooperation between the two space powers reached an apogee in 1975, when their spacecraft rendezvoused in orbit and the crews—two Soviets and three Americans—spoke each other's languages as they conducted experiments. Known to the Soviets as the Soyuz-Apollo project, it still is a source of national pride.

As commander the Soviets chose Alexei Leonov, first man to walk in space and a demigod in the pantheon of Soviet space heroes. Three-flight veteran Tom Stafford led the American crew, which included Vance Brand and Donald K. "Deke" Slayton.

During training, Soyuz-Apollo crews and support teams visited each other's countries half a dozen times, giving U. S. experts their closest look at the Soviet space program. I talked with crew member Deke Slayton, now president of Space Services, Inc., a commercial launch company.

"Fine, generous guys," he recalled of his Soviet colleagues. "We were all pilots, with a lot in common. Their training was like ours except they spent less time in simulators and more in the classroom. They weren't as technically oriented. We were involved in engineering, while their role was primarily medical. They didn't like being guinea pigs, but they went along."

Mr. Slayton spoke of the cosmonauts' lofty social status. "They're heroes—almost revered. The Soviets have been playing at being atheists, and the cosmonauts seem to

fill a vacuum." And so it seemed to me. Exploits in space stir the Soviet soul like a religion—stirrings fanned by a government immensely proud of space successes.

At the cult's pinnacle stands the martyred Yuri Gagarin. Only Lenin's likenesses outnumber his among busts and paintings honoring Soviet heroes. At the numbing news of his fiery plane crash in 1968, Red Square spontaneously filled with silent mourners.

An estimated 175 space museums attract devotees across the land. In the vast Young Pioneers program, the Young Cosmonauts attract the best and the brightest. Television, newspapers, postage stamps—all tout Soviet achievements in space.

SEEING the uneven progress of Soviet technology, I often wondered how this still industrializing land had achieved a lead role in the exotic arena of space exploration. For an answer my hosts took me to Kaluga, 160 kilometers southwest of Moscow, where a century ago a rustic genius charted the course to the stars. Here Konstantin E. Tsiolkovsky, a near-deaf schoolteacher who had read Jules Verne, made the theoretical calculations necessary for man to "emerge from the bounds of the atmosphere."

Soviet space research surged after World War II with an influx of German rocket technicians who were pressed into service. The Soviets acquired V-2 rockets, along with blueprints for an ocean-spanning monster designed to hit New York City.

The stage was set for the final triumph. Sending probes ever higher, in 1957 the Soviets put in orbit a small sphere they called Traveler—in Russian, Sputnik.

In the fine space museum at Kaluga I heard a recording of the next great event Tsiolkovsky made possible, the launching of Yuri Gagarin: the firm command to fire the rocket, the terrifying roar, then Gagarin's jubilant cry, "*Poekhali!*—Let's go!"

That command to fire came from another great space figure, Sergei P. Korolev, the engineer whose forceful personality translated Tsiolkovsky's calculations into rockets and spacecraft. The Soviets kept his name secret during his lifetime, referring to him only as Chief Designer.

What of the future? Where are the Soviets

headed in space? Obviously no ready road map greets the inquirer. But my hosts gave some hints, and Western analysts contribute plausible projections.

Space stations: Western observers see Salyut and Mir being replaced in a few years by a larger station. This hinges on successful launching of a heavy-lift booster comparable to that which lifted Skylab. "They could assemble a large station today, piece by piece," said Geoffrey Perry. "But it's much more efficient to send up large components."

U. S. Defense Department analysts expect test launches of a jumbo rocket at any time, with a new generation space station to follow within a year or two. "When it flies, it will be huge," calculates Charles Vick, "about 8.3 meters in diameter and weighing at least as much as Skylab."

Meanwhile the Soviets are expected to dock as many as four large modules at Mir, with continuously operating crews.

Shuttle: The Soviets contend that their inexpensive, mass-produced rockets make a shuttle unnecessary for the near future. "We see no need until the next century, when we will want to transport more material between earth and space," General Dzhhanibekov told me.

U. S. analysts dispute this. U. S. satellites have photographed the Soviet shuttle. Defense Department spokesmen add that it will look familiar—built partly from U. S. shuttle plans obtained by means of an immense Soviet apparatus for technology acquisition.

Space industries: Despite a slackening of U. S. interest, Soviet authorities speak bullishly of prospects for space manufacturing and processing industries. Pharmaceuticals and semiconductors lead the products list. Gen. Vladimir Shatalov, chief of cosmonaut training at Star City, states that space industries will earn 50 billion rubles (35 billion dollars) annually by 1990.

To the moon? A number of U. S. authorities believe the Soviets will establish an orbital moon station and from there colonize the lunar surface. "They'll do it partly to gain experience for going to Mars," says analyst Marcia Smith, president of the American Astronautical Society.

To Mars? The Soviets feel a spiritual pull toward the red planet. "Even back in the



Heroes in life, demigods at death, Soviet spacefarers inspire a nation. A 1967 photograph captures a trinity idolized by their countrymen (above): Valentina K. Tereshkova, first woman in space; Alexei Leonov, right, first to leave his spacecraft and fly tethered; and—beloved beyond all others—Yuri Gagarin, the ebullient trailblazer whose 1968 plane crash plunged the nation into sorrow.

Cosmonauts join Gagarin's mother, Anna Timofeevna (above), on the 20th anniversary of his flight: Alexei Leonov, behind her, Vladimir Dzhanibekov, beside Gagarin's sister, Zoya, and Yuri Malyshev, veteran of two missions.



The portraits show Gagarin resplendent in medals and Sergei Korolev, guiding hand of the Soviet space program, who selected Gagarin for his historic mission.

Valentina Komarova (right) kisses the portrait of her husband, Vladimir, whose 1967 test of the first Soyuz ended in a fatal crash. His ashes rest in the Kremlin wall alongside those of other Soviet luminaries.

Space museums dot the nation, space stories saturate the news, busts of space heroes adorn buildings and parks, and living cosmonauts enjoy adulation approaching reverence.



ALL FREE FROM SOFOTO



thirties, when Tsiolkovsky was alive, that was our dream," I heard from aged rocket designer Igor A. Merkulov.

The logistics posed by a three-year round-trip are staggering. The Soviets estimate a crew of three would require four and a half tons of food, ten tons of oxygen, and 17 tons of water. "The technology of water regeneration is advancing rapidly," Dr. Gazenko said. "But then there are the psychological obstacles. How do you regenerate the human spirit?"

When will a Mars mission get under way?

Academician Sagdeev stated that a Mars voyage will not take place before the year 2000. Nicholas Johnson interprets Soviet expectations to encompass lunar bases within 20 years, Mars expeditions a decade later.

Yet cosmonaut Savinykh, speaking in Yugoslavia, said he has signed up to ride a Mir to Mars before 1995. This sounds plausible to Londoner Rex Hall. "Once the Soviets accumulate five or so years of success in Mir, they'll feel comfortable moving on to Mars. We could see three or four Mirs and modules in tandem, manned by a crew of six who work and sleep in shifts."

Soviets at all levels speak hopefully of a joint U. S.-U.S.S.R. mission to Mars.

Military: Because the Soviets admit to no military space program, and with much U. S. information classified, Western observers peer into a clouded crystal ball. Most agree, however, that Soviet militarization of space is extensive.

Space stations play a definite military role, with cosmonauts engaged in visual reconnaissance and development of strategic materials. Two Salyuts—3 and 5—were dedicated to military tasks.

The Soviet antisatellite weapon is operational, in contrast to the thrice-tested U. S. version. And the Soviet A-sat can reach higher, to 5,000 kilometers, spokesmen for the Department of Defense stress.

The Soviets' rapid-fire launch capability

confers an enormous military advantage. "If some of their satellites were knocked out, they could quickly replace them," observes Nicholas Johnson. "Our smaller U. S. constellations of satellites would be easier to disable and harder to replace." Even without the disruption of war, accidents had grounded the U. S. launch system at the time of my writing.

Soviet officials speak out vehemently against the U. S. Strategic Defense Initiative, or "Star Wars." But many U. S. experts contend that the two superpowers are steering parallel courses, with the U.S.S.R. perhaps out front in space laser weaponry, a key component of "Star Wars."

"The Soviets already have developed ground-based lasers with the capability to blind low-orbiting U. S. satellites flying directly overhead," said a defense official. "These could be operational by the end of the 1980s. By then the Soviets could be orbiting space-based lasers for use against satellites." Development is also under way on weapons employing particle beams, radio waves, and kinetic-energy devices.

SO WHO'S AHEAD in the space race?

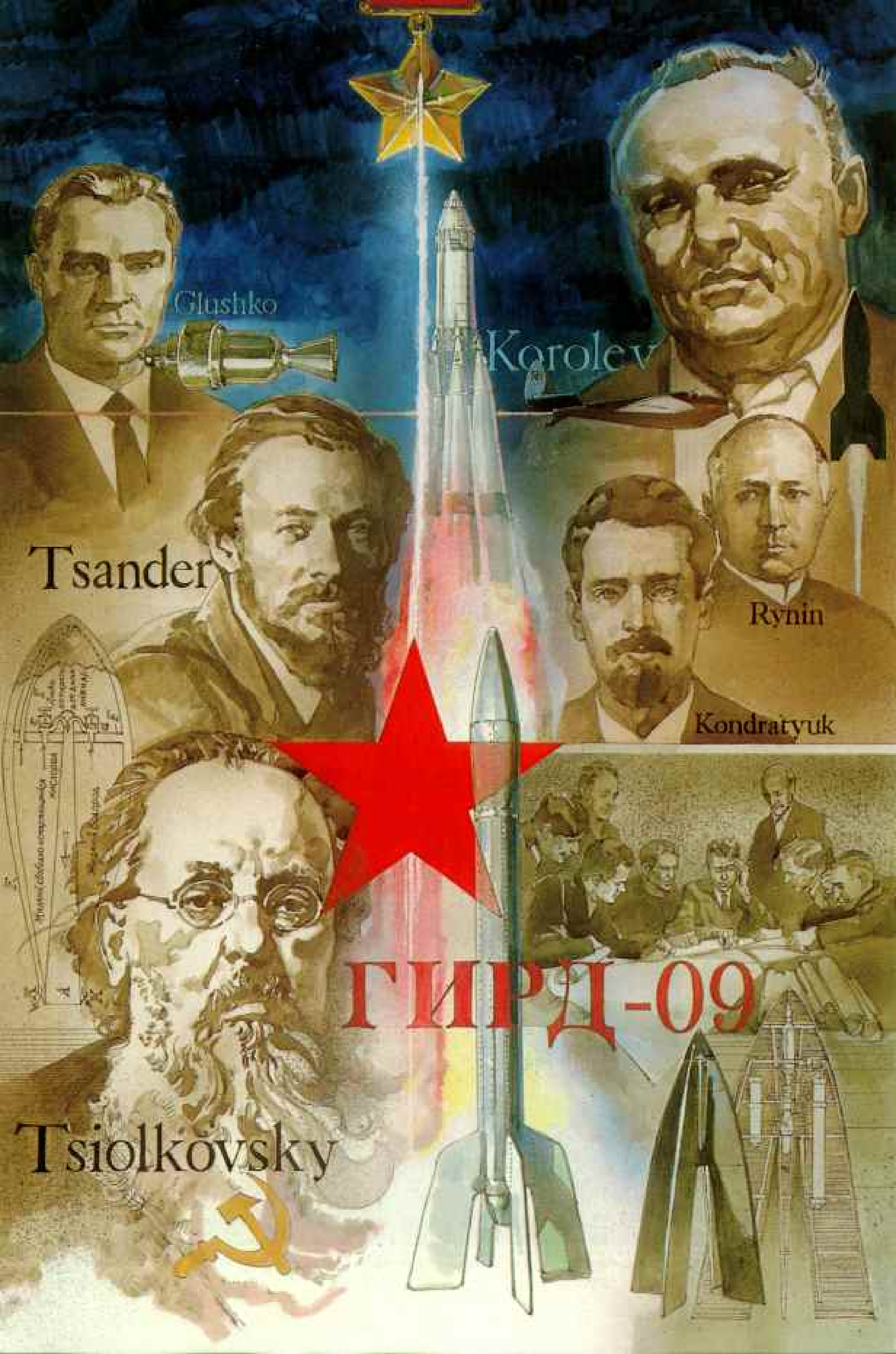
"The U.S.S.R. has a powerful program," said Sven Grahn, a Swedish space engineer and a leading member of the Kettering Group. "In many areas—manned flight, space medicine, materials processing—they may be out front. But they have nothing yet to match American shuttle technology, and they can't go much further without a heavy-lift rocket."

Their strengths, analysts agree, lie in their methodical, building-block approach and the breadth of their commitment: strong military and manned programs, imaginative space-science goals, and a busy launch schedule—all while developing a shuttle and medium- and heavy-lift rockets.

It's a race without a finish line, but they're running hard. □

Pathfinders to the cosmos, a handful of brilliant theoreticians and engineers inspired the Soviet surge into space. Konstantin E. Tsiolkovsky, a small-town schoolteacher, formulated the theoretical foundations of space travel at the turn of the century. In the 1920s his disciple, Fridrikh Tsander, stimulated research and experimentation dominated by Valentin P. Glushko, engine expert; Nikolai A. Rynin, space encyclopedist; Yuri V. Kondratyuk, rocket theorist; and Sergei P. Korolev, a forceful engineer who melded his colleagues' genius into the Soviet space program.

PAINTING BY BOY ANDERSEN



Glushko

Korolev

Tsander

Rynin

Kondratyuk

Tsiolkovsky

ГИРД-09



In the Far Pacific

At the Birth of Nations

By CAROLYN BENNETT PATTERSON
FORMER SENIOR ASSISTANT EDITOR

Photographs by DAVID HISER
and MELINDA BERGE

New flags in the Pacific go on proud display (below) at Truk state's Xavier High School, still scarred by World War II shells. Traditions are kept on Yap state's island of Mogmog, where Western dress is discouraged (right). Such are the contrasts among three new nations and a commonwealth, sponsored by the United States of America, that now are about to step onto the world stage.



FLAGS SHOWN CLOCKWISE FROM 12 O'CLOCK: YAP STATE; TRUK STATE; REPUBLIC OF THE MARSHALL ISLANDS; PohnPEI STATE; REPUBLIC OF PALAU; AND THE REPUBLIC OF KIRIBATI, FORMERLY THE GILBERT ISLANDS, WHICH WERE NOT PART OF THE TRUST TERRITORY UNDER THE U. S.

BOYS BY DAVID HISER





Maze of unsurpassed beauty, the Rock Islands of the Republic of Palau set tropical gardens atop coral ridges.



DAVID HIBER

Speedboats carrying tourists, mostly Japanese, carve glass-clear waters filled with a fantasy of sea life.



COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS

- Meig Is.
- Ferallon de Pajaros
- Asoncion
- Agrihan
- Pigan
- Alamagan
- Giguuan
- Saipan
- Anatahan
- Ferallon de Mindilla
- Agujan
- Tinian
- Rota

Guam (U.S.)

PHILIPPINES

- Palau Islands
- Kayangel Is.
- Babelthuap
- Koror
- Peleliu
- Sorsoral Is.
- Pulo Anna
- Merir
- Tabi
- Hosen Island

REPUBLIC OF PALAU (BELAU)

- Ulithi Atoll
- Mogmog
- Yap Is. - Colonia
- Ngulu Atoll
- Sorol Atoll
- Wbleai Atoll
- Eitunok Atoll
- Gaferut
- Faraulep Atoll
- Pigaiwe Atoll
- Namonuito Atoll
- Ulul
- Pulap Atoll
- Pulowat Atoll
- Satawal
- Tamatam
- Pulusuk
- Etal Atoll
- Satawan Atoll
- Lukonor Atoll
- Nukuoro Atoll
- Kapingamarangi Atoll
- Fayu
- Hail Is.
- Mint
- Moen - Reef
- Truk Islands
- Dublon
- Kolonia
- Pohnpei (Ponape)
- Ant Atoll
- Ngatik Atoll

FEDERATED STATES OF

The Caroline Islands, stretching some 2,000 miles from Palau to Kosrae, are divided politically into the Republic of Palau and the Federated States of Micronesia.

INDONESIA

PAPUA NEW GUINEA

South Pacific

SOLOMON ISLANDS

AUSTRALIA

CHINA

JAPAN

North Pacific Ocean

Taiwan

U.S.S.R.

Aleutian Islands

Islands on the Move

Specks of land scattered across an ocean area the size of the continental United States, the islands of Micronesia were first settled by seafarers from Southeast Asia. European discovery in the 16th century led to foreign domination by Spain, Germany, Japan, and, following World War II, the U.S., which has administered them as a trust territory under the United Nations. Now the more than 2,000 islands, with a population of some 160,000, will be divided into the Republic of the Marshall Islands, the Federated States of Micronesia, the Republic of Palau, and the Commonwealth of the Northern Mariana Islands—a U.S. territory.

Hawaiian Islands

REPUBLIC OF THE MARSHALL ISLANDS

Wake Island (U.S.)

- Enewetak Atoll
- Ujae Atoll
- Mokil Atoll
- Pingelap Atoll
- Kosrae
- Ujae Atoll
- Ebeye
- Ailinglapalap Atoll
- Jatut Atoll
- Namur Atoll
- Majuro Atoll
- Kili Island
- Ebon Atoll
- Taongi Atoll
- Bikar Atoll
- Utirik Atoll
- Aluk Atoll
- Meir Island
- Woleje Atoll
- Erikub Atoll
- Malcelap Atoll
- Isur Atoll
- Arno Atoll
- Ine
- Mil Atoll
- Knox Atoll

MICRONESIA

Beginning in 1892 the Gilbert and Ellice Islands were administered by Great Britain. In 1978 the Ellice Islands achieved independence as Tuvalu, and in 1979 the Gilberts became the Republic of Kiribati.

REPUBLIC OF KIRIBATI

TUVALU

EQUATOR

Ocean

- Koronia: National capital
- State capital
- Line of separation (not a formal international boundary or territorial limit)
- Micronesian place-names in text shown in bold
- Scale varies in this perspective view

MAP COURTESY OF THE DIVISION OF GEOGRAPHY AND CARTOGRAPHY, U.S. DEPARTMENT OF THE INTERIOR, BUREAU OF LAND MANAGEMENT, WASHINGTON, D.C. 20250
 PRODUCED BY RANDY WILSON
 MAP EDITOR: JOHN T. BULLOCH

FROM THE SEA Puluwat is everyman's dream of paradise: an island set in the blue depths of the Pacific, ringed by a coral reef that encloses a crystal clear lagoon.

Ashore it looks like a garden, with towering coconut palms lining the broad sandy paths and great old breadfruit trees, their roots clutching the earth like gnarled fists, rising majestically above the green banana and taro patches.

And the people. The men bare to the sun save for their *thus*, a bright swath of cotton stretched tight between the legs and tied around the waist with loose ends swinging. The women in long skirts, their breasts uncovered, bending low in obeisance whenever they meet older males. The youngest children, naked.

It was like this on Puluwat, one of the Caroline Islands, 18 years ago when the people held a feast to bid 21-year-old John Uruo

The wall John went to leap was figurative, built of conditions that separated him and fellow islanders from today's world— isolation, poor health care and education, and few financial resources. In good health, John had a plan to overcome the others. He would go to college in the United States—the first from his island to do so.

Aided by a scholarship, John succeeded. He graduated from Minnesota's Bemidji State University, married an American girl, and eventually returned to Truk in the Federated States of Micronesia, where I met him. There he serves the governor as a municipal affairs officer, in an area that includes his home island of Puluwat. Having jumped over the wall himself, John Uruo now helps others do the same.

Recently I spent nearly three months among three Pacific island groups known as the Marshalls, the Carolines, and the Northern Marianas, in a part of the world called



Man of two worlds, John Uruo, left, pilots an outrigger sailing canoe on a visit to his home island of Puluwat in Truk state. Some 18 years ago he left Puluwat for college in the United States, believing that he was leaping over a wall to the modern world. Today, as a municipal affairs officer for the governor of Truk, he helps such islands as Puluwat in the struggle for a better life. John's American wife and two teenage daughters live mostly in the U. S. because he wants the girls to be educated there.

farewell. Related by blood and extended family to most of the islanders, John at his leave-taking drew a large crowd, who brought to the feast homegrown bounty—roast pig, fried fish, boiled breadfruit, taro root and leaf cooked in coconut milk, small sweet bananas, and coconut wine.

After the elders' speeches John rose. "I go to jump over the wall," he said.

Micronesia. The islands sprinkle a vast ocean kingdom about the size of the continental United States but with less land area than the state of Rhode Island and a population of only 160,000.

Today the islands are emerging into the light of self-government, taking their places on the world stage after nearly 40 years as a trust territory administered by the United

States under United Nations auspices. In May the United Nations Trusteeship Council recommended to dissolve this last trusteeship. The dissolution now awaits a Security Council vote, which will formalize the new arrangements.

Under new flags, the Marshalls in the east and Palau, a group of islands in the western Carolines, have voted to be republics, while the other islands in the chain have united as the Federated States of Micronesia—Kosrae, Pohnpei, Truk, and Yap.

Although self-governing, all three nations are to be closely tied to the United States by a compact of free association, an arrangement unprecedented in U. S. constitutional practice. Under the compact the U. S. will apportion among the three a total of 2.7 billion dollars, including adjustment for inflation, over a period of 15 years. (Palau's compact, presently being contested in Palau's Supreme Court, would run for 50 years but after the 15th year would be funded out of a 70-million-dollar investment fund.) In addition the U. S. will continue to provide airline and airport-safety services, public health and weather prediction, currency, an international postal service, and disaster relief.

For the Republic of the Marshall Islands, where on Bikini and Enewetak Atolls nuclear devices were tested from 1946 to 1958, the U. S. has agreed to set up a 150-million-dollar trust fund to benefit islanders affected by the tests.*

Finally, the United States assumes all responsibility for the defense of the three states, asking in exchange that they remain closed to the military forces of other nations unless the U. S. agrees otherwise.

The fourth group in the Trust Territory of the Pacific Islands—the Northern Mariana Islands—elected an even closer bond with the U. S., the status of a commonwealth. Its residents receive regular benefits from a wide range of U. S. government agencies, and their territorial government is given financial grants for special needs. Ultimately they will become U. S. citizens.

EVERYWHERE on my travels I looked for such walls as John had leapt and found many still standing. Others are crumbling, and some have disappeared. But I found that I too had

to jump over a wall, the wall of my own ignorance about the area.

Pipe-smoking and patient, Sam McPhetres came to my aid. Archivist for the trust territory government, he recounted how the islands were settled in prehistory by intrepid peoples who sailed there from Southeast Asia. After the region's discovery by Europeans—Magellan came through in the 1520s—trouble followed. Spain, claiming everything, lost everything in the Spanish-American War of 1898. The United States took Guam and the Philippines as territories; Spain sold the other islands to Germany, which lost them to Japan in the early days of World War I.

Under a League of Nations mandate, Japan energetically colonized and cultivated the islands until World War II, when the United States got them the hard way, with the lives of its fighting men. In 1947 the U. S. Navy set about administering the islands as a United Nations trust territory; the U. S. Department of the Interior took over the administration in 1951.

"But it was not quite that simple," said Sam. "Having fought our way across the Pacific, island by bloody island, our country wanted to be sure they would never again be used against us. The territory was declared a 'strategic trust,' a status that gave us the right to fortify it with military bases and close off certain areas if necessary.

"In fact," said Sam, "we're sitting in one of those once closed-off areas right now." His office in Saipan, the administrative center of the trust territory and capital of the Northern Marianas, was built in the 1950s by the Navy for the Central Intelligence Agency as part of a supersecret complex for training Chinese Nationalist troops to operate inside the Communist-ruled homeland.

The Kwajalein Missile Range in the Republic of the Marshall Islands is another case in point. With the 600 native people moved out, "Kwaj" harbors 3,000 American civilians in a 900-acre setting that most resembles a golfing condominium complex in, say, the state of Florida (pages 472-3).

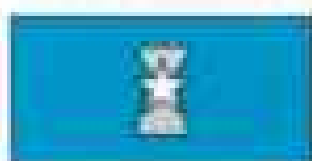
But the purpose of the island's development is far from frivolous. Situated at one end of the world's largest atoll, Kwaj is the

*See "Bikini—A Way of Life Lost," by William S. Ellis, in the June 1986 NATIONAL GEOGRAPHIC.

THE COMMONWEALTH
OF THE NORTHERN

MARIANA ISLANDS

Candidate for addition to the U. S., the Northern Marianas have elected to be a commonwealth, with full U. S. citizenship.



But economically the Northern Marianas look to Japan to support the chief industry, tourism. On Saipan, Japanese visitors (facing page) stand atop seaside Banzai Cliff, where hundreds of Japanese soldiers and civilians leapt to their death rather than be captured by Americans in 1944. Prayers adorn wooden memorials (right) on nearby Suicide Cliff, where hundreds more died.

An American visitor excited attention last year. Flag-waving youngsters (below) gather to welcome Vice President George Bush.



ALL BY MELINDA BERGE



Pacific terminus of a U. S. missile range, where experts measure the splashdown accuracy of ballistic rockets fired from Vandenberg Air Force Base, 4,500 miles away in California. The facility is expected to play an important part should President Reagan's "Star Wars" technology go forward.

For the use of Kwajalein and the other islands in the missile range, the United States pays a rent of more than 10 million dollars a year. The money goes to the Republic of the Marshall Islands, chiefly for transmittal to 5,000 landowners, most of whom live on nearby Ebeye. Many work on Kwajalein, commuting to some 600 jobs there.

"SLUM OF THE PACIFIC," I had heard Ebeye called, but, even so, I was unprepared for its squalor when I arrived at dusk from Kwaj. Along a pocked asphalt lane, houses of sheet metal and cinder block crowded wall-to-wall with no space for grass or trees. Bands of children, some mere toddlers, ranged the street, their only playground on the 78-acre island where 8,000 people live (pages 474-5). Spotting me, the youngsters crowded around, incessantly calling "Hello."

The next day I visited the hospital and met the public health nurse. To the question "How are things?" she answered: "How can I make a progress report to the United Nations when there is no progress? We need help! Today, for example, we have no insulin." A serious matter when at least a third of the adult population on Ebeye, as elsewhere in urban areas of the Marshalls, have diabetes, due to genetics and diet.

Making the steamy rounds of the several dimly lit, unair-conditioned, and expensive grocery stores, I found Ebeye lacked other things: fresh meat and fish, fresh fruits, fresh vegetables. In the freezer of the largest store there were only a few chickens and two cans of orange juice.

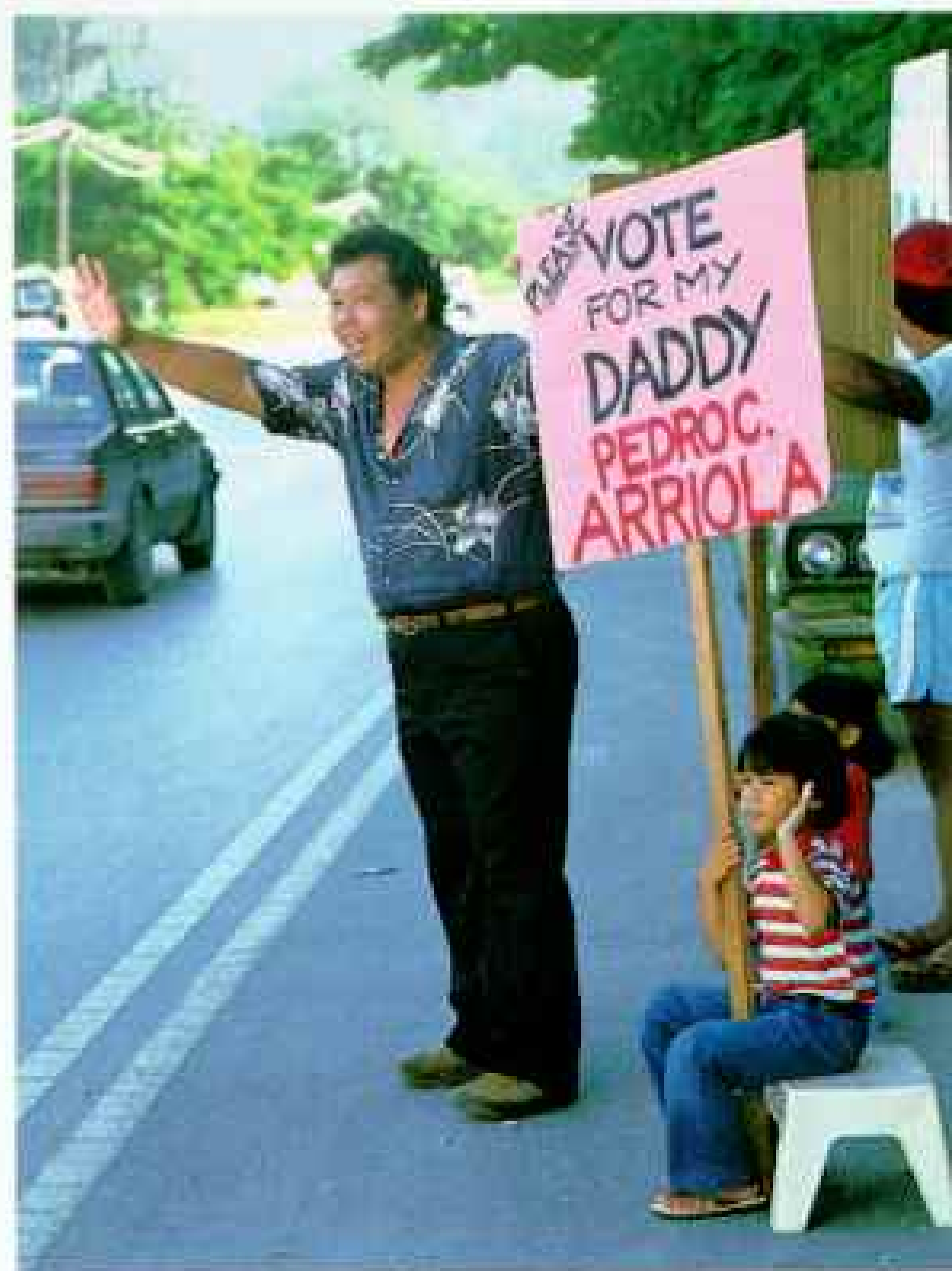
The next day I strolled about neighboring Kwajalein, where the banning of passenger cars gives streets over to the pleasantries of bicycles and foot traffic. The shops were filled with the plenty of their stateside counterparts. And as with U. S. military commissaries worldwide, they were off-limits to the natives who work on the base.

I noted three playing fields on Kwaj, a

bowling alley, swimming pool, and golf course. The bulletin board announced the Commodore's Ball up at the Yacht Club, \$17.50 a person for cocktails, petit filet mignon, and dancing under the stars.

I was glad my fellow Americans had such a good life on Kwajalein. But I wondered about the stark contrast on Ebeye. So I put some questions to various officials: Why the terrible crowding? It's due, they say, to the traditions of the people and their belief in the extended family. For example, if you are in need and a relative is getting rent money or good wages from Uncle Sam, you move in with the relative.

And why no insulin in the hospital? From Majuro, capital of the Republic of the Marshall Islands, the secretary of health services sends word: "Ebeye never out of insulin."



HELENA BERDE

Hitching a vote, the daughter of Pedro C. Arriola helps daddy win a seat in the legislature. During a general election last year, American-style politics swept Saipan like a tidal wave, bringing massive rallies with free beer and food, blaring loudspeakers, and posters that papered every vista.

Other officials agreed. Who to believe?

High prices and poor selection of food? It is explained that the merchants on Majuro supply Ebeye's shops and don't appreciate subsidized U. S. competition from Kwaj.

And what about the scant water and electricity? I'm told that new plants will be finished this year.

Shortly after I left the Marshall Islands, the U. S. use agreements on Kwaj expired, and some of the landowners occupied several islands on the missile range, asserting their right to the land and demanding significantly increased rent and direct negotiations with the U. S.

During that uncertain period, the U. S. Congress enacted the Compact of Free Association, which will provide to the Marshall Islands government nearly 400 million dollars over 30 years for payment to the Kwajalein landowners in direct income and for projects. Their development plan calls for a causeway to link Ebeye to six other islands, new roads, elementary schools, a high school, renovated housing, and a new dock.

Hope for Ebeye rises as the walls that enclose it promise to fall.

ALTHOUGH EBEYE is in the worst-case category, its problems are shared to some extent throughout the trust territory. Despite an immense flow of American money, effort, and goodwill, many islands still suffer from a shortage of water and power, poor to nonexistent roads, struggling educational systems, meager public services, few job opportunities, limited natural resources, and, at the top of the list, inadequate health care. Much blame must be laid to the region's geography, especially difficult when it comes to delivering adequate health services.

In the Marshall Islands, as elsewhere, every island is supposed to have a health aide, operating out of a well-equipped dispensary, with access to a radio in the event of an emergency. In a life-or-death situation a patient is picked up by boat or plane, if possible, and taken to the nearest hospital, often hundreds of miles away, or to Hawaii.

The bill can be astronomical. And it is paid for by the government. The Republic of the Marshall Islands is going broke trying to meet the cost of modern medicine. When I

was in Majuro, it was reported in the press that the republic's department of health had overspent its budget, and that all other departments would be cut to provide the necessary funds.

I asked President Amata Kabua about the story, and, sadly, he admitted that it was true. "But what are we to do?" he appealed to me. "We are a Christian nation. We can't simply allow people to die when doctors in Honolulu can save their lives."

The Marimed Foundation, established by two altruistic Bostonians, Dr. Lonny Higgins, a gynecologist, and her lawyer husband, David, expects to address this very problem with its specially designed sailing ship, equipped with the latest in medical technology. The Higginses plan to enlist doctors and nurses for limited volunteer service. Sailing among the islands, they will use their diagnostic, surgical, and treatment skills, while teaching preventive medicine.

I accompanied the Higginses on a medical excursion to Arno Atoll, a three-hour motorboat trip from Majuro. We arrived at Ine at twilight, but already a huge full moon had risen, creamy white in a gray-blue void. Lonny's supplies went from our motorboat to a rowboat and finally into our arms as we waded ashore through the gentle surf.

A 15-minute stroll down a rutted lane brought us to the dispensary, where we discovered that the health aide was off-island, taking a refresher course in Majuro.

The dispensary was far from clean. The refrigerator didn't function for lack of electric power on the island. The broken toilet was useful only with water supplied by a bucket. The few supplies included a cream for burns, a clamp for an umbilical cord, test tapes for diabetes, vitamins for pregnancy. The single bed even lacked a mattress.

My husband, Pat, and I headed for the beach, where we unrolled our mats and slept under a full moon. Then about 3:30 a. m. we awoke in eerie darkness. Totally unexpected to us, with the impact of a miracle, there was a magnificent full eclipse of the moon.

The next day, stripped to the waist in the terrible heat, David Higgins scrubbed down the dispensary walls while Lonny drew simple, colorful pictures of the human reproductive organs as a way of teaching her patients. Then they

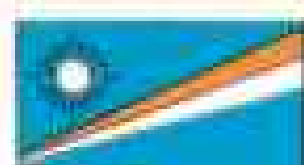
(Continued on page 476)



REPUBLIC OF THE

MARSHALL ISLANDS

Oceanic bull's-eye, Kwajalein Atoll is the target for rockets (above) launched 4,500 miles away in California. The 3,000 Americans on the 900-acre island (right)—mostly civilians



employed by private contractors to the U. S. Army Strategic Defense Command—enjoy such amenities as the supermarket dubbed

“Surfway” (below). Some 8,000 Marshallese, many commuting to jobs on “Kwaj” by boat, occupy 78-acre Ebeye (distant island, right). The U. S. pays more than 10 million dollars a year for use of the Kwajalein land.



U. S. ARMY STRATEGIC DEFENSE COMMAND (TDF); MELINDA BERGE





Pollution in paradise, junk overwhelms a beach on crowded Ebeye (above). People flock to the island because the Marshallese tradition of extended family obligates an islander with good wages or rent money to care for less fortunate relatives. Ebeye's busy main street (left) contrasts with Kwaj, where private vehicles are forbidden. The U. S. is financing an intensive program to improve living conditions on Ebeye.



Free lunch for senior citizens in Majuro, capital of the Republic of the Marshall Islands, reflects a weakening of the extended family that in earlier times would have provided for its own elderly.

Western-style education, where long hours in the classroom preempt time once spent in traditional pursuits, tends to break down the heritage of island culture. Few young men of Majuro, for example, now know how to sail an outrigger canoe.



ALL BY MELINDA BEHRE

(Continued from page 471) began arriving.

That day, assisted by three women who had come with us from Majuro—a public health nurse, a social worker, and Jinnie deBrum, a Marshallese member of the Married Board—Dr. Lonny Higgins examined 27 women. She discovered a pelvic mass, a thyroid abnormality, and several bleeding disorders. Of 27 Pap smears taken to Hawaii for testing, six signaled follow-up tests.

And that night another seeming miracle transpired. As darkness fell, we heard singing and saw a procession of lanterns swinging down the road. The island chief and a laughing crowd of women and children had come bearing gifts of bananas, fish, pork, and breadfruit. And time slipped away in dancing, singing, and speeches from a host of grateful hearts.

MOVING EVER WEST, we flew to Kosrae, one of the four Federated States of Micronesia, where in the 19th century diseases

strictness, is Kosrae's most powerful force. Women are modestly clothed—bathing suits are too risqué, even for visitors—and Sundays are strictly for churchgoing.

The American presence today appears beneficial, as we saw upon arrival on Kosrae's enormous new jet runway (pages 478-9), a legacy of the trusteeship and big enough for 727s, although such planes have yet to be scheduled through Kosrae.

We were met by Madison Nena, Kosrae's 34-year-old director of tourism, and Christopher O'Connor, a 25-year-old Peace Corps volunteer assigned to develop tourism. Slender and dark with a neatly trimmed mustache, Chris, a hotelier, came to Kosrae from New York City's Waldorf Astoria, where he worked in guest services.

Aside from the island's beauty the major sight is the Leluh ruins, whose huge stone walls, canals, and kings' tombs speak of a highly developed culture that flourished 500 years ago. Teddy John, Kosrae's historic preservation director, guided us through the



Tears flow as a Civic Action Team "Doc" on Yap investigates an injured foot. Composed of men from the United States Army, Navy, and Air Force, Civic Action Teams regularly spend several months on duty in the Federated States of Micronesia, responding to needs identified by the state governments. They build bridges and roads, repair buildings, improve playgrounds, entertain with free movies, and provide medical care.

brought by traders and American whalers nearly wiped out the native community. Incidentally, I was told that the seagoing visitors of that day so habitually uttered a certain four-letter expletive that islanders gave all white people the name "ohshits."

When the Congregational missionaries arrived, Kosraeans flocked to Christianity. Now the church, clinging to past-century

jumble of stone, still in private hands and littered with beer cans.

A burly man with black hair and beard, Teddy spoke with deep regret about the condition of the ruins and of his hope that the government could buy the land and stabilize the stone structures. "When I was a boy, water still flowed through the canals, and I could dive off the walls," Teddy told us. "If

we could dredge the canals, we could make the place look like the old days."

When Leluh was at its height, the king and high chiefs owned all the land and lived with their servants in this city of more than a hundred walled compounds. The compounds of royalty were used for burial as well as worship of Kosraean gods.

"Those gods must have been really powerful," Teddy said with a smile, "because Kosraean legend claims that magic moved these stones, since the people had no machines to transport such heavy material."

Teddy invited us to dinner at his two-room, concrete-floored home, where we met his wife, nine children, and a lively group of Americans, mostly government advisers, who like to hang out at Teddy's. Teddy is an admiring listener to the swirling conversation. "I learn so much every night," he told me. He is, in fact, an intellectual but is too innocent and modest to discern it.

Thirteen Americans on the island are in the U. S. Army, part of a Civic Action Team. They live at spick-and-span Camp Wilbur L. Trahan and work on civic projects such as road and bridge construction, government buildings, and school playgrounds. Everybody is invited to their monthly outdoor movies. Hundreds find help from "Doc," their medical corpsman.

The team's Doc, Sgt. Leonard Resler from Boulder City, Nevada, explained: "Each Civic Action Team stays for six months, and we're getting ready to pull out, but I am grateful for this experience. I have the feeling that we have really helped."

THE SAME FEELING prevails at The Village, a hotel in Pohnpei that employs some 50 neighbors to serve guests in but 21 rooms. By employing a large staff only part-time, the innovative American owner-managers, Bob and Patti Arthur, run a first-class hotel while recognizing native habits and traditions.

"The people here value their leisure time," said Patti. "They also need time for their pattern of living. A funeral, for example, takes four days."

The Village demonstrates how tourism might proceed in today's Micronesia. Built on a hillside, the hotel rises in a tropical garden with an open-sided dining, bar, and

lobby area. Positioned for privacy, thatched-roofed guest cottages are screened to permit the full sweep of Pacific breezes.

The island's town, Kolonia, is capital of the state of Pohnpei as well as capital of the Federated States of Micronesia. Although a new FSM capitol building is in the planning stage, the seat of government at present is in the remodeled Navy hospital, a one-story frame left from the 1940s. The national congress meets in the old operating room; the president's office was the children's ward.

Calling on President Tosiwo Nakayama, I learned the story of his life—another tale of walls and extraordinary effort to scale them. Nakayama's father was a Japanese businessman sent to Truk before World War II. He married a girl from the island of Ulul in the Namonuito Atoll.

When the Pacific war broke out, the family, now with several children, settled on Dublon in Truk Lagoon, Japanese headquarters. It was from Dublon, at the age of nine, that young Tosiwo heard the "ominous, incessant, ever louder drone" of the U. S. airplanes that sank a Japanese fleet of 60 naval and cargo vessels.*

At the end of the war the United States sent home all the Japanese nationals living in Micronesia, including the elder Nakayama. Deprived of his father, the young Tosiwo took on the responsibility of his family. He went to work and earned enough money to take his mother and sisters back to her relatives on Ulul. Only then, at 16, did Tosiwo voice his ambition: "I want to go to school." He had never spent a day in a classroom up to that time.

Nakayama eventually went to the University of Hawaii on a U. S. government scholarship, where the quality of his mind and personality attracted attention, and he was set on the track of leadership.

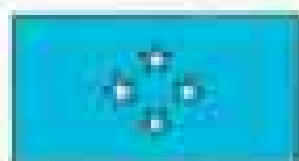
What kind of influences shaped the young Nakayama, I wondered. I decided to visit the island of his mother's people, Ulul—a resolve that sent me on the unforgettable voyage of the *Micro Dawn*.

All the outer islands in Micronesia are supposed to be regularly served by such ships, sent by the various governments to deliver supplies (Continued on page 486)

*See "Life Springs From Death in Truk Lagoon," by Sylvia A. Earle, in the May 1976 GEOGRAPHIC.

KOSRAE

Built with American dollars, a runway (below) long enough for large jets is the gateway to the state of Kosrae, but at present a 16-passenger



propeller plane is the biggest aircraft that regularly serves the island, one of the largest in

the trust territory. Five hundred years ago the tribes on the island united under a powerful king and built Leluh, a city of more than a hundred basalt-walled compounds threaded by canals. There the king, his servants, and a few nobles lived off the labor

of commoners, who farmed and fished.

With the coming of the Europeans, that way of life ended. Diseases brought by whalers and copra traders so ravaged the islanders that at one time only 300 people were counted.

Congregational missionaries converted the entire population, and religion is now the chief force ordering social life.

On the economic side Kosrae, noted for its fine tangerines, limes, and oranges, promises to become the vegetable and fruit basket of the Pacific (right). A project is under way to restore giant clams, once plentiful, to the surrounding reef, using juveniles raised in the Micronesian Mariculture Development Center in Palau. And with the ruins of Leluh as an attraction, tourism is viable.





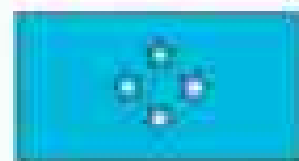
BOTH BY MELINDA BERRE



FEDERATED STATES OF MICRONESIA

POHNPEI

"Diamond Head of Micronesia," the volcanic plug known as Sokehs Rock helps guide ships to Pohnpei's harbor. The island's tortuous terrain and heavy rainfall contributed to the U. S. military decision to bypass the island during World War II, thus sparing





WELYNDA BERKE

it the ravages of combat. Torrential rains continue to play a beneficent role in the life of Pohnpei, nourishing its lush foliage and floral displays and feeding the countless waterfalls that keep the sound of rushing water often in earshot.

President Tosiwo Nakayama of the

Federated States of Micronesia often decries the underdeveloped state of his nation. "Alas," he told the author, "we have no bargaining chips to get more aid for development, because the FSM has nothing the American military wants." But he added, "That's not all bad either."

The way of death on Pohnpei speaks to a way of life steeped in family care, traditional values, and long-revered ceremonies. The body of 80-year-old Tadius Fricht (below right) lies in state at his home on Mwahnd Island, a reef just off Pohnpei, as the women of his family keep vigil. Money on his casket is contributed as a token of respect. Although Mr. Fricht will be buried within 24 hours of death because of the island's hot climate, other gifts demonstrating respect will pile up at his home throughout the four-day funeral feast. Most are gifts of food, such as pig, taro, dog—regarded as a delicacy on Pohnpei—and yams.

This 1,500-pound yam (below), in a cradle borne by 25 men, was grown especially for funeral use. With the feasting, Pohnpeians drink sakau, a slimy, mildly narcotic beverage

made from the root of a pepper plant pounded into pulp and strained through hibiscus fiber. After the funeral, in the tradition of sharing, the leftover food is divided and sent home with the mourners.

Although mostly Christians, many of the people of Pohnpei still revere the 700-year-old ruins of Nan Madol (right), an immense complex of 93 man-made islets walled by "logs" of basalt, that spread across 150 acres. Its canals still filled with water, this Venice of the Pacific is similar to Leluh on Kosrae but less damaged by time. Nan Madol has been declared a U. S. National Historic Landmark as an aid to its preservation. Here the last light of day lingers on part of the city's outer wall, a shield before a burial vault of Nan Madol's kings.





ALL BY MELINDA BERGE

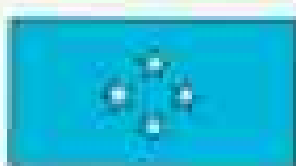




FEDERATED STATES OF MICRONESIA

TRUK

Only link to the outside world, save for radio, the *Micro Dawn* rides the swells off Pulusuk (above). Such government ships irregularly sail from Moen, capital of Truk state, to its various islands, bringing food, supplies, and services. They pick up copra and handicrafts made for sale by the islanders.



Outrigger canoes once carried commerce

between islands but are now used for lightening cargo, local fishing, or simply for pleasure. Canoe building is still an art on Puluwat (below), where Aidnor Bisalen uses an adz to fashion a 14-foot vessel from a breadfruit log. The secrets of canoe building are closely held and passed from father to son.

Change exacts a heavy price in Truk state, which has one of the world's highest suicide rates for males from 15 to 24. Authorities cite anger and fear of shaming the family as the major causes. The family of Atarino Pau, a 24-year-old suicide, gathers atop his tomb (right) near the family home.



ALL BY DAVID HISEN



(Continued from page 477) and people and pick up island produce—copra, woven mats, handmade rope, and the like. The trips last from one to three weeks, depending on distance.

Sam McPhetres warned me: "All field trips are late getting off, all take longer than expected, and there is no regular schedule." On a tight schedule myself, I had hoped for a one-week trip out of Moen, the capital of Truk, and was assured that I would have it. Sam volunteered to go along. And the governor of Truk assigned John Uruo to accompany us, my first meeting with the young man from Puluwat. Things looked good.

ON THE SAILING DAY we moved on board the *Micro Dawn* and watched it being loaded. Into the forward cargo hold went the stock for island customers to buy after they had acquired some cash from the sale of their copra. Into the main hold went box after box of canned goods and other foodstuffs from the United States: sweet potatoes, peaches, evaporated milk, soy sauce, mixed vegetables, shortening, green beans, and huge bags of rice, flour, and sugar—much of it destined for the school-lunch program.

Then came the passengers, the men in their *thrus* with sleeping mats and lethal-looking machetes; the women with coconut-frond-wrapped parcels of food and bags of coconuts for drinking; the children, racing madly around the ship.

The cabin passengers were a dedicated little band of government people working to bring some services to the islands: two educators testing students, a nutritionist checking on school food programs, a health officer examining needs of the handicapped, and a young American physician, Dr. Don Preston, a graduate of Oregon Health Sciences University serving in the Public Health Service, accompanied by a health aide. They would inoculate the infants and tackle any medical problem that arose.

Another cabin passenger, Father John Fahey, a Jesuit, joined us at railside. He ministers to the people of Puluwat, Tamatam, Puluwat, and Pulusuk, an island group in Truk state collectively called the Westerns.

"But isn't the *Micro Dawn* going to Namonuito?" I inquired. "Yes, but *after* the

Westerns," replied the priest. And sure enough, that night we sailed for Puluwat, home island of the ship's captain.

I tried to see things as philosophically as Father Fahey, who laughingly explained: "Out here we are constantly faced with either a crisis or an emergency. We are often chagrined but not surprised."

We stayed at Puluwat four days, living out a pattern that would repeat itself at each stop. Outside the island's encircling reef the *Micro Dawn* launched two deck boats with outboard motors that shuttled back and forth throughout the day.

We all went ashore, leaping from a ladder on the side of the ship into a small boat as it bobbed up and down in the heavy swells, hoping not to fall into the sea and attract the four enormous sharks that hung around the stern feeding on ship's garbage.

On the island the men loaded copra onto the boats while the women barbecued a delicacy, turkey tails, bought frozen from ship's stores. The doctor set up a clinic, and the government people went about their respective assignments.

We sailed for Tamatam, 15 minutes away, and spent another two days—a delay that killed any prospect of reaching the rest of the Westerns, much less Ulul, in the hoped-for span of a week. So, we radioed Moen to send a chartered boat to pick us up at Puluwat, the *Micro Dawn's* next stop, and were told that a 40-foot fishing boat, *Miss Namonuito*, would come.

Then on to Puluwat, where John Uruo was clearly a star as the local boy who made good. He introduced me to Eric Sanford, a Peace Corps volunteer, who told me a story. After a 1982 cholera epidemic in Truk, a campaign to provide all the islanders with latrines got under way. Eric himself helped install 60 of them.

"I spoke to each family, emphasizing the importance of toilets to everyone's health," Eric said. "Yet today only 10 percent of the islanders use them." On the other hand, Eric also helped build 29 water catchment tanks and improve seven others, providing healthier drinking water and the frequent showers that everybody loves to take.

And the islanders are ambitious for their children. Although Truk state supports an elementary school on the island, junior and

senior high school students once had to go to Ulul for classes. To keep their early teenagers at home, Puluwat built the Puluwat Middle School, a cluster of cottages with thatched roofs, latticed walls, and sand for floors. Puluwat's own college graduates have returned to staff the school.

On our third day at Puluwat, the chartered boat *Miss Namonuito* finally turned up after having been lost. Since the boat's radio didn't function while the motor was running and the 26-year-old first-time captain failed to inspire confidence, we decided to stay with the *Micro Dawn*, despite whatever time it took.

After a stop at Pulusuk the *Micro Dawn* lost an engine as well as its radar and ran low on both food and water. Under the circumstances the captain decided to return directly to Moen to refit and resupply. We sailed into Truk's capital 11 days after leaving it. I never did get to President Nakayama's island of Ulul.

was the *Miss Namonuito*, resigned to exile."

WHEN WE LEFT TRUK, we flew, of course, on Air Mike, the nickname for Continental/Air Micronesia, the only jet service linking all the new nations of Micronesia. But Air Mike is more than an airline, it is a lifeline. Dividing planes into cargo and passenger sections, it carries everything, including automobiles.

The airline's "island hopper" is a kind of trolley car of the Pacific, with the down-home flavor of the neighborhood streetcar. Stopping at island after island, the 727 picks up presidents and governors, missionaries and teachers, entrepreneurs and lawyers—all of whom know one another. To travel on Air Mike is like being at a party—daily evidence of how small the vast Pacific truly is.

For Air Mike's arrivals on Yap, the last of the four states of the Federated States of Micronesia that I would cover, the sense of

Tragedy of war turns into a windfall. During World War II American aircraft sank a fleet of some 60 Japanese vessels in Truk Lagoon. The sunken ships entombed many of the possessions of the dead, while live coral and tropical fish gradually turned the graveyard into a choice destination for hundreds of scuba divers from around the globe. These shoes and a wine bottle may well have been set out by a guide for a diver to "discover," before being stored away for the next visitors to "find."



DAVID HISSER

But a footnote. A report came to me from Moen: "I thought you'd like to hear what you missed by not taking the *Miss Namonuito* back to Moen. Once more the crew got lost, and this time wound up in Ulul. Then they set out from Ulul and got lost again. At last radio report the captain was going to give up sailing. When we stopped by Ulul this trip to drop off the high school students, there

party heightened. A crowd of Yapese, led by Governor John Mangefel, met the plane, to welcome incoming passengers and visit with those on-going, who invariably debark for just such talks during the short layover.

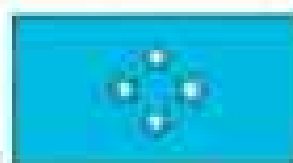
The air terminal is a metal-roofed shed divided by woven bamboo half walls. Its gift shop is a counter where trays of betel nuts are sold; a snack (Continued on page 492)



FEDERATED STATES OF MICRONESIA

YAP

No female eyes may watch these male dancers in the village of Omin on Yap as they dance out the erotic story of the capture of a young woman from another village and her fate in the men's house of her captors. Many people of Yap state, the most traditional of the islands of





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Micronesia, still cling to their own island dress and abide by old-time taboos that separate villages by caste, with the upper, or "pure," caste expecting menial labor from the lower, "polluted" caste.

Except in the most educated families, women of both castes are regarded as below

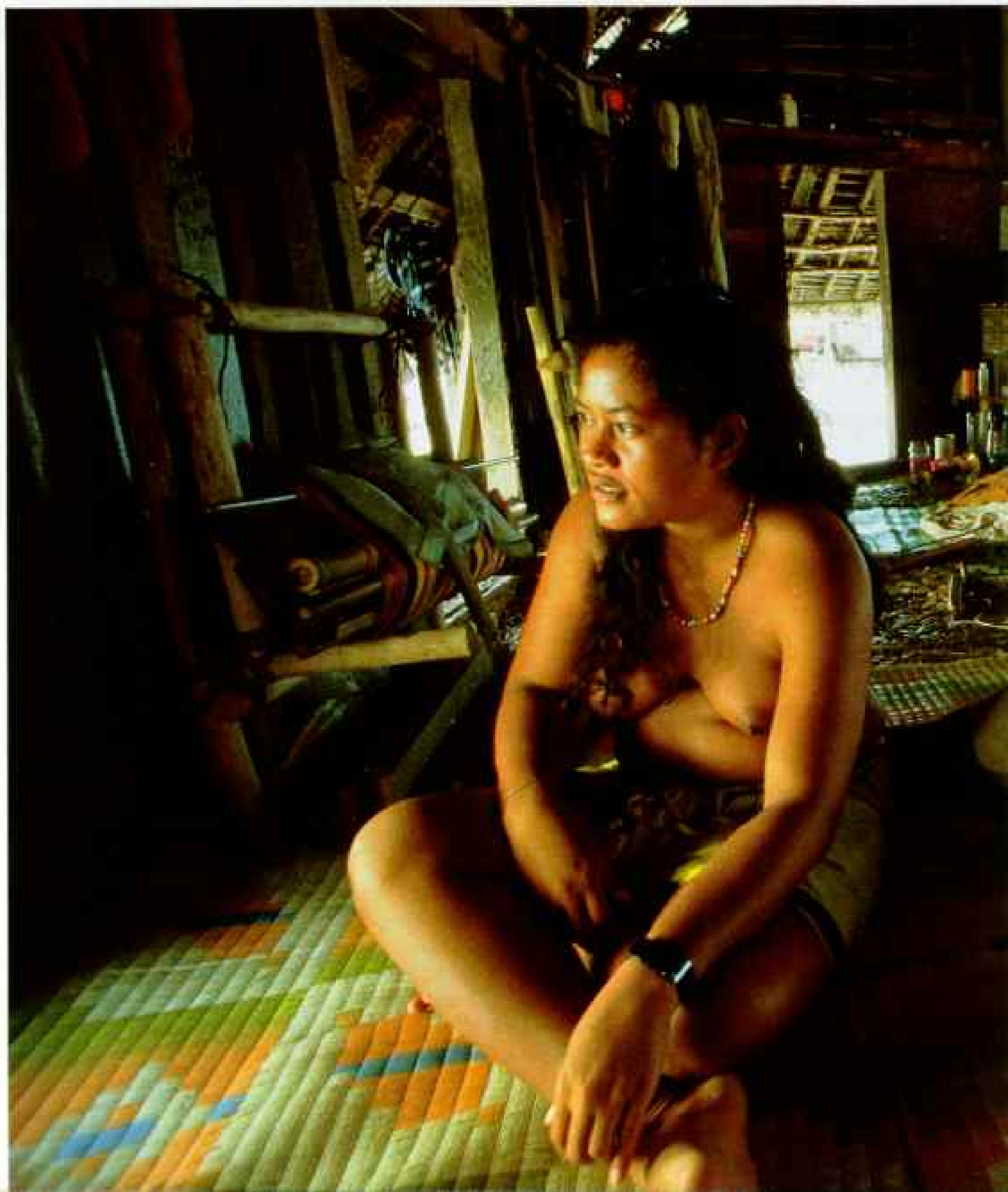
men, and many live today much as their ancestors did. But change is coming. An American-style high school enrolls both boys and girls, and bright students often have a chance for higher education, regardless of their village background. There is even a troop of Girl Scouts on Yap.

Ruled by custom, women of Mogmog, an island in Ulithi Atoll, while away the day in the ipul, or women's house, where they must remain during their menstrual period. Most women enjoy this break from their normal labors and spend the time happily talking or weaving on looms; at left and upper right.

The onset of puberty once called forth a far-reaching set of taboos throughout the islands of Yap. Today only the most remote still require a young girl, at the first sign of her first period, to head immediately for the women's house. As she approaches, the women within begin to

chant loud enough for the village to hear: "The menstruating one, ho-o-o!" This triggers hours of erotic dances by both the women in the house and the men of the village. Living in the women's house, the girl may not cook food for the men or eat with others for eight days; after another six days she may leave, but then only to live apart in her own hut.

As these taboos disappear, so too do bamboo and thatch building materials give way to more typhoon-resistant concrete walls. These men (right) raise such a wall for a new house on Mogmog.





ROTH BY DAVID HIDER



(Continued from page 487) bar stocks Ziploc bags of pepper leaves and lime for enhancing the pleasure of betel-nut chewing.

Governor Mangefel, his mouth blood red and bulging with betel nut, wore informal attire: thongs, shorts belted below a bulging tummy, and sport shirt barely closed with a single button.

His appearance deceives. The first college graduate from Yap, with a major in English literature from the University of Hawaii, John Mangefel is a writer of wit and learning; he also has winning charm.

Yap is famous for its money, big stone disks first cut and brought from Palau centuries ago and intermittently transported since. I saw hundreds, in all sizes, lining garden paths, adorning home platforms, and congregated in the yards of lofty meeting-houses. Yap has more than 6,000 pieces of this traditional stone money, whose histories and owners are known and whose

servants and serfs were considered "polluted." In exchange, the low-caste villages provided goods and services, usually menial. In both castes women were in a class below and apart, not even expected to eat from the same taro patch as men.

While this feudal system is eroding, some caste distinctions remain, with gratuitous services still demanded of the lower caste.

I heard the story of a high-caste, college-educated government official whose mother had an old man of low caste working in her yard, even though blind. "Why," he asked his mother, "do you keep this poor old man struggling to serve you?"

"Because it's God's will!" she cried.

When I talked to Henry Worswick, principal of the 400-student high school on Yap, I learned that he has seen "tremendous social change" since starting in education 20 years ago. Yet: "I find the situation alarming," he said, "when people are denied educational



Bidding for importance, the small state of Melekeok in Palau lobbies to become capital of the republic. Here Governor Thomas Tellei, left, and Andrei Demei, speaker of the state legislature, show off a model of their plan for a 250-million-dollar city, with a capitol, hotels, hospital, schools, airport, and roads. The road they stand on stretches only 2.7 miles, its entire length marked by a double yellow line to prohibit passing, despite the fact that almost all traffic is on foot or motorbike.

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value is calculated by the difficulty of the trip and the cost in human life to bring the disks across the sea from Palau by sailing canoes.

Yap is also known for its caste system, possibly the greatest wall still separating it from the modern world. In times past, high-caste villages, with chiefs, nobles, and commoners regarded as "pure," were expected to take care of the low-caste villages, whose

and job opportunities, promotions, prestige—all because of being low caste."

Governor Mangefel is a conservative and wants to preserve what he considers the best of Yap's cultural heritage: respect for elders, the extended family, and reliance on private initiative rather than government subsidy.

On my last night in Yap I went with New Yorker Becky Hynicka, of the Girl Scouts of

the U.S.A., to the community center at Colonia, the capital, to witness the investiture of Girl Scout Troop No. 34. The governor came in his usual dress, with a betel-nut bulge in his cheek, and sat on the floor until the moment called upon to assist in pinning his daughter, Geneivie, one of the new Girl Scouts. Just before the ceremony, the girls sang "Paddle, Paddle Your Own Canoe."

It was all something of a wall-jumping experience: that these little girls, growing up female in a society still rooted in feudalism, could each yet aspire to paddle her own canoe. I was touched.

THE WESTERNMOST among the emerging nations of the Pacific, the Republic of Palau (or Belau), population more than 15,000, is divided into 16 separate states, each with its own governor, lieutenant governor, and legislature. Most state populations are very small, and one wonders if anyone has time for anything but government, American style and democratic though it may be.

An example is Peleliu, the tragic island where more than 13,000 Americans and Japanese died during less than three months of fighting, often hand to hand, in the autumn of 1944. Pat and I went to Peleliu from Koror, the republic's capital, by speedboat, a wave-tossing, rear-slapping 45 minutes, and arrived to discover it was the state's election day, with five candidates running for governor. Although Peleliu claims a population of 2,000 people, only 400 actually live there. More registered voters live in Koror than on their home island, and 800 send votes from Guam. The situation is similar in Palau's other states.

A current joke puts a laugh in the truth. A man walks into a bar in Koror and calls out, "Hey, Governor!" And half the men in the place stand up.

But that's only the state story. The national government is headed by President Lazarus Salii, followed by a vice president, a cabinet responsible for five ministries, a judiciary, and a legislature with a 16-member house and a 14-member senate.

Then there's the hereditary leadership. Each village has ten chiefs, ranked in importance. And, dividing the island group, there are two paramount chiefs. Never, I thought,

have so few been so governed by so many.

With all these people on government salaries, it is not surprising that at least half the paychecks stem from the government. But I did find two people independently swimming against the tide.

Masahuru "Max" Moros of Koror, about 50 years old, gave up a government job in the marine resources department to go it alone as a fisherman and farmer. On his small plot he raises Chinese cabbage, sweet potatoes, cassava, bananas, papayas, coconuts, three varieties of limes, and betel palms, saving the three dollars a day needed to supply his wife with betel nut. For protein and extra cash, he goes fishing or crabbing.

"Since I stay home," he told me, "I make four times as much money as working for the government. The other night I trapped 35 coconut crabs and sold 20 to make \$180.

"Palau imports as much as 75 percent of its food today," he lamented. "But the people could grow or catch everything they need, just like they once did." He failed to mention that beer is Palau's second leading import, after fuel oil, and that its dollar value is twice that of all the country's exports.

Harson Shiro, a young man who went to school in Michigan and Texas, returned to his native state of Ngaraard, determined to help young people find meaningful work—and dignity—at home. He was building a hotel virtually single-handedly.

We went on another tooth-jarring boat ride to see how he was coming along. On a sandy strand shaded by magnificent old trees stood Harson's first unit, a single room under a thatched roof, decorated with staghorn corals and carved storyboards, equipped with a pool table, and set up to serve drinks and food. Nearby, thatched roofs already covered sites for six guest cottages, and planking lay stacked for walls.

"Before cutting a tree for the planking," Harson told me, "we dance beneath it to pay respect for the life of the tree and the lives of the people who have passed beneath it." He and his young assistants plant ten trees to replace each one cut.

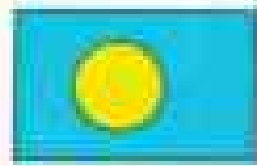
Harson's big push was for money to pour concrete floors in the cottages. "Tourism," he said, "is the hope of our future."

In Koror, President Salii agreed. He invited us to a picnic (Continued on page 498)



PALAU

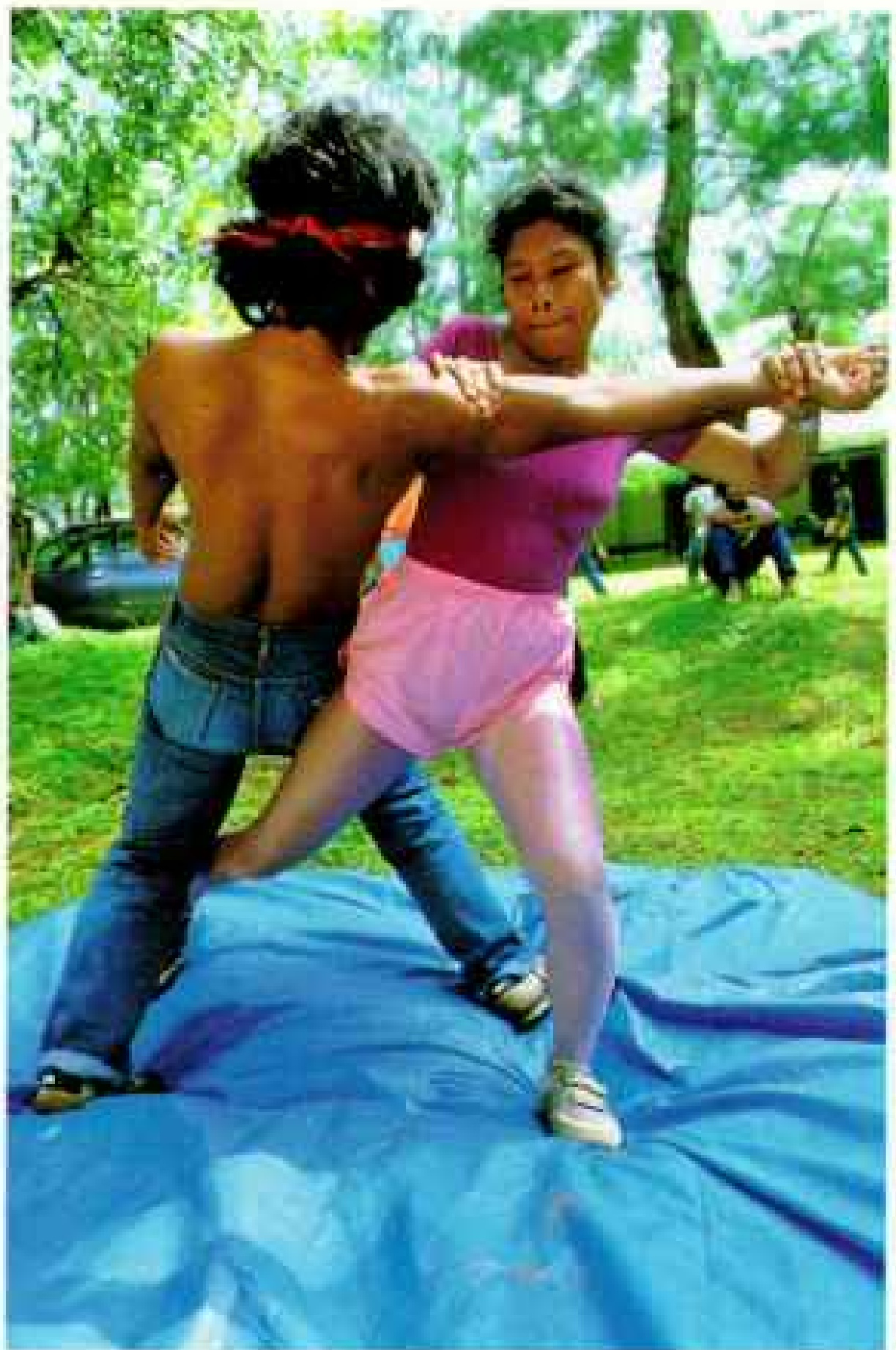
Second only to fuel oil in import value, beer comes by the containerful to Palau (left). Of more lasting value, the



Micronesian Occupational College in Koror, capital of the Republic of Palau,

offers practical courses in a part of the world where technical skills are limited, and the arrival of an electrician on an island is welcome news. Young men and women taking the police-science course break tradition by training together. Virginia Ikeye (right) practices defense against an assault.

Putting his talents to work while serving time in the Koror jail, a prisoner carves a Palauan legend in wood to earn income (below). The concept of storyboards was introduced by a Japanese artist during Japan's occupation of Palau and adapted by the islanders to record their traditions.



ALL BY DAVID HYSER

Geography added to the carnage in the battle for Peleliu, one of the bloodiest in the Pacific in World War II, costing more than 13,000 Japanese and American lives. From the air, island heights looked like rolling hills, but, bared of foliage by shelling and flamethrowers, they showed up as a horror for attacking Americans—jagged coral in bizarre shapes pocked with caves that the Japanese had fortified (right). Now Peleliu is dotted with memorials (lower right) to men of both sides, and many survivors return for visits that give the island a steady income. A downed Japanese Zero (below), near Koror, lies in waters shallow enough for visitors to drop into the cockpit.

Another important source of Peleliu income is illegal: the growing of marijuana, usually in 50-gallon oil drums. During one raid in 1983, police identified 16 fields from the air. On the

ground, they counted 216 plants in one plot alone. "They were laid out in perfect rows," recalls police officer Bill Stinnett, the leader of the raid. Recently it was estimated that authorities on Peleliu in one raid seized marijuana worth several times the entire annual budget of the state—\$120,000.

Government is a third source of island income. When the author visited Peleliu on election day last year, she learned that although only 400 Peleliuans live on the island, five candidates were running for governor, with an undetermined number standing for lieutenant governor and the state legislature—a situation similar to that in Palau's other 15 states. "The most overgoverned place on earth," says Fred Radewagen, publisher of the Washington Pacific Report and a longtime observer of Micronesia.





ALL BY DAVID HIDER

(Continued from page 493) one Sunday, showing us, himself, the incredible beauty of his realm. In white shorts and shirt, devil-may-care at the wheel of his own speedboat, President Saliu took us darting among the myriad Rock Islands, onetime coral reefs that through time have been lifted above the sea, carved by wave action, and dressed in tropical foliage (pages 462-3).

"There are a thousand private beaches here, just a quick boat ride from our hotels," he said with a smile that transformed his face. "And a million wonders in the water."

Snorkeling, I saw live soft coral waving in a rainbow of hues and tropical fish in a fantasy of sizes, shapes, colors, and markings, representing at least 1,500 types. We paddled over giant clams, some four and a half feet in diameter and weighing 200 pounds, believed to be more than 60 years old. We marveled that these beautiful creatures grow so huge, thanks to symbiosis with tiny but abundant one-celled algae. This natural food production encourages several Micronesian islands to farm the clams for human consumption.

President Saliu may be fun-loving on his day off, but he takes his job seriously. After Palau's first president, Haruo Remelick, was assassinated in June 1985, Saliu ran for president, promising to resolve the impasse with the United States that had prevented the negotiation of a compact.

The problem? The Palauans had voted for a constitution that banned nuclear devices. Saliu then initialed a compact agreement with the U. S. allowing American ships and planes of all types to operate in Palau. A court ruling held the compact illegal without a 75 percent referendum vote, a constitutional stipulation.

Saliu dissented, arguing for a more flexible interpretation of the constitution: "It does not say we cannot allow nuclear-powered ships if they are *in transit*." If an appeal fails, he could ask his countrymen to give him the 75 percent endorsement at the polls. Difficult? Maybe. But the agreement won a 72 percent referendum last February.

The Palau compact also allows the American military the option of using the nation's big island of Babelthuap for bases if the U. S. should lose those in the Philippines.

At the end I returned to Saipan and sought

out Governor Pedro P. Tenorio of the new Northern Marianas commonwealth. We lunched together looking out on the gardens of a luxury hotel filled with Japanese honeymooners, as are most hotels in Saipan. Japanese money had built the hotels with foreign labor, because the labor force on Saipan, as elsewhere throughout Micronesia, is meager and largely untrained.

"The Japanese didn't treat us badly before World War II," said Governor "Pete" Tenorio. "Their policy, I believe, was to keep us native Chamorros out of harm's way. Before the Americans invaded Saipan in 1944, the Japanese had us move from our home on the coast to our farm in the hills. We kids never knew about the suicides until later."



At gift-giving time at Xavier High School on Truk, Santa Claus, wearing a traditional *thu*, hands out gaily wrapped practical gifts such as corned beef, toothpaste, and soft drinks. This school, offering a liberal-arts education to some of the best young minds in Micronesia, and the Pohnpei Agriculture and Trade School are run by Jesuits. Both are sorely needed in the Pacific's emerging nations.

Believing surrender dishonorable and fearing that victorious Americans would kill, torture, and rape, hundreds of Japanese settlers and soldiers leapt to their death from cliffs now known as Banzai and Suicide.

I had stood atop Banzai Cliff, rising sheer from the foaming sea, and, in my mind's eye, saw the horror. Whole families came to jump, the children lined up by age with the youngest at cliff's edge. On command, each child pushed off the one in front, until the father pushed the mother and he turned and jumped with his back to the sea, so as not to lose his nerve. And all the while, Americans in small boats offshore broadcast pleas in Japanese for them not to jump and attempted to save those who survived.

The governor grew up to go to high school and college on Guam, working his way. He started his business career on Saipan with a single gas pump that led to a rental agency for jukeboxes and electronic games, then slot machines, and now poker machines, a popular hotel entertainment.

But politics is Governor Tenorio's deepest interest, as I observed firsthand during his run for a second term as governor. The campaign was a corker, with public debates turned wild with accusations, massive rallies fueled by free beer and food, newspaper crusades, and illustrated posters nailed to every tree and post. The political tempest was brewed in the teapot of a mere 7,000 voters, 90 percent on Saipan, virtually all the rest on the islands of Rota and Tinian.

AS AMERICAN as the election was, however, Janet McCoy, the High Commissioner of the Trust Territory of the Pacific, sees the islanders as little changed by the U. S. presence in fundamental values and sense of identity. "Of course, I've seen the improvements brought by our country," she told me, listing airplane runways and COMSAT stations in each capital, maternal and child health-care programs, Head Start classes, and many college-educated young people. "But what I see most is a group of people who, down the centuries, through occupation by four totally different governments—Spanish, German, Japanese, and American—have managed to retain their own culture. They have remained true to their own

beliefs and ways of life, have never truly been assimilated, and are now, at last, free to govern themselves, to make their own decisions, to handle their own affairs.

"The best thing we may have done is to help educate and train exceptional island leaders," she said. "In the four and a half years I have been here, I've seen them grow and mature, at home and at the UN."

Lazarus Saliu too had spoken of these leaders. They had all once served together in the territory-wide Congress of Micronesia—FSM President Nakayama and Bethwel Henry, Speaker of the FSM Congress; Governor Resio S. Moses of Pohnpei, Governor Mangefel of Yap, Governor Tenorio of the Northern Marianas, President Kabua of the Marshalls, and President Saliu himself. The Congress of Micronesia had limited power, subject to veto by the U. S. high commissioner but with an advise-and-consent voice in appointments. It was their training ground—and they had all been together.

"There was a time when many of us hoped," said Saliu, "that we could have a United States of Micronesia—one nation. But it was not to be. . . ."

I remember my last meeting in the Federated States with Tosiwo Nakayama, Bethwel Henry, and Resio Moses. I had invited them and their wives to lunch at The Village on Pohnpei, and we were served delicious fresh crab and breadfruit salad in the big, breeze-swept dining room. As we lingered over glasses of white wine, a tropical storm blew up, and in the fury of wind and rain we seemed to draw closer to one another.

Once I had mentioned to President Nakayama that I had heard the American administration of the trust territory described as the "scandal of the Pacific." And he had been quick to respond. "Not so. We owe everything to the United States. You gave us our freedom, the right to speak our minds. And education."

Now he spoke again of the United States and the difficulty of having a brother so big, so powerful, so flaunting with nuclear power. But it was of a family that he spoke; people in the islands understand about families.

As for me, I felt I had been witness at a birth in that family. The birth of nations that are forever bound by memory of the days they were one, in trust. □





The Dutch Touch

In their heyday as seagoing traders and architects of a worldwide empire, the Dutch came home to a land where the books were balanced, the streets scrubbed, the dikes quickly repaired. Today's Dutch are as tidy as ever, but they inhabit one of the world's most crowded countries, brimming with hundreds of thousands who flooded in after the empire ran aground. Undaunted, the stubborn, fair-minded people of the Netherlands plug away at problems with characteristic ingenuity. Even a no-nonsense city like Rotterdam (left), leveled by German bombs during World War II and now the world's busiest port, finds an avant-garde solution to the housing shortage with a street-spanning apartment complex.

By BART McDOWELL
SENIOR ASSISTANT EDITOR

Photographs by NATHAN BENN
and FARRELL GREHAN

Headlines called it "Murder on the Milk Train," and broadcasters gave hourly reports. Hijackers had seized a train with 24 hostages in—of all places—that orderly kingdom, the Netherlands.

The terrorists were residents of the Netherlands but not Dutch. *South Moluccans?* Newsmen thumbed their atlases to find the Moluccan islands, part of Indonesia. Why had South Moluccans come around the world to live in the Netherlands, and what were their grievances? Before the 12-day siege ended, news bulletins had spread more questions than answers. The Netherlands, it seemed, was a land of ethnic minorities.

"That was the moment in 1975 when everyone realized we had major problems," says Jan Harbers, an Amsterdam official who now works with residents from every inhabited continent.

Historically, the Netherlands has always been a haven for refugees: Jews fleeing the Iberian Inquisitions, Huguenots forced out of France, even the English Pilgrims before they sailed on the *Mayflower*. But all those famous refugees came before the Dutch lost a worldwide empire, full employment, and their complacency.

Today this 41,160-square-kilometer kingdom (15,892 square miles, half the size of Maine) is home to 14.5 million residents—making it one of the most densely populated nations in the world. At least 540,000 are "outlanders," as the government tactfully calls them ("foreigners" seems inhospitable, other terms pejorative). That number doesn't include the slim, sloe-eyed people of Indonesian ancestry who have Netherlands nationality and speak Dutch "with a sweet, singing tone," as some say. "We consider them fully Dutch," one man told me.

Surinamers—some of African stock, others from the subcontinent of India and the East Indies—may also carry Dutch passports; about half as many live in the Netherlands, roughly 180,000, as in independent Suriname. "They are here

because we were there," says a clergyman.

People once known as guest workers (and now often the guest unemployed) may come from Turkey (156,000), Morocco (112,000), southern Europe, even West Germany or Britain.

South Moluccans remain the hardest core. They have resisted any form of assimilation since the first 900 arrived on the ship *Kota Inten* 35 years ago. These Protestant Christians were warriors loyal to the Netherlands in the colonial struggle against Muslim Indonesia after World War II. They say that the Dutch led them to believe they would help them win the independence of their homelands. Bitterly, some have insisted on living "temporarily" in the barracks of old concentration camps while nursing their dreams of returning home. They have competing governments-in-exile. Moluccans now number 40,000, and the younger people seem as obdurate as their parents.

Though France has its Arabs, Germany its Turks, and Britain its Indians, no other European country has anything like the Netherlands' variety of new residents living in such proximity and concentration. Perhaps 10 percent of the Dutch population now comes from exotic stock. Not impressive by U. S. standards—but a new demographic experience in modern Europe.

This unmelted pot now bubbles with a national unemployment rate that hovers around 13 percent—though among some minorities the rate is far higher. Generous health insurance and other benefits cushion the hardship. A quarter of the population of Amsterdam is on welfare or social security.

Since their government stoutly opposes ghettos, old Dutch families in working-class neighborhoods smell strange foods cooking and hear the high-decibel sounds of alien music, the voices of children who noisily stay up well past the traditional Dutch bedtime. Native-born Dutchmen compete for jobs with the outlanders and pay high taxes for services that the strangers receive. No wonder they are reexamining policies of

Exotic faces line the streets of The Hague, the Dutch seat of government, as Moluccans mark the 36th anniversary of an "independent" Republic of South Molucca. Angry that they received no help in regaining their homeland following the Dutch loss of Indonesia in 1949, South Moluccans resist assimilation in the Netherlands. Bitterness has erupted into violence several times.

An estimated 10 percent of the Dutch population is of foreign extraction. Traditionally tolerant, the Dutch levy fines against anyone caught making racist jokes in public.



NATHAN BERRY

their welfare state and even their historic traditions of tolerance. Visitors may well ask, "Who are the Dutch today?"

Once the answer was easy. I can remember when Dutch friends defined themselves proudly as "traders and preachers." They counted their blessings and their cash, and they boasted, "Our language has at least eight words for 'cleanliness.'" Admirable. And how many synonyms for "dull"?

But the Dutch were never dull. These were the folk who produced Rembrandt, Mata Hari, and Limburg cheeses. On the surface, of course, they seem phlegmatic, cautious, stubborn, and blunt—how else should a Dutch uncle speak?

Matter-of-factly, Dutch engineers still take on daunting jobs: expanding the world's busiest port, Rotterdam . . . completing the world's most complex public works scheme, the Delta Project (page 526).

Struggle has made the Dutch what they are. Rome's historian Tacitus wrote of the people living in the Rhine Delta, "They form

a Germanic group that is extremely civilized but with rude manners." Pliny the Elder took note of man-made hillocks where people lived just above the ocean tides in the first century A.D.—"like sailors on a ship, when the surrounding land is flooded."

The first real polders—reclaimed lands—date from about 1100, and drainage windmills began pumping in the early 1400s. As one observer marveled, "God created the world, but the Dutch made Holland." Canals scored the soggy soil. Squat barges and tall sailing ships brought prosperity to growing ports.

The Dutch repelled invaders, harassed occupiers, and grabbed imperial prizes. Once their empire embraced 80 million people. But the Dutch also learned to avoid foreign quarrels. Grudges were not Christian—and were also bad for business. Neutral in World War I, the Netherlands later became the home of the World Court.

World War II and Hitler's five-year occupation tested Dutch mettle. Alone among Europeans, Amsterdammers went on a general strike to protest the persecution of Jews.





FARRELL UREMAN

After their own liberation the Dutch lost their empire but won world trading markets. Great companies—both Dutch and multinationals like Royal Dutch/Shell and N.V. Philips—hired battalions of workers. So former colonials came home along with loyalists from Asia and the New World and hastily recruited laborers from lands around the Mediterranean. Of course, the newcomers stayed on.

For all the new Dutch diversity, many people still follow traditional pursuits: They make cheese, balance accounts, tend tulips, paint canvases, fish for herring, and wear wooden shoes in muddy gardens. Their standard of living remains among the highest in the world.

Behind their ramparts—1,200 miles of dikes, dams, and dunes—the Dutch still struggle against an old and intimate enemy, the sea. Recently, though, they talk of a truce. “We have taken our last land from the ocean,” a conservationist assured me: Times change.

But traveling around the Netherlands, one wonders. For all the oceanic flatness of the land, for all its geometric farms with Mondrian angles, the country conserves a vast variety.

Each city has its stubbornly protected flavor. Rotterdam, rebuilt from war rubble, is all work and no play. “Shirts in Rotterdam,” says the old saw, “are sold with sleeves already rolled up.” The city dies at night.

Spires and towers of Leiden, Delft, and Utrecht are as old as history, the streets as spirited as the students who animate their cafés.

The Hague stands on ceremony. Bureaucrats wear white shirts and dark suits, for The Hague is the seat of government. But not the capital: That titular distinction belongs to Amsterdam, and only the Dutch can understand the difference.

Curtain of flowers and drinking straws separates a red-veiled Surinamese Hindu bride and yellow-garbed groom from guests at a ceremony near Amsterdam. Some 170,000 Surinamers in the Netherlands accepted the offer of continued Dutch citizenship following their nation's independence in 1975.



Flat appears vertical in this aerial view of sub-sea-level farmland near Naarden in the central Netherlands, where Dutch farmers trim their fields.



PHOTOGRAPH BY PHILIPPE GUYON

with drainage canals. Nearly half of the Netherlands consists of polders—reclaimed land—and one-quarter of the nation lies below sea level.

Everyone, though, sees the difference between the cities themselves. The Hague is neat and stuffy; Amsterdam is untidy and self-indulgent—with much to indulge: museums, concerts, theaters, piety, and sin. The oldest church in town abuts the red-light district. Antique houses slouch, and the city rings with secular bells: bicycles, streetcars, striking clocks. Restaurants offer menus for pet dogs, and dogs offer hazards for strolling the streets.

Northeast, but still within commuter range, lie lands newly seized from the sea and the raw, planned city of Lelystad. ("It hasn't a single disco," an Amsterdammer mourns. "But it does have toilets for dogs.") Its residents are recent transplants, and wives of commuters are called "green widows."

The village of Volendam, surrounded by Protestants, is a Catholic island in the north. Tiny, immaculate houses face the street with windows polished like gemstones; on each sill sits a small still life of fancy china and pampered plants. ("It is not true that we wash our windows every day," says Hilda Reurs firmly. "Only once a week!") And in their own special dialect Volendam fisherfolk tell how to take the smell of herring off one's hands: First apply vinegar, then wash. People wash a lot in Volendam.

Along the North Sea stretches Friesland, guarding its language with road signs in both Dutch and Frisian. The horizon is lanced by windmills, onion-dome church steeples, and trees tilted by prevailing winds. Offshore, these winds and ocean currents create "walking islands," as local folk call the unstable sandbars that gain and lose their sand. Beyond them lie the North Sea gas rigs, a hefty source of Dutch revenues before the price of natural gas tumbled.

People in Friesland have short first names ("they say there used to be a tax for registering long names"), but in the Catholic south, names expand to honor relatives and saints. In Limburg everything seems more expansive. Hilly, wooded, this was coal-mining country, often invaded during its long history. The antique capital, Maastricht, takes its name from the River Maas, or Meuse, which Romans forded there in A.D. 43.

Limburg's governor, Dr. Sjeng Kremers,

a former professor of psychology, characterizes his people as "really southern. We like to laugh and eat. We're optimistic. And we celebrate everything—if we are sick, we say, 'I celebrate because I'm ill.' We had a trinity here: the provincial government, the old coal mines, and the church. We like to work—and never have strikes. Minority groups here have caused no trouble."

East of Arnhem on the German border, farmers plow black earth, whitened in spring by foraging sea gulls. Pig raisers may think in terms of exporting whole farms—livestock, machinery, and even, temporarily, staff—to developing countries. "But at home they are conservative," notes a village physician. "On the German side of the frontier, villagers keep their curtains drawn at night. Not the Dutch. We have nothing to hide—or else we want to see outside."

A varied people, innovative, traditional.

"What charm is for Italians, and allure for the French, tolerance is for the Dutch." So says art historian Luca Dosi Delfini, a resident of the Netherlands for 20 years, an Italian by birth and a former resident of France. "The Dutch," he adds, "are the most civilized people I know."

"Our tolerance is largely a myth," insists Amsterdam clergyman Dr. H. G. Boswijk. "When Surinamers come to our churches, people observe a friendly distance. They say, 'You are welcome, but leave us alone.' It's a kind of implicit apartheid."

And yet Dr. Boswijk reports a recent incident in his own Protestant church. "A lesbian couple had a child by means of a donor, and they wanted to baptize the baby. The congregation discussed the matter at length—and decided we should baptize the baby. It was a very happy day."

"That could not have happened ten years ago," says one feminist leader, herself a lesbian. "But we get along with each other in the Netherlands because we are a small country. We need each other."

In the Catholic south—"below the rivers," as they call it—Protestants were often isolated. Film producer Ton Vriens, who grew up in the south, recalls such isolation even in Amsterdam years later: "We had a Catholic baker and butcher—and Protestants wouldn't shop there. Many Dutchmen knew what it was to be different."

And perhaps that was the very reason so many Dutch risked their lives during the Nazi occupation to save Jewish neighbors. Consider Judith Belinfante, director of the Amsterdam Jewish Historical Museum. She was born to a Jewish couple in hiding in The Hague during the occupation. Her parents' former maid, a girl not yet 21, announced that she herself was the mother, registered the birth as illegitimate, and secured a ration of milk for the baby, risking her own life.

Tolerance seems too weak a word.

A longtime admirer of the Dutch is the former Spanish ambassador to The Hague, the Duke of Baena. His book *The Dutch Puzzle* is widely quoted and, like everything else in the kingdom, debated.

The duke calls the Dutch “grand and petty. . . materialistic and realistic—and above all, extremely religious. . . Their exterior is . . . slow in movement, the rhythm of bicycles and barges. . . yet in no part of the world have I known a more nervous people. . .”

A Dutch housewife complained to me about Moluccan child rearing: “They have loose hands.” Meaning Moluccans slap their youngsters. It was the same complaint that 17th-century citizens of Leiden leveled against the refugee English Pilgrims—too harsh with their children.

“In 20 years I have never seen a child physically punished,” notes Dosi Delfini. “Heroes are not welcome,” he continues, “and neither is rhetoric nor extravagance.”



FARRELL GREHAN

Floral artistry in The Hague portrays Beatrix, Queen of the Netherlands, at right, and 77-year-old Princess Juliana, who abdicated in favor of her daughter in 1980. Ruled by matriarchs since 1890, the Dutch invest their monarch with few political powers beyond selecting the person who forms a government after each national election.

When my friend from Germany brings her fancy car to Amsterdam, she often gets a broken window."

Last winter, when canals froze solid, the Dutch held their traditional 11-city ice-skating race. Some 17,000 citizens signed up to skate, among them a last-minute entry listed as "Mr. van Buren," actually 18-year-old Willem-Alexander, Prince of Orange and heir to the throne.

The prince completed the 200-kilometer tour in 14½ hours, and a delighted Queen Beatrix greeted him at the finish line. The prince was roundly cheered for spunk

and endurance. But heroism has a price.

"The palace shouldn't have let him sign up ahead of others who were turned away," some people grumbled. "It was unfair."

Rotterdam businessman S.J.R. de Monchy recalls that when his wife inherited some old family jewelry, she wanted some diamonds reset. "But the jeweler refused to do it. 'These stones were set over charcoal,' he said, 'so they would glitter less.' It was bad taste to show off."

A Calvinist society with stubbornly maintained traditions. Now enter the exotics, bearing problems. Drugs, for instance.



Royal paperwork occupies Queen Beatrix (right) daily in her office in The Hague. She is of the House of Orange-Nassau, the ruling dynasty since 1814.

Restored to its 17th-century grandeur, the royal country estate of Het Loo Palace (below), near Apeldoorn, was donated to the state in 1971 for use as a museum.



PHOTO BY NATHAN BERN

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Window-shopping takes on a new meaning in the Wallen, Amsterdam's infamous red-light district. Here in the heart of the capital, prostitutes beckon from brothel windows (right), and Salvation Army volunteers (below, in a double exposure) cheerfully distribute literature. Loosely regulated by authorities, many of the port city's several thousand prostitutes pay taxes, get regular checkups, and participate in government-sponsored health and insurance plans. They also take traveler's checks.



Drugs are met more frequently by Dutch tolerance than by law enforcement.

As a crossroads city with far-flung trade, Amsterdam has had its share of hard drugs, and crime increased with narcotics. But things have changed since Amsterdam's happy hippie days in the 1960s. Mayor Ed van Thijn's cleanup campaign has brought such a decrease in crime rates that Amsterdam is now a strong contender for host of the 1992 Summer Olympics. Yet there is still work to do.

"Hard drugs have ruined the brothel business," complains Frits van de Wereld, a kingpin of local prostitution and the hashish market. Frits owns seven brothels, by his own count. ("Actually, he owns 11, but won't admit it for tax purposes," insists crime reporter Hans Hofman.)

"I been here 59 years—and no protection

paid," Frits says firmly. "No Mafia here. Too small. The girls here? Not Dutch girls—70 percent international." But street prostitutes—tolerated if not legally accepted—have undercut prices in brothels. "Hard drugs is *finish*."

The former chief of the Amsterdam narcotics squad, Barry Thomas de Koningh, estimates that of 400 street prostitutes, 300 are addicts. "Our old opium law lists illegal drugs, but the public prosecutor gives guidelines to the police. Marijuana is technically a misdemeanor, but it is not enforced."

True. At the Bulldog café on Leidseplein, customers can openly buy marijuana in a variety of blends and flavors. Dozens of coffeehouses around town display signs showing the seven-fingered leaf of the marijuana plant. They serve hash-laced "space cakes" with butter and syrup.

"We're not interested in these people,"



FARRELL GREYNE LABOVIC; NATHAN BORN

explains officer de Koningh. "We want hard-drug *dealers*. If people in these respectable places try to sell hard drugs, the owners will call the police. I just arrested a heroin dealer. He could get six years."

Of the 10,000 addicts in Amsterdam—half of the Netherlands total—40 percent are Dutch, 30 percent Surinamers, and the rest foreigners, chiefly German.

Mayor van Thijn asks, "What gives Amsterdam the bad reputation? Our addicts—even counting foreigners—represent slightly more than one percent of our population. Rome has 50,000 addicts—nearly 2 percent of the Roman population. Comparing big cities of the world, we're not on top."

Mayor van Thijn has used an innovative approach with squatters—"a decreasing problem," as the mayor observes it. A few years ago groups of

far-left young people would seize any vacant building and live there. Until recently Amsterdam had been losing population for years as families moved to suburbs and factories relocated. Vacant buildings were plentiful, and city laws made eviction difficult. Several times a year revolution-minded squatters staged major riots, wearing helmets and using paramilitary methods. Squatters had their own illegal radio station, their own newspaper ("a good one—I read it," notes Mayor van Thijn), and an alarm system that rallied public support when police threatened. "When I became mayor, I stated that I wanted to end the spiral of violence," the mayor recalls.

And then the squatters took over a vacant carpet factory, a site that the city council had voted to use for a hotel. "I was forced to take back the site," says Mr. van Thijn. "And it was a test to avoid violence."

"I took a risk. We announced the day before that we would take back the building. The squatters mobilized some 2,000 people inside. When 800 police arrived, I ordered them to enter the building unarmed, without baton or battle dress. One by one the police took out the squatters. After two hours or so, the others inside decided to leave. You see, by announcing our plans in advance, we were sure everyone would be inside—not fighting in the street." So there was a relatively peaceful eviction.

A very Dutch solution.

Though new and tougher property laws to take effect next January may ease the problem, Amsterdam still has some squatters. Jaap, 29, is one of them; for legal reasons, he does not reveal his last name. When I met him, Jaap and a hundred squatter colleagues had lived in "their" building on Spuistraat for more than two years. "Our movement has almost fallen apart," he said.

His own living area looked it: mattresses on the floor, paperback books and kitchen utensils scattered around.

"We are unemployed, mostly, living on welfare," said Jaap. "I am a student with a stipend from the government, and the only person here with a structured life. I'm a member of the Communist Party, but not active. . . . A weakness in our squatter movement is ethnic. We are mainly white men. But in Amsterdam, maybe 10 percent of the young people are Moroccans or Turks—and they're not squatters. Surinamers are taboo. As a political movement we're finished."

Inside trade unions ethnics do only slightly better. In Utrecht I talked with Turkish-born Talip Demirhan, a Muslim employed in the Christian trade union movement, the CNV, advising the union on policy toward minorities. "We want a society where everyone participates," says Mr. Demirhan. "I



know 18 kilos of laws dealing with aliens."

So far, only 5 percent or so of union members come from minorities—Surinamers, Turks, and Moroccans, in that order. And because of their authoritarian government at home, Moroccans have special problems. "Some Moroccans are fearful of informers who report to Moroccan secret police."

Talip Demirhan came to the Netherlands without his wife, and the marriage ended in divorce. "Many have had that fate," he says. "Many Turks came from rural areas, and they kept old ideas here. But Turkey itself has changed. After 1960, television came to Turkey—now even your program 'Dallas.' Women imitate Pam and Sue Ellen. My mother used to wear seven meters of clothing. Now she behaves like Miss Ellie. In the Netherlands, Turks change slowly. Only 15 percent of Turkish women here work outside the home."

I met one of them in The Hague, a housemaid in the historic Hotel des Indes named Dolma Nihal. At 29 she has been married ten years. Her husband used to work in the Philips cable factory, but he is now out of work and gets unemployment compensation. Friends and neighbors tend their four young children while Dolma is at work. "No, my husband does not help with housework," she laughs. "Turkish men never help the way Dutch men do."

Turkish foods are available in local shops, and medical facilities are better than in Turkey. ("Here they even have translators at the hospital.") But Dolma still hopes to return home. Her children—all born in the Netherlands—speak Dutch with one another. "They'll decide on their own to stay or go."

Turks can go home at age 55 with a small pension—about \$370 a month. But staying in the Netherlands, they get far more, plus an allowance for children, low rents, and health insurance. "So it is cheaper for the Netherlands if they go home," notes social worker Evert van den Broek.

This year Ramadan, the month-long Muslim observance comparable to Christian Lent, began on May 10. The long days in northern Europe present special problems for Muslims living in the Netherlands. They must take no food or water from dawn until sundown, so such a fast can last more

than 16 hours. "I must not even swallow my spittle," an Egyptian chauffeur told me.

During Ramadan I visited one of Amsterdam's 25 mosques, a former auto-repair garage converted for worship with carpets and crystal chandeliers. The imam, or prayer leader, M. S. Echarrouti, proudly told me, "Until 1979 we met in the basement of a Catholic church. Now we own our place. On Friday 1,200 people worship here.

"We have no subsidy; we want no government regulation. Each member pays 13 guilders a month for our expenses—though parents of the 200 children in the madrasah [Muslim school] pay more. We are all Moroccans, though our Muslim Federation also has mosques for Turks, Pakistanis, and Muslim Surinamers."

Some youngsters wore jeans, others long Moroccan robes. A delicious aroma filled the mosque. "Yes, we are cooking food for the breaking of our fast," said the imam.



BOTH BY NATHAN BEHR

Protest is a way of life for many of the Dutch. Amsterdam policemen get a lecture (above) outside the café headquarters of the squatter movement, which has encouraged homeless young people to occupy abandoned buildings. Nearly a thousand Amsterdam apartments are now under squatter control.

Demonstrators (facing page) protest the Dutch parliament's decision to permit deployment of U. S. cruise missiles at Woensdrecht NATO base.



EACH BAG 2.5-	
	GRAMS
JAMAICAN	2.0
THAIWED	2.3
SINSEMILLA	2.3
BURMA	3.5
BRASIL	3.5
COLUMBIAN	6.0

FARRELL GREHAR (TOP AND LEFT); NATHAN BERRY

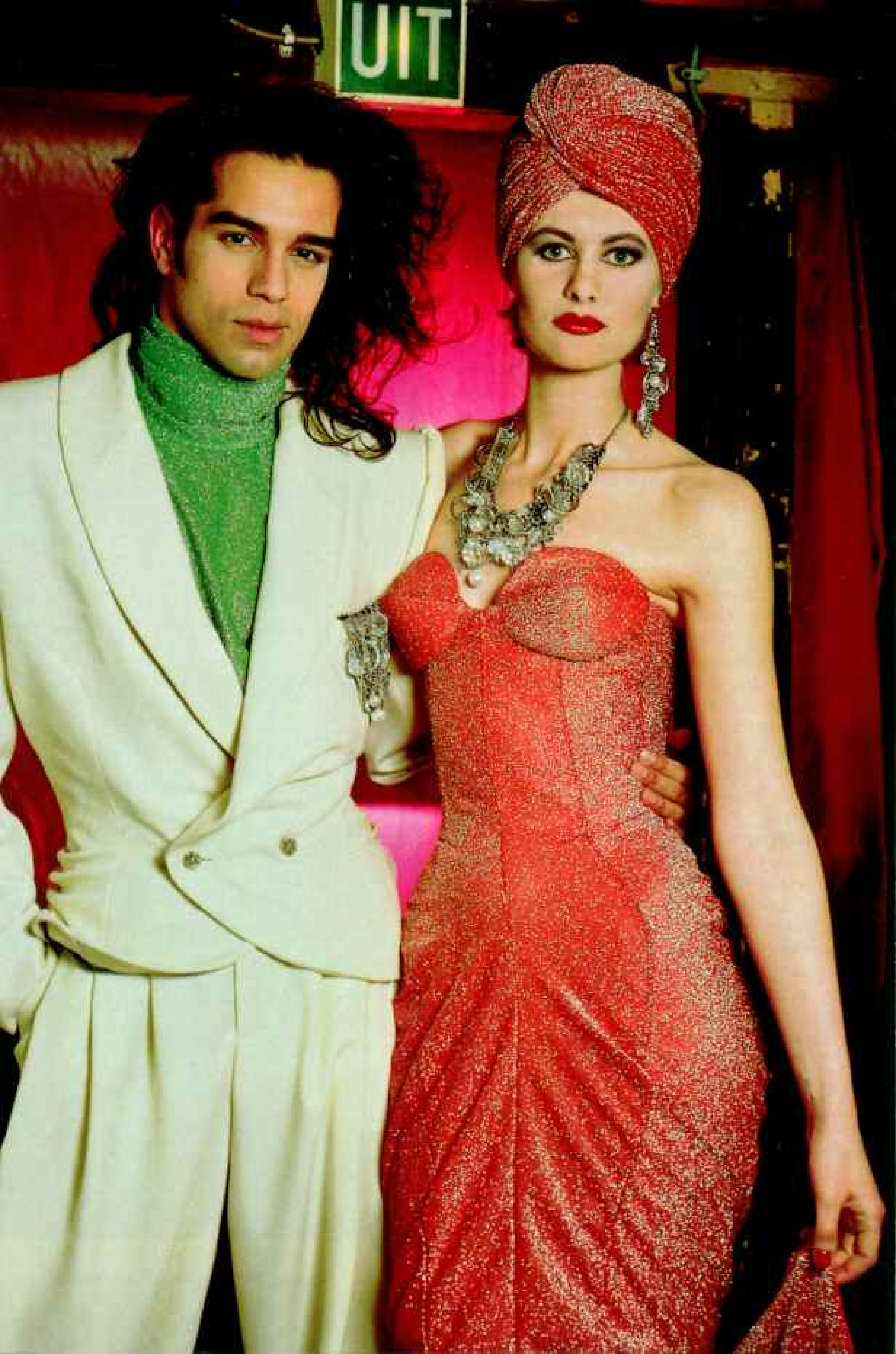
theater and disco with an occasional fashion show. In a basement dressing room, models (right) pose in the latest from Dutch designers.

Amsterdam's free and easy ways have also made it one of the top drug-trafficking areas in Europe. Although technically illegal, marijuana is on the menu (above) in many coffeehouses, while authorities reserve their get-tough policies for a growing problem with hard drugs and crime. "We thought we could be tolerant and still control hard drugs," says a government official. "We were very naïve."

Anything goes in Amsterdam, a city whose "live and let live" reputation has made it a mecca for the free spirits of Europe. That includes everyone from the street people (above), living on handouts, to the established

artists and their patrons who gather for conversation at the Art et Amicitiae (top), a private club with a five-year waiting list.

A glimpse of what's in might be appearing nearby at the Paradiso, a combination



"First, some dates. Then bread and *harira*, a hearty soup of meat and vegetables. The meal is for working people who have no family here. In Islam it is thought good to give food to those hungry or fasting."

Last spring Muslims received permission to broadcast on Dutch television, joining Catholics, Protestants, and political partisans who have programs of their own. At the Dutch Broadcasting Foundation studios at Hilversum, the editor of a program called "Passport," B. J. Martens van Vliet, explained his work:

"Most of our audience is Dutch, but we broadcast in five languages—with subtitles. About 15 percent is entertainment. . . . Two words we avoid are 'integration' and 'racism.' Every week we have 30 minutes each in Turkish, Arabic, Spanish, Italian, and Serbo-Croatian. I'm the only Dutchman on our staff of 16."

Dutch television is not above artful propaganda in a good cause. Novamedia/Chanowski Productions airs a puppet show five minutes every weekday evening called "*Fabeltjeskrant*," with animal characters as protagonists. An owl is the narrator, beavers are technicians (they are Rotterdammers who build dams), and a dog is a stock comic-villain who discriminates against exotic forest creatures. The dog, for example, calls the zebra, who speaks Dutch with a Moroccan accent, "an artificial horse." A stork speaks with high-society mannerisms and comes from The Hague. Chico Lama has a Spanish accent coached by real-life Chilean refugees.

Last March, resident foreigners were first permitted to vote in Dutch municipal elections, so Novamedia TV writers followed suit; children were asked to write letters voting for their favorite animals on the show. Response was massive. The producers expected 20,000 ballots and got 200,000. Newspapers covered the mock election almost as fully as the real ones.

Star fortress of Naarden guarded the eastern flank of Amsterdam in the 17th century, when the flourishing Dutch Republic became one of the world's leading commercial powers.

The winner was a foreigner: Chico Lama.

As a mirror of society, the TV fable made a fair prediction: Dutch voters in 697 communities elected 49 outlanders to city council posts. I met some of them when they later met in The Hague. The list included the nationalistic Moluccans and even Moroccans, who had been asked by Morocco's King Hassan not to participate.

"Could foreigners someday vote for members of parliament?" asked an Italian



councilman. The government is seriously considering the idea.

Typical of the winners is Secil Arda, a Turkish woman married to a Dutchman. Ms. Arda represents Enschede, an industrial city near the German border; she has lived in the Netherlands since 1980.

"I'm very proud of the Netherlands, my chosen country," she says. "Of course, now I can't go to market without dressing up!"

Not every woman in the Netherlands has

so cheerful a view of society. The Dutch lag behind most other Western European countries in the number of working women. "The government gives the feminist movement 12 to 13 million guilders a year to do research," says one activist. "Then they ignore our reports. Discussion is open, but power structures are closed."

In the village of Dinxperlo, smack on the German border, Ypie Volbeda, a social psychologist, works with women in a



FARRELL GREENAW

conservative farming community. "I'm considered a bad mother because I don't stay home with my children," she says.

"Farmwives feed young calves and pigs and decide when to breed the cows. A man never enters a vegetable garden. Women keep the accounts, but when the banker calls, a wife serves coffee while her husband discusses the finances."

"The Dutch woman's role is like the Queen's," observes a feminist. "She can do a lot, but she can't decide. There's a traditional limitation on all women."

Queen Beatrix herself would never enter such a social controversy. But she is not at all a weak figure.

The Queen (page 511) has a strong Dutch handshake, a grip suitable for scepter or sword. She is a stylish, magnetic woman with plumb-line posture and a profile meant for minting coins. Best of all is her smile, sudden, spontaneous, genuinely merry.

The Queen has received photographer Nathan Benn and me for photos in her private office at the residential palace, Huis ten Bosch—"house in the woods." She is carrying a bulky manila envelope, in case Nathan wants action pictures. He does. And since these papers are authentic royal homework, the photos can be unposed. Her Majesty hates to pretend.

While Nathan works his cameras, the Queen makes marginal notes. This is work she begins each day by 7:30; she breaks at midmorning for conferences and ceremonial duties and returns to paperwork at night.

Her office, small and bright, reflects an active royal personality—informal family snapshots, avant-garde collage and sculpture, tables of glass and brass, tulips in a vase. Reference materials fill bookshelves; no fiction. But on one wall I spot a framed cartoon: A king in crown and ermine sits at his council table with a full cabinet of wild-eyed court jesters. Says the cartoon monarch to a visitor, "Frankly, it's no better or worse than any other form of government."

Behind Her Majesty's writing desk, a portrait of William of Orange looks over the royal shoulder. This was the heroic prince who drove the Spanish Duke of Alba from the Netherlands when 16th-century Spain tilted at Dutch windmills. As stadtholder, or

First of the season—and reputedly the tastiest—herring is served to the mayor of Katwijk (right). A local boat had brought in the first catch. Dutch fishermen net almost 100,000 metric tons of herring annually.

The eating habits of gray seals (below) are studied in a British-Dutch program on Texel Island. Newcomers to Netherlands waters, the seals have migrated from Britain, where fishermen complain that they deplete North Sea fish.



royal protector, of three of the seven provinces that would later become the Dutch Republic, William fused the fates of his nation and his House of Orange. And though the family Orange gave Britain a king—another William, who shared his British throne with Mary II—the constitutional Dutch monarchy did not formally begin until 1814.

Even now republican ways prevail: Dutch monarchs have investitures, not coronations; they never wear a crown. And for 96 years and three generations the kingdom has been ruled by queens—Wilhelmina, Juliana, now Beatrix—though each queen took an oath as "king."

This is not an interview, and Her Majesty's conversation remains off the record. But my own impression of Queen Beatrix is not: She has, as one of her subjects told me, "a bubbling personality" and a panorama of interests. Everyone in the Netherlands knows that the Queen's hobby is sculpture and that she has a studio in this 17th-century palace. But because she also has a keen interest in historic preservation, I'm aware that Queen Beatrix settled for a less-than-ideal studio rather than alter a national



BOTH BY FERRILL GREENAN

monument. Her Majesty is also quite conscious of costs, for the royal family bore a generous share of the expense of furnishing this palace.

We finish in the office and move on to the famous Orange Hall. It's historically important, especially for Americans: John Adams presented his letters of credence here. Adams, our first minister to the Netherlands, found his post "like no other. It is all the effect of industry and the work of art."

Art still works in this hall, where the ceiling and walls are completely covered with paintings of the Flemish school. A proper setting for a queen with an artist's eye.

Perhaps it was that same artistic flair that first attracted the 12-year-old Princess Beatrix to the pages of NATIONAL GEOGRAPHIC. She has been a life member of the Society ever since. And perhaps that is the reason we have this chance to meet Queen Beatrix.

The Dutch employ one civil servant for every 16 citizens. "And," observes a Dutch taxpayer, "we pay them the highest salaries in the world."

The government subsidizes an amazing

array of private-sector groups: an assortment of businesses, trade union movements, religious sects, environmental organizations that oppose government projects, foreign refugees campaigning against conditions in their homelands ("it's hard to explain to friendly foreign governments when our public funds support their opposition," notes a Foreign Ministry functionary), the feminist and homosexual movements, artists ("our patrons are no longer the church or a prince, but the government"), and homes for wives who have left their husbands.

Free discussion and fairness are a national obsession, and results reflect practical compassion: Dutch bank notes, for example, are embossed with Braille-like numerals to help the blind make change.

At least once, in 1975, the government of Amsterdam reportedly subsidized graffiti. A group wanted to protest some city plans, and an official furnished city paint for a sign on the side of a building, but later complained, "They didn't return our brushes."

Unsubsidized graffiti provides a rich anthology of public statements. They may denounce South Moluccans, cruise missiles,

and farmers who confine chickens in overly cramped cages. My own favorite was a lament lettered just above the waterline of a canal, the war cry of an old Dutch struggle: TOO MUCH OCEAN.

For the ethnics, slogans and debate sometimes obscure the progress. But it's there.

A grade-school teacher says, "First I had to teach Dutch children not to hit Turks, then the Turks not to hit the Moroccans. Now I must teach Moroccan children not to hit little Surinamers." Progress.

Individual success stories improve the image of new residents. Poor Italians, who came a generation ago as chimney sweeps and peddlers of ice, can look proudly at one of their own, Sergio Orlandini, now president of KLM Royal Dutch Airlines.

South Moluccans have a hero in Simon Tahamata, age 30, a 60-kilo soccer star with the Feyenoord club of Rotterdam. On a rainy Sunday I watched Simon's team eke out a muddy victory over Utrecht in a stadium aptly nicknamed the Tub.

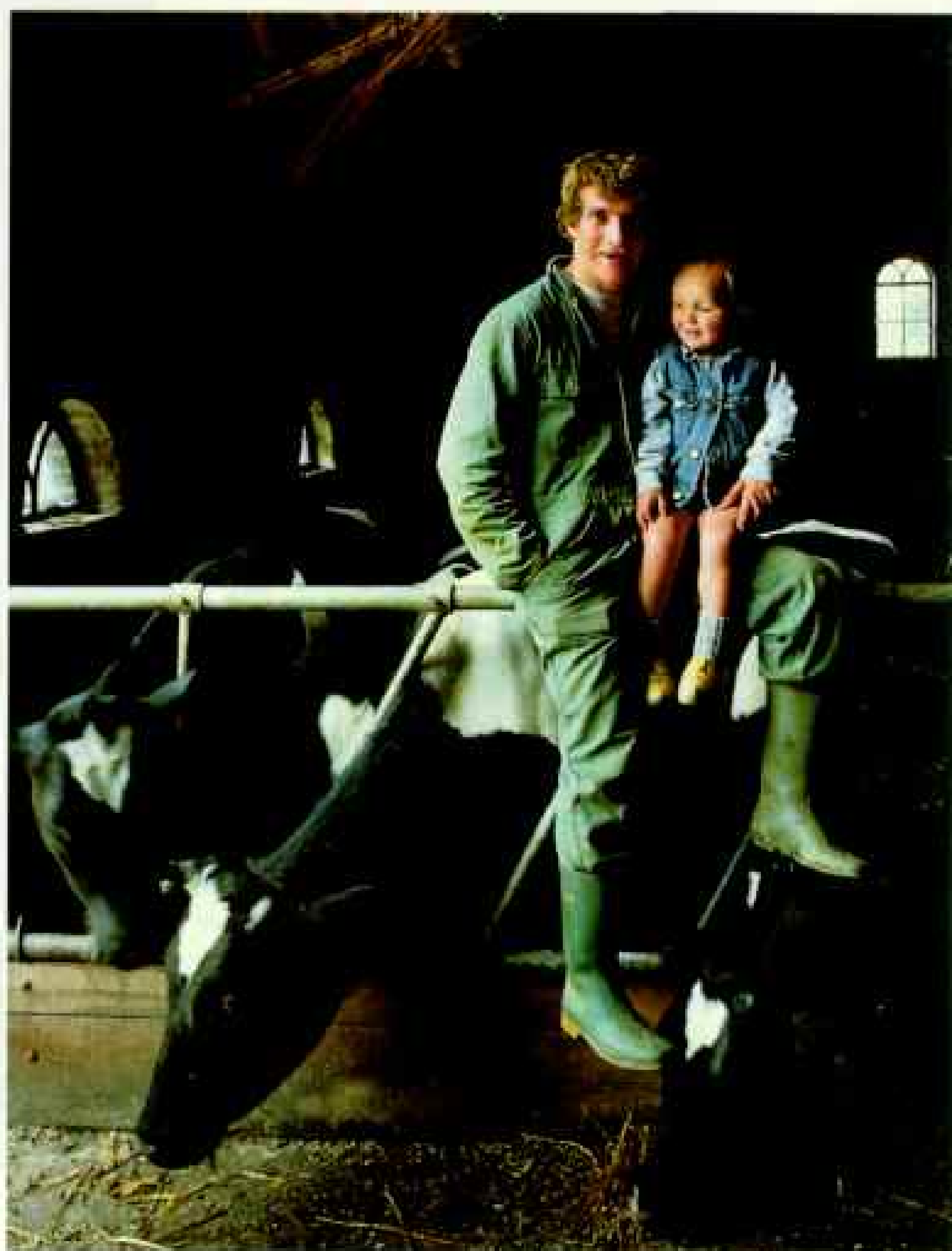


After the game I met Simon in the clubhouse. His toddler son was romping in his lap as Simon told me about his own boyhood, playing soccer in the streets of Amsterdam. "When the train was hijacked, it was a hard time for me. The mentality of Amsterdam people is very hard. I didn't know any of the hijackers, but I visited them in prison at Christmastime. After all, they threw away their future for us."

A delegation of South Moluccan and Dutch officials held a press conference

recently for "historic announcements" on the 35th anniversary of the Moluccans' arrival in the Netherlands. To me their news seemed slight: an "agreement of intentions" to establish a museum of South Moluccan culture, and an offer by the Dutch government to increase the pensions of some 3,000 aging Moluccan veterans and their widows. And, of course, both sides agreed to continue discussions. Were the offers too late, little, and woolly?

At least seven groups speak for the 40,000



MARTIN KERS (LEFT); RUTHAN BORN

Marathon man plus: Evert van Benthem (above, with his son, Rolf), a 27-year-old dairy farmer from Sint Jansklooster, skated to victory in 1985 and 1986 in the Elfstedentocht, a 200-kilometer race over frozen waterways through 11 Frisian cities. The event had been canceled for the previous 22 years because of mild weather. At Hindeiopen (left) stragglers pass on the canal outside, as TV keeps pace with the leaders.

The rhythm of skates on a frozen canal sets the winter pace for many in the Netherlands. Here the townspeople of Balk, in Friesland, spend an evening skating under the lights.

South Moluccans. So I asked some unofficial young Moluccans attending the press conference what they thought.

"I am content but not glad," said one third-generation immigrant. Even he wanted to return to an independent homeland.

"I am neither content nor glad," said another. "I am skeptical. It's like your American treaties with Indian tribes." He spoke like a Cherokee after the Trail of Tears.

"We can't make war on Indonesia so they can go home," said a Dutch newsman. "But this agreement keeps us talking."

Talking. A consulting psychologist for the Amsterdam police, Dr. Francis Denkers, says, "We Dutch are too rational. Talking, thinking, but short on gestures." Dr. Denkers, nonetheless, sees some gestures of change. "By 1990 our goal is to have a police force one-quarter women and 10 percent minorities."

Since Dutch citizenship is a requirement for policemen, recruiters have arranged for minority candidates to begin their training—and be assured of a police job—before they undergo a speeded-up, six-month naturalization process. Already more than 50 minority candidates are enrolled.

Meantime, Dr. Denkers sees a change in other attitudes. "In the past two years we have become more conservative. Unmarried couples are marrying. Childless women of 40 have said, 'Now I want to have a child.' There's a rejection of the free sex of the 1960s and '70s. In bookstores you find more religious literature—a deepening of Christian interest, both Catholic and Protestant."

Old Dutch verities are renewed.

Such trends do not surprise the dynamic Prime Minister of the Netherlands, Ruud Lubbers: "As an economist, I think in terms of cycles. So I think of returning to values that seem to have been lost."

Prime Minister Lubbers, a farsighted man, is willing to look ahead and predict—"or guess, even a wild guess"—a



view of his country 50 years from now:

"The electronic age will have done its work. Service industries, information, international specialization, travel—all increased. Our working time will be organized less strictly.

"But we'll still need places for human contact. Altogether, there will be more opportunity for religious and social life



FARRELL SHERMAN

than in the second half of this century."

And the people? "Our population may reach 16 million and gradually recede. We'll have more elderly people. The Surinamers and Mediterranean people will be integrated, and our population will seem a bit different. One out of four or five children will have parents or grandparents born outside the Netherlands."

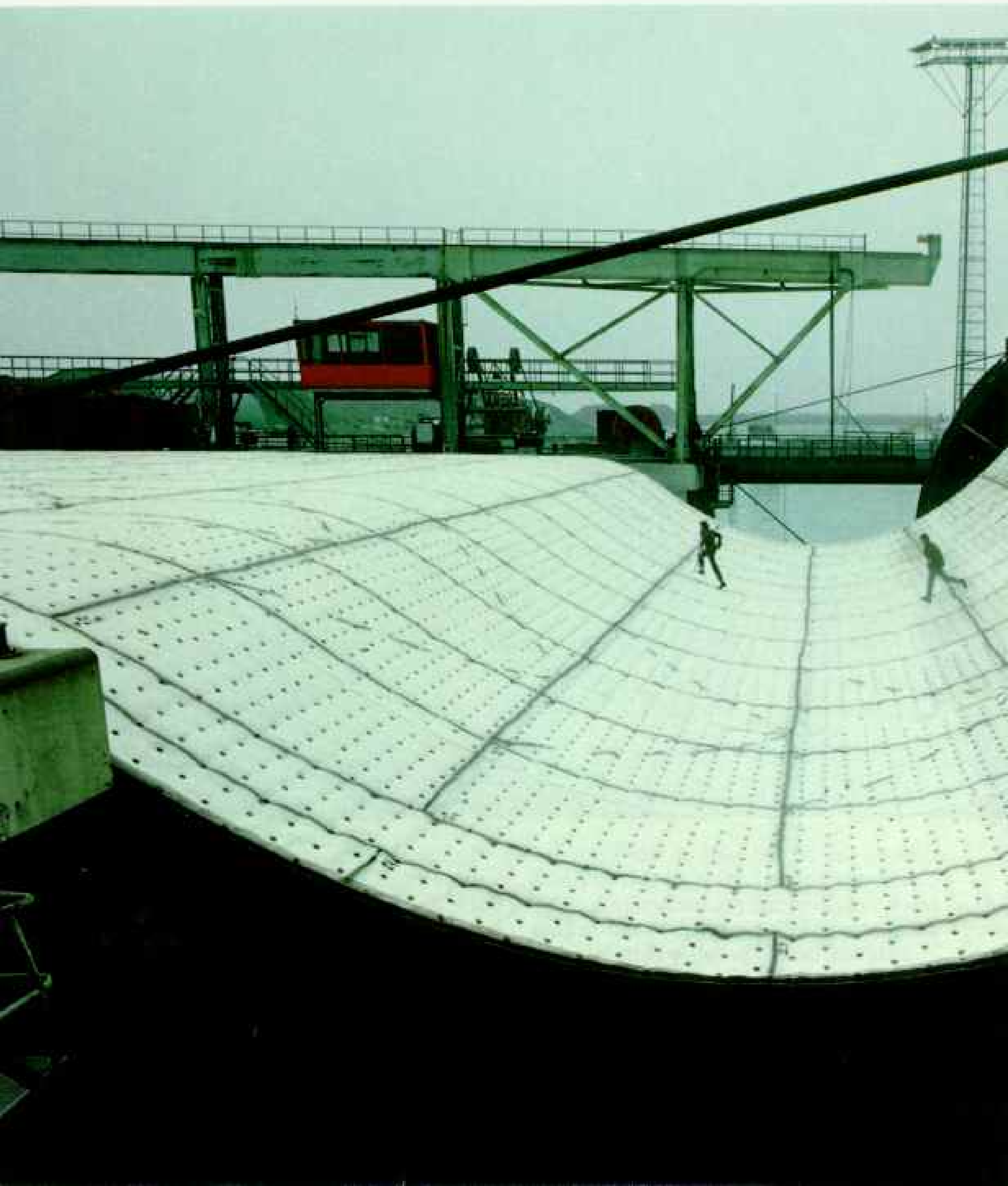
The prime minister's fellow Rotterdammer S.J.R. de Monchy takes a similar view but adds, "There will still be someone you'll recognize as a Dutchman."

For myself, I think of the new polder lands and raw Lelystad. "It will take a hundred years," people there told me, "for the earth to settle fully." And maybe that long for its people too? □

THE OOSTERSCHELDE BARRIER

Man Against the Sea

By LARRY KOHL NATIONAL GEOGRAPHIC SENIOR STAFF



Continuously threatened by the tempestuous North Sea, the Dutch seek to protect the southwestern corner of their country with a colossal hydraulic-engineering project. Begun more than 30 years ago, after a savage North Sea storm devastated much of the southern Netherlands, the five-billion-dollar Delta

Project will be officially completed this October 4. Queen Beatrix will preside over inauguration ceremonies for a gigantic surge barrier that will seal the Oosterschelde estuary during dangerous storms. Last component of a vast complex of dams, dikes, and channels, the barrier will safeguard both a valuable

estuarine environment and future generations of Dutch. To stabilize the millions of tons of concrete, rock, and steel composing the surge barrier, great sheets of seabed mattresses (*below*) were rolled onto gigantic drums for transport to their appointed positions at the mouth of the estuary.

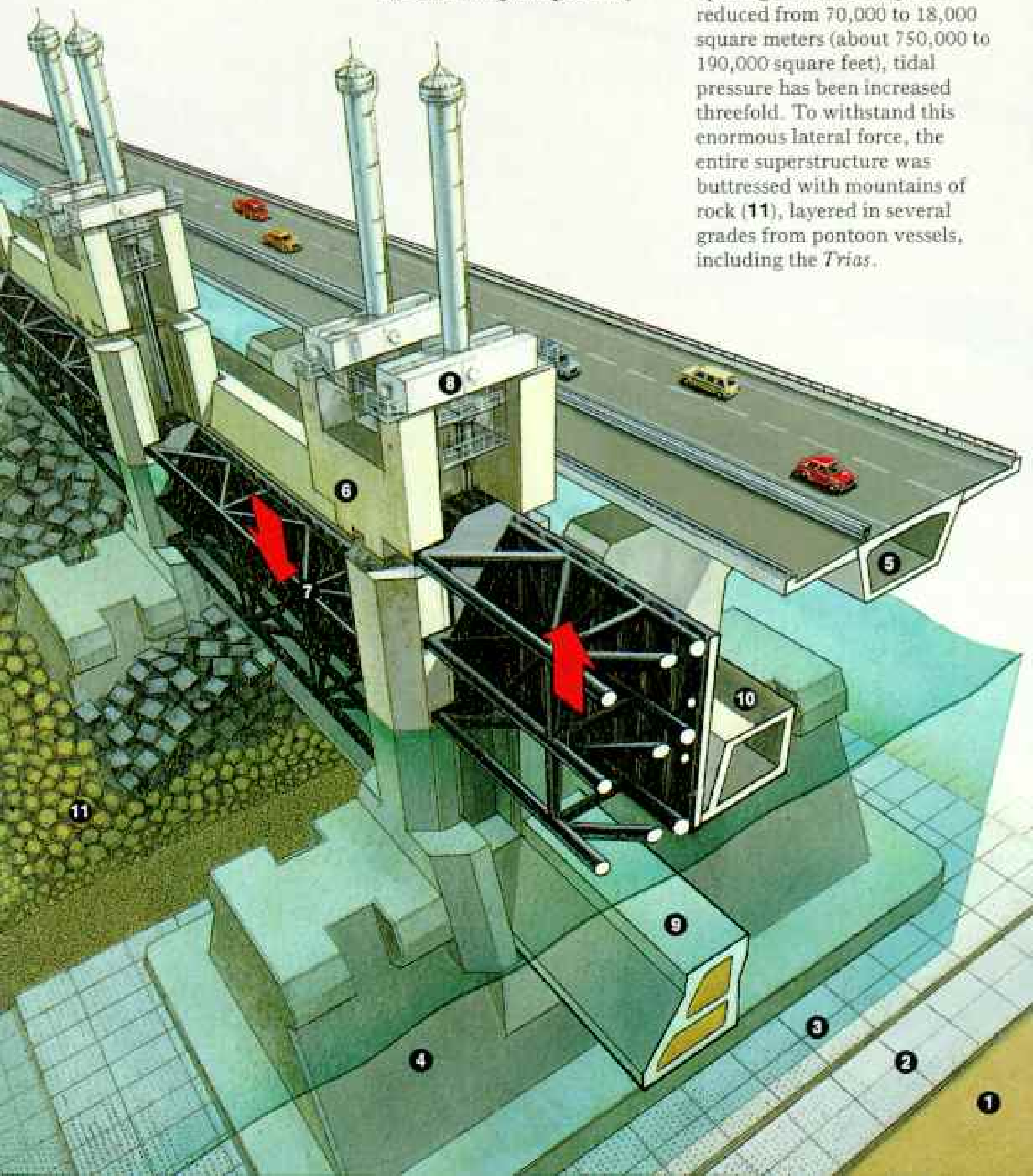
FARRELL GREHAN 527

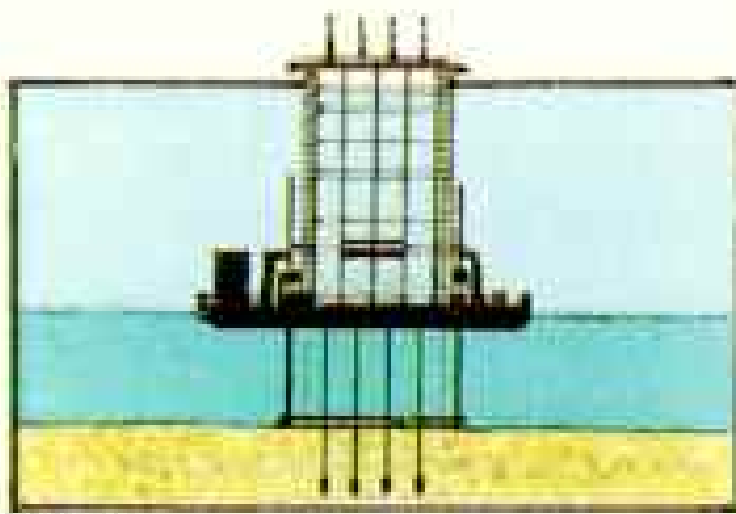


Radically new concepts in dam design and an extraordinary fleet of construction vessels (*facing page*) made the surge barrier possible. In preparation for the enormous weight of the structure, the sandy bottom of the Oosterschelde (1) was compacted with giant vibrating needles extending

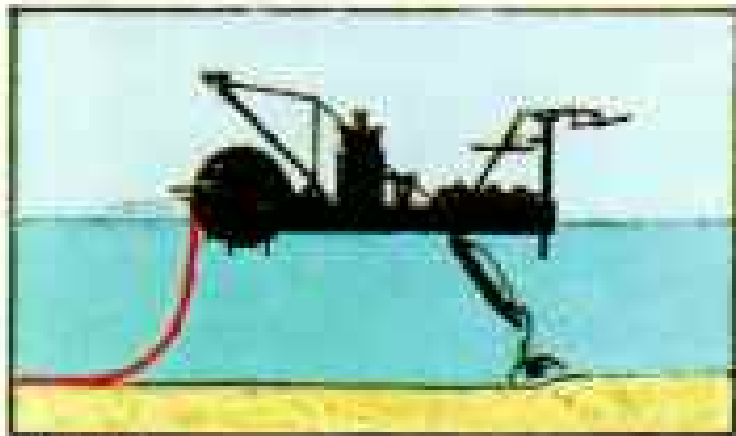
from the vessel *Mytilus*. To prevent seabed erosion, sand-and-gravel mattresses (2 and 3) were laid down by the *Cardium*. Onto each mattress foundation one of the 18,000-metric-ton piers (4) was lowered by the *Ostrea*, which had been guided into position by the mooring pontoon *Macoma*. *Taklift 4*, one of the world's largest floating cranes, placed the remaining components,

beginning with a traffic beam (5), whose interior duct holds hydraulic and electronic equipment to operate the gates, followed by a concrete capping unit (6). Next the gate (7), shown here in closed position, was lowered into place. Finally the hydraulic gate lifts (8) were added, along with two beams (9 and 10) that define the gateway. Since the estuary's discharge opening has effectively been reduced from 70,000 to 18,000 square meters (about 750,000 to 190,000 square feet), tidal pressure has been increased threefold. To withstand this enormous lateral force, the entire superstructure was buttressed with mountains of rock (11), layered in several grades from pontoon vessels, including the *Trias*.

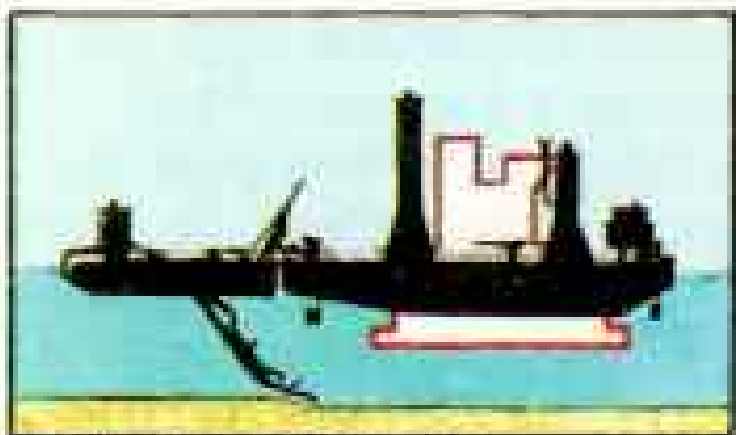




MYTEUS



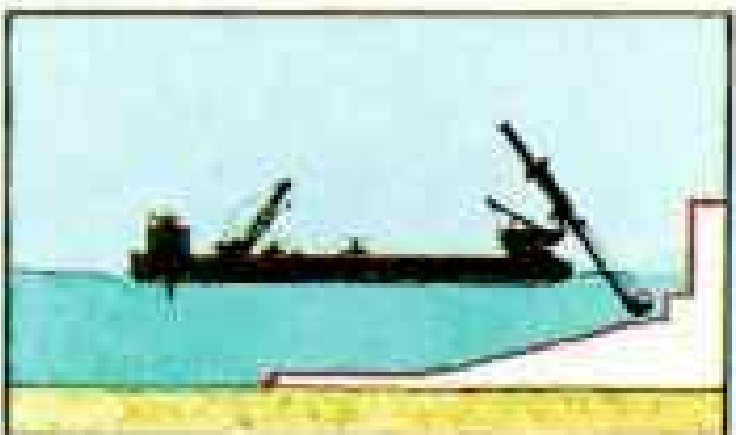
CARDIAM



MACOMA, AT LEFT, AND OSTREA



TAKLIFT 4



TRIAS

PAINTINGS BY WILLIAM H. BOND
NATIONAL GEOGRAPHIC ARTIST



“Never again,” vowed the Dutch after a 1953 storm tide breached dikes in the vulnerable delta region, killing 1,800 people. Thus began a spate of dam building that has shortened the coastline by 780 kilometers (485 miles) and dramatically lessened the risk of floods. Half the country would be inundated twice daily were it not for the dunes and dikes along its shores.

In the mid-1970s, as time approached to begin the final and largest dam at the mouth of the Oosterschelde, Dutch conservationists persuaded the government to construct an

open surge barrier instead. Thus an important estuary would be preserved as a commercial fishery, rich in mussels and oysters, and as a vital part of one of Europe's most important migratory-bird havens.

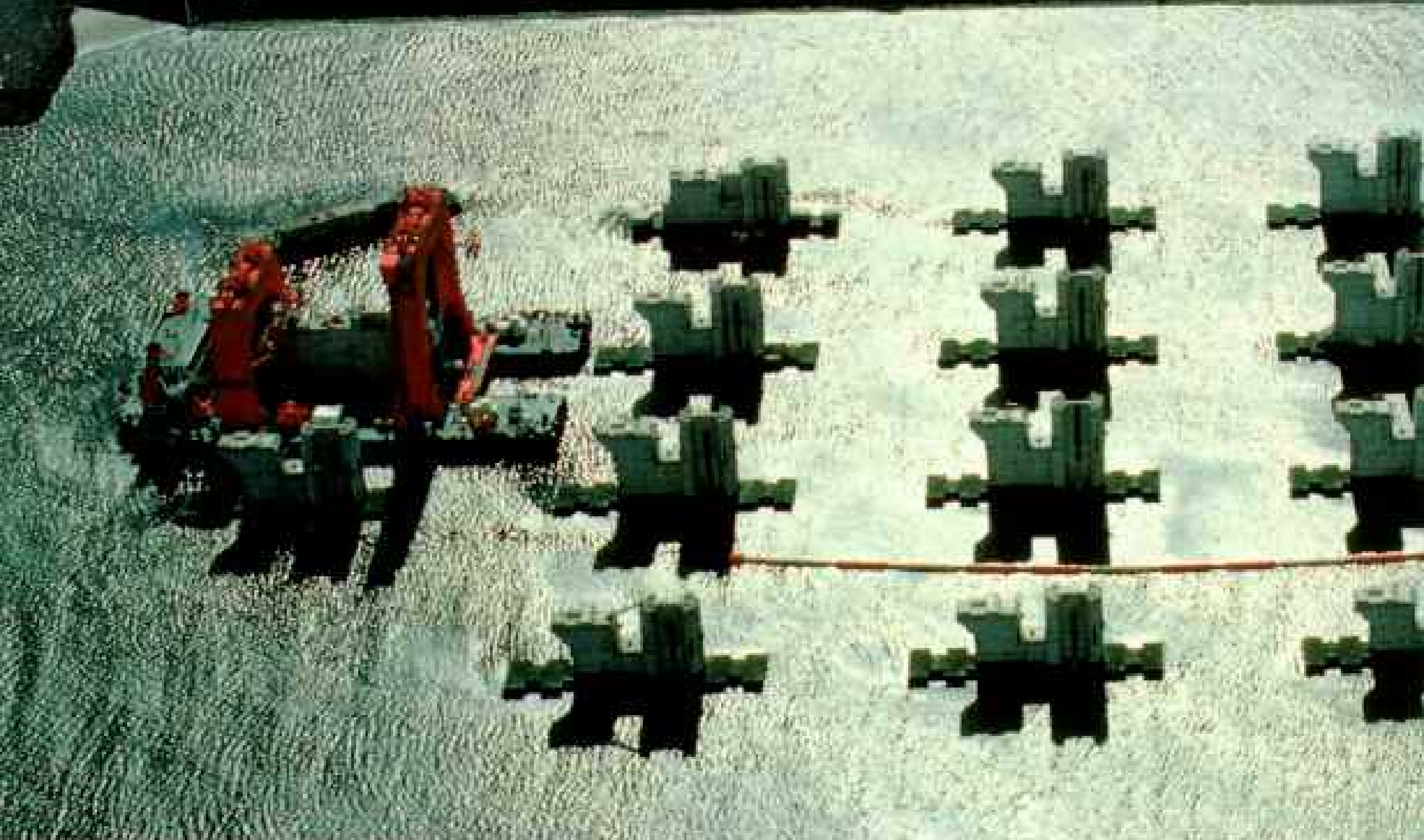
Many citizens now oppose a planned 125,000-acre polder in IJsselmeer, the former Zuiderzee. They cite the lake's ecological and recreational value for a nation that enjoys such agricultural surpluses it has no need for new farmland. Proponents of the project point to the nation's population density, among the world's highest.

that could handle the Oosterschelde's tremendous tidal currents put hydraulic engineers to the supreme test. As one project engineer put it, "We had to invent everything from scratch." Few Dutch, however, doubted that their engineers, who have a worldwide reputation for water projects, would succeed.



DYKE ARSLANIAN LEBOVITZ, FARRELL BRENNAN





Embraced by the U-shaped lifting vessel *Ostrea*, a finished pier is hoisted by towering gantry cranes (above, at bottom left) from the island of Neeltje Jans. The construction dock's three pier compartments were built 15 meters below sea level to allow for flooding and towing of the

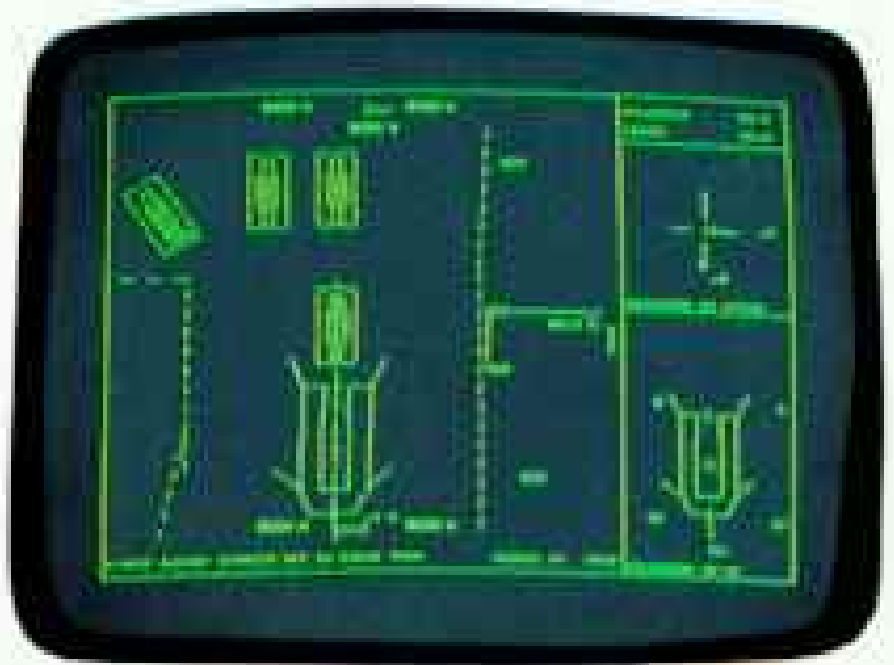
piers to the placement sites. There the *Macoma* was coupled to *Ostrea*'s stern to maintain a precise position. Aboard the *Ostrea* a computer (far right) indicates her location, as well as information on winds and currents. On shore, other guidance equipment (right) enables the pier to be lowered

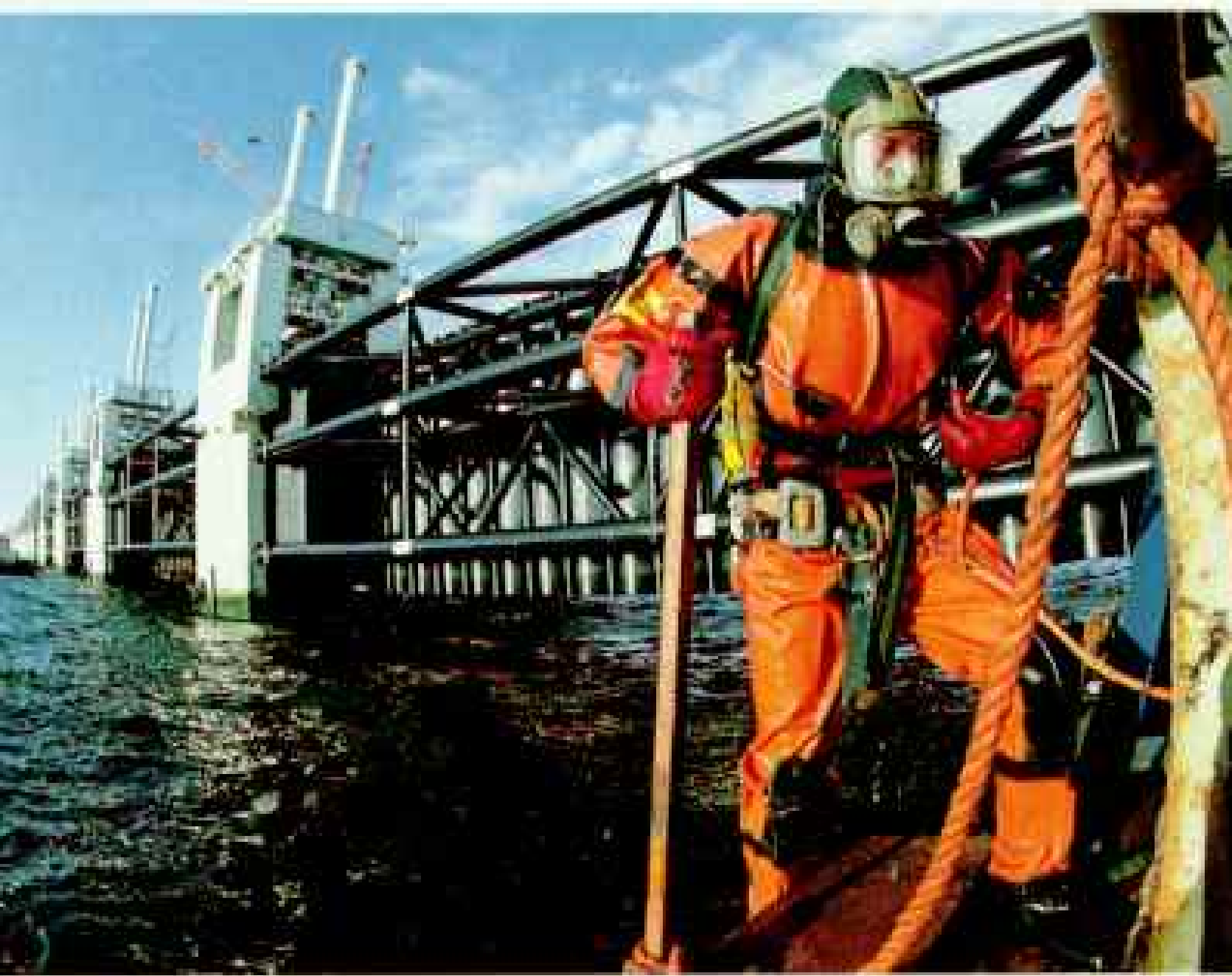
into position with no more than ten centimeters of error.

The 150-acre work island contains a power station and computer control center for the operation of the gates. The Dutch government is considering a proposal to use Neeltje Jans as an exhibition center for the Delta Project.



ALL BY OYAR, BRESLANIAN





NATHAN BEHN

Window of opportunity, the ten minutes or so of slack water between tides allows a diver to inspect the base of a pier (*left*). Since tidal currents are too dangerous at other times, various diving craft were also employed to inspect underwater matériel.

Placement of the various components entailed operations of utmost delicacy, demanding ideal weather—which explains in part why the barrier took nine years to build. In the northernmost channel *Taklift 4* lowers a 400-ton steel gate between two piers (*facing page*). A 28-million-dollar bridge, in background, was built to provide access to the work



island. When the road across the barrier is completed, the bridge will be dismantled.

Last June, after the final installations, 31 of the barrier's 62 gates spanned the estuary's two northern channels (*below*). Except for monthly testing, the gates are expected to be closed no more than once or twice a year, during threatening storms.

What next for the Dutch sea masters? By the end of the century they plan to complete improvements on dikes all along the nation's shoreline. That, combined with the mighty works of the Delta Project, should reduce the likelihood of a major flood for centuries to come. □



BART HOPMEESTER, AEROCAMERA (BOVEN); MICHAEL ST. MAUR SHELL



Living crowns, new antlers sheathed in velvet sprout from red deer stags. After the velvet sheds, the stags will become targets for trophy seekers who pay to hunt on this New Zealand farm.

Far away on a Scottish island scientists find this relative of the American elk ideal for their study of breeding dynamics (pages 556-62). Widely hunted by early man, the red deer declined as a food source with the spread of agriculture. Now a growing taste for venison and increased sport hunting have brought new attention to this increasingly domesticated animal.



RED DEER

By T. H. CLUTTON-BROCK



AND MAN

Photographs by JIM BRANDENBURG

BY FLICKERING torchlight the Stone Age hunter-artist painstakingly applied oxide pigments to a limestone rock face. When the painting was finished, a file of majestic stags decorated a wall of the now famed cavern of Lascaux in southwestern France.

Whether it was an invocation of the spirits to aid the hunt, or simply a tribute to the animal itself, we can never be sure. But the painting, together with scores more animal likenesses, has survived some 15,000 years in the dark, dry grotto.

From prehistoric times the red deer—*Cervus elaphus*—has been a favored quarry of the human hunter and an important component of human tradition and ritual. It is both today. The medieval tradition of hunting red deer with hounds continues in several European countries; deer stalking in the Scottish Highlands remains a popular sport. In most of the Far East, red deer parts (antlers, fetuses, reproductive organs, and tails) are important ingredients of many traditional Chinese medicines, a market that red deer farmers in New Zealand have been quick to exploit.

Red deer occur naturally from western Ireland through Europe, Turkey, and Kashmir to Chinese Turkistan and Mongolia. In some areas north of the Himalayas, they're replaced by wapiti (elk), which extend eastward across Siberia and China (map, page 558).

In North America, elk originally dwelt from coast to coast, south as far as Mexico and north to the Yukon, perhaps ten million strong. During the past two centuries man's indiscriminate hunting and destruction of their habitat have exterminated the wapiti throughout 90 percent of its former range. Despite its larger size, darker coloring, and high-pitched bugle, the New World wapiti, or American elk, is now usually classified in the same species as red deer. Confusingly, Europeans use the name elk to refer to what North Americans call moose, *Alces alces*, a species also widespread in northern Europe and Asia.

From the first habitation of western Europe by man, red deer provided meat to hunting communities. By the end of the Mesolithic, deer constituted the single most important food species. Tools and weapons

were fashioned from deer bones and antlers. Sinews and skins made cords. Antlers furnished hoes and picks.

The stag has become a symbol of male power and aggression. In the cave of Les Trois Frères, in France, a painted figure performs a ritual dance, antlers of a stag sprouting from his brows, in a scene between 13,000 and 15,000 years old.

In Chinese mythology the god of longevity is paired with a deer. An early Chinese herbal written around A.D. 200 describes the uses of the growing antler: "Deer velvet tastes sweet and its property is warm. It is used for treating metrorrhagia . . . febrile disease, and epilepsy, and also for reinforcing vital energy, strengthening memory and will, and delaying the onset of senescence." In present-day Chinese medicine almost 20 different parts of deer are used as tonics to prevent debility.

AS FARMING CULTURES spread across Europe, the importance of red deer as a food source declined, but their role in sport and ritual continued. Nobles and kings held exclusive rights to hunt residual herds, chasing the majestic animals with hounds until they stood at bay, then dispatching them with knife, spear, or bow.

The tradition continues today. In the rounded hills and deep combes of Devon and Somerset lives the largest population of wild red deer in England, about a thousand animals concentrated in and around Exmoor Forest. (In English terminology, Forest with a capital *F* usually signifies an ancient hunting preserve. A Forest—as in the case of Exmoor—can consist almost exclusively of moorland and need not have a tree on it.) Today Exmoor and its environs are hunted by the Devon and Somerset Stag-hounds, one of only four packs in England. About 35 packs still hunt red deer in France.

Dr. T. H. Clutton-Brock is a Royal Society research fellow in the zoology department at Cambridge University. He has published extensively on the evolutionary ecology of large mammals and co-authored *Red Deer: Behavior and Ecology of Two Sexes*. Photographer Jim Brandenburg, twice winner of the Magazine Photographer of the Year award, is a frequent contributor to NATIONAL GEOGRAPHIC.

ON A WET October morning I joined Frankie Dallyn, the Devon and Somerset harbinger (the person who finds the stag), to locate a suitable animal to be hunted that day. We drove in Frankie's Land-Rover along a ridge of moorland running down toward the sea.

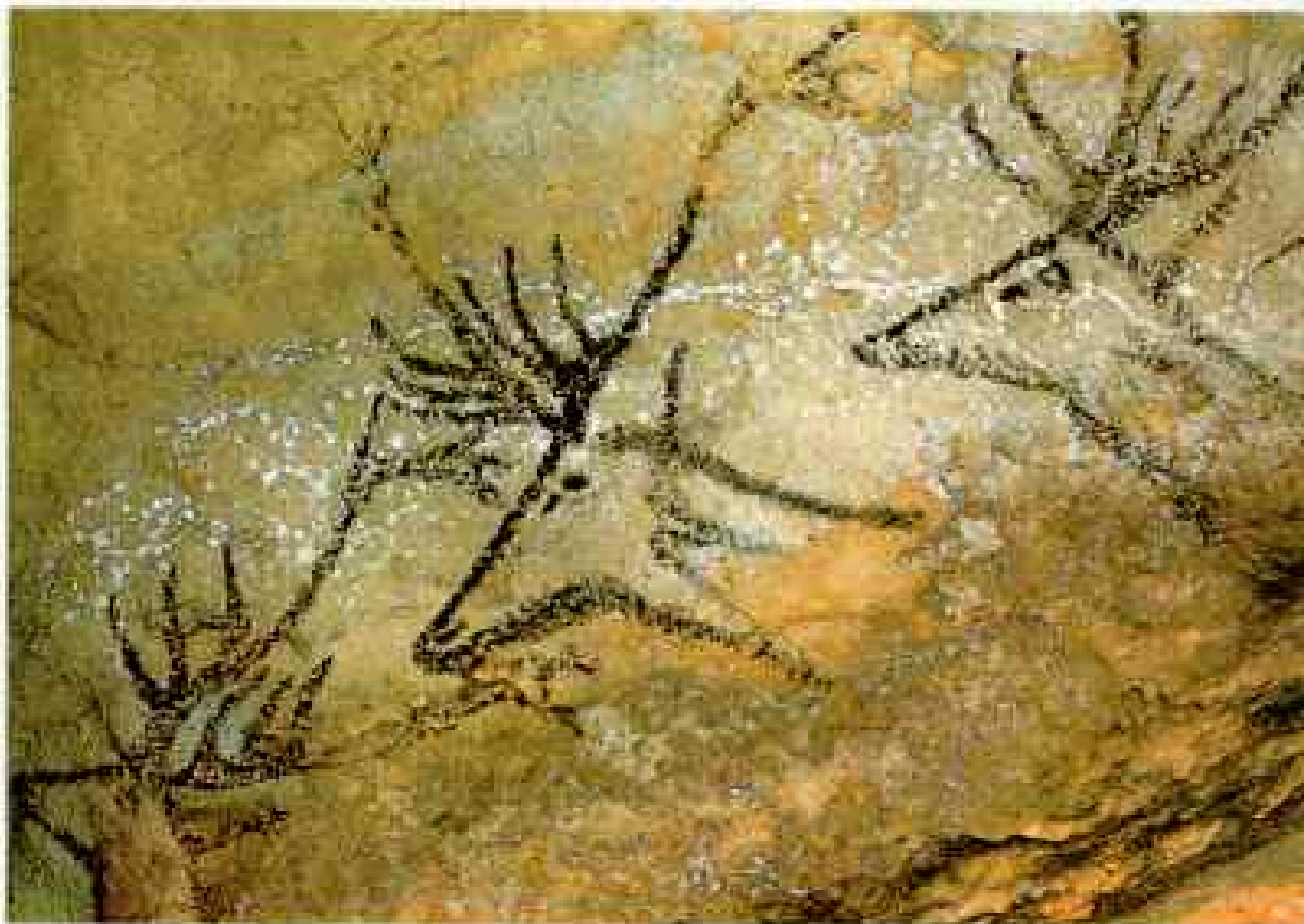
"I zeed a big stag here las' wik," Frankie told me, "but mebbe e's left un hinds [females]. The farmers round here say there be a tremendous lot of deer. Comes of being close to Horner." In the valley below, the browning oaks of Horner Wood tossed in the wind, a refuge for hunted deer.

As the skyline paled into dawn, we scanned the opposite slope. Four hinds materialized from a beech wood. After them paced a large dark stag that sniffed the rump of the last hind, pawed the ground pensively, then lay down. Frankie settled in to watch. A group of magpies lighted among the deer. "One for sorrow, two for joy, three for a girl, and four for a boy. Five for sorrow." The fifth bird landed on the stag.

By eleven o'clock the track was jammed with cars, trucks, and horse boxes. Some riders sported black riding boots, pale breeches, black coats, and black bowler hats. Others wore oilskins and leggings. The horses ranged from rough ponies to slim, well-groomed hunters. The scarlet coats of huntsman Dennis Boyles, the whipper-in, and the master glistened in the rain.

The huntsman gathered his tufters around him. These are old and experienced hounds, whose job is to flush the stag and begin the chase. Boyles and the whipper-in cantered down the slope with three and a half couples (seven) of hounds around them and 50 riders strung out behind. On the far slope the deer stood and edged uneasily up the field. The big stag disappeared into a steep combe, the tufters in full cry. Two younger stags appeared—and some of the hounds followed them. Suddenly the great stag came into view against the pale edge of

Early homage to the red deer, 15,000-year-old rock paintings adorn Lascaux Cave in southwestern France. The art may have played a role in religious rites.



JEAN VERINE

the skyline. He sprinted for the oaks of Horner Wood and vanished.

The huntsman stopped the tufters and waved a white handkerchief, the signal to release the rest of the pack. With the hounds behind him, the huntsman disappeared into the wood. The stag ran upstream, then doubled back along the Horner Water. Half an hour later, he came to bay, standing in mid-stream against a narrow bridge. The hounds crowded round but did not touch him. A senior hunt follower rode up and shot the stag below the ear with a shotgun. The quarry slumped. Later the gutted carcass would be divided among the area farmers.

In this way the Devon and Somerset Stag-hounds kill about a hundred stags and hinds each year. "Without the hunt," says Dick Lloyd, hunt chairman, "there wouldn't be a deer on Exmoor. The farmers wouldn't tolerate the damage the deer cause the crops. They'd shoot them." Not everyone agrees. The League Against Cruel Sports backs control but has campaigned against stag hunting for more than 50 years.

The Highlands of Scotland, with their bleak and beautiful moorlands, remain the chief stronghold of red deer in Britain. By



Canopy of antlers, more than 3,000 stag heads and skulls collected since 1790 festoon the ballroom of Mar Lodge near Braemar, Scotland. Rebuilt in 1895 for a



granddaughter of Queen Victoria, the house and its 77,000-acre estate, offering salmon fishing and hunting for birds and deer, became a commercial sporting lodge in 1963.



Man's encroachment pushed the red deer into isolated regions of the British Isles, chiefly Exmoor Forest, the Lake District, and the Highlands of Scotland. The deer also range across continental Europe and parts of Asia.

1790 total numbers of Highland deer had fallen to probably less than 10,000. But after the industrial revolution the demand for sport shooting grew, and landowners began to increase their herds.

Much of the Victorian tradition of deer stalking survives today. The 180 principal deer forests are largely owned by the same families that held them in 1912. Only landowners or their tenants hold the right to shoot the 260,000 red deer that roam Scotland's hills. The owner of a forest shoots stags there himself or with guests between August and November. Or he leases his estate—or part of it—to a stalking client from elsewhere. The client's lease specifies how many stags he may shoot. He usually gets only the antlers. The venison belongs to the estate and is mostly sold to West Germany.

Which animals to shoot is the decision of the stalker—a man employed by the landowner to take clients stalking and to manage the deer population. Today most estates selectively shoot stags with poor antlers, allowing animals with large and well-formed heads to breed. Some 15,000 stags are shot



High in the heather of Scotland's Perthshire, professional deerstalker Nicky Boulton (left) points out an emerging target to client Mark Taylor, center, and the author. Only male deer are hunted by clients, but stalkers often dissuade them from shooting a particularly majestic stag whose genes would improve the herd.

Baying hounds corner a stag in a scene from the hunt engraved in silver on the breech of this German-made rifle (below left).

Kilted in his family tartan, Maj. Neil Ramsay (right) offers hunting with "old-world elegance" in Scotland's deer forests. For just shy of \$4,000, each guest at Farley House, Ramsay's estate in Perthshire, receives a week of hunting with a guide, luxurious quarters, and black-tie dinners featuring salmon, grouse, and, of course, venison.



each fall, while hinds are culled by the stalker during the winter.

In early October I lay in the Perthshire heather beside an American stalking client, Mark Taylor. Mark, a medical engineer from Pennsylvania, was one of a shooting party of 12 Americans staying with Maj. Neil Ramsay at Farleyer House. An icy wind hammered cold rain in our faces. Nicky Boulton, Farleyer's stalker, carried Mark's rifle slung across his back. I could hear the roar of a rutting stag. Client and stalker crawled closer, then peered over a hillock. The stag, a large 11-pointer, was within easy range. But Nicky tapped Mark's shoulder and motioned him back. "Too good," he murmured. "We'll leave him."

We walked on around the bare hillside. Suddenly Nicky froze and motioned Mark into a crawl. I saw a stag, about six years old, with small, twisted antlers, guarding a group of five hinds. Nicky unslung Mark's rifle, checked the magazine, and loaded the chamber, only then passing the rifle to Mark. Mark sighted, there was a report, and the stag somersaulted and lay still.

Nicky bled and galloched the carcass—removing all entrails except the heart and liver. These, together with the tusks (canine teeth), are the stalker's traditional perks. The carcass was left for pickup by one of the estate workers.

A MONTH LATER, on the other side of the world, I saw red deer hunted in a very different way.

As the pursuing helicopter flailed across the shoulder of the mountain, a hind plunged into undergrowth away from the deafening clatter above her. From inside the Hughes 500, I watched grassy slopes and snowy peaks of New Zealand's South Island swirl in a blurred jumble as Kim Hollows slewed the machine in a tight circle. The rotor blades almost touched the treetops where the hind had disappeared. Kim reached round and switched on the siren. Its screech sent the hind bolting uphill. The helicopter sideslipped over the edge of the trees, blocking her way back into the forest.

In the shooter's seat beside the pilot, Noddy Deaker reached for the net gun—an



In decorous fashion, members of the Devon and Somerset Staghounds pursue their quarry through England's Exmoor National Park. Once the sole province of nobility, such hunting, which attracts large followings, is now available to the public in park and farmland.

open-ended box holding a nylon net with weights at the four corners mounted at the muzzle of a modified .308 Mauser rifle. The helicopter rode in low above the quarry. Noddy leaned out the doorway. Bang!—and the deer was struggling in the heavy netting. The helicopter lurched down to hover five feet above the animal. Noddy leapt onto the deer's back, bulldogging her to the ground. The chopper landed, and the hind was huddled into the net and loaded into the helicopter. Noddy stepped back onto the skid, and Kim pulled the machine up in a turn.

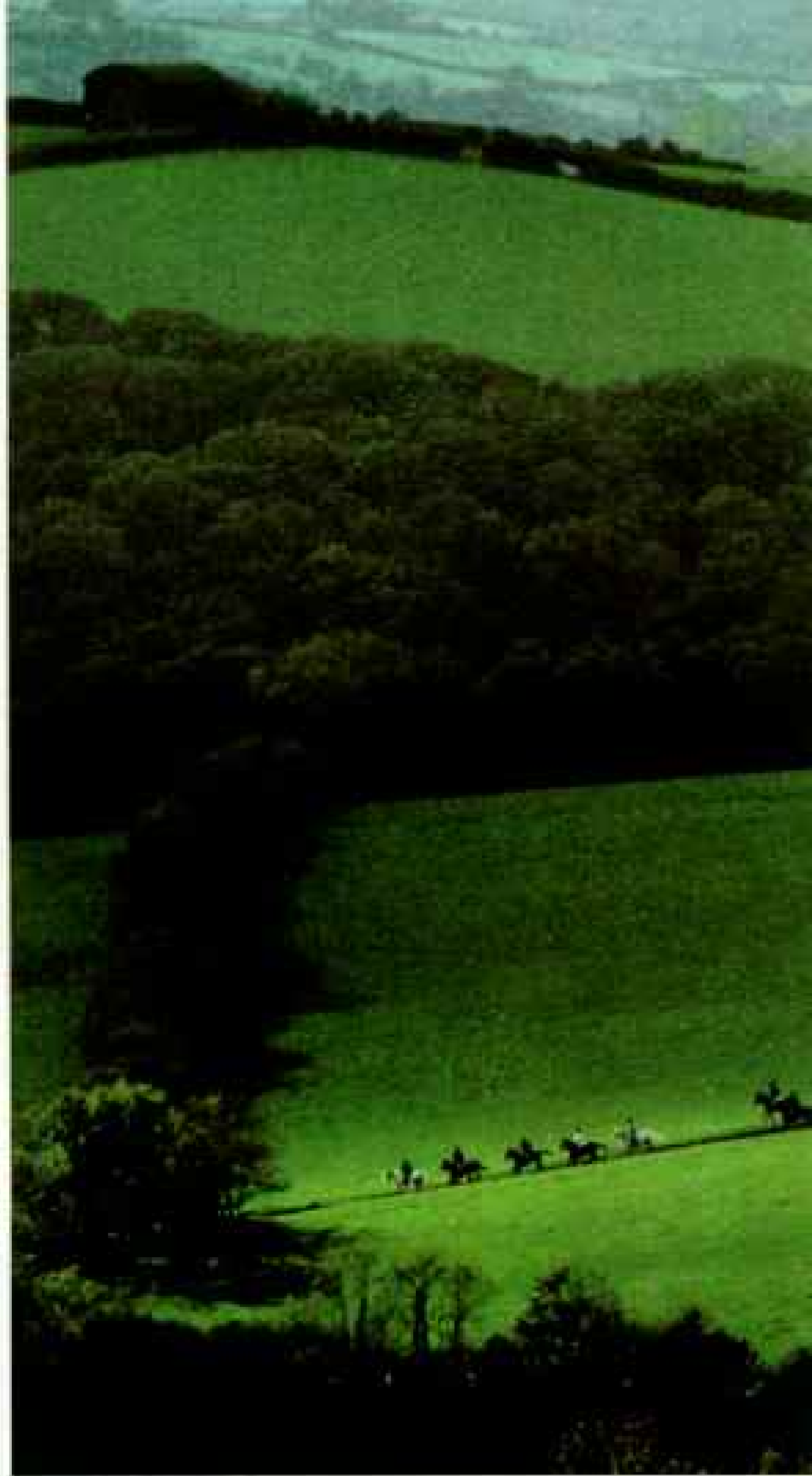
We had lifted off before dawn from the *Ranginui*, a converted steamer moored in Doubtful Sound in New Zealand's fjord country. Now, one hind up, we set off to look for more deer.

Kim and Noddy were one of eight Alpine Helicopters crews working to catch red deer. Kim, 24, worked up through gutter and shooter to helicopter pilot. "All I ever wanted," he told me, "was this sort of life."

Two hours later we landed at the Te Anau airstrip, having missed another hind and shot two stags. To Kim and Noddy it was an average day. The hind would fetch around 1,500 New Zealand dollars (U. S. \$800) from a deer farmer; the crew would share N.Z. \$300 of it. A packinghouse would buy the stags for less than \$300 each, of which only \$60 would be divided by the crew.

From 1980 to 1985 nearly 70 helicopters worked full-time catching red deer in New Zealand, not only turning a profit but also fulfilling an important role in conservation. Between 1850 and 1923 red deer from Britain were introduced throughout New Zealand to provide sport for European settlers. With no predators, deer spread rapidly throughout the hill country of both North and South Islands, stripping mountain slopes of shrub and grass cover. Forests receded and the native fauna declined.

After 1923 further deer liberations were



prohibited. By 1931 all protection of wild deer had been removed. Bounties were paid to hunters for every deer killed; teams of government hunters controlled numbers in hard-hit areas.

But red deer kept increasing. By the mid-1950s government hunting teams were killing 50,000 deer annually. Gradually a market for the venison developed, principally in West Germany. By 1964 more than 30,000 carcasses a year were exported. Yet many deer killed in steep, rough country were simply abandoned.

The wastefulness of killing deer and leaving them to rot determined Tim Wallis to turn control of a pest into a profitable business. Since he was running a timber operation, Wallis used his trucks to collect deer carcasses, then built his own packing plant.

In 1963 Tim and two partners leased their



first helicopter. In a valley in western Otago Tim and ten other hunters killed more than 200 deer the first day, flying half of them out to waiting trucks before bad weather forced them to abandon the rest.

"In those days," Tim remembers, "there were still lots of deer. The helicopter drove the deer together and held the mob while the hunters shot them."

TIM'S COMPANY, Alpine Helicopters, speedily built up, and others were quick to follow. Soon hunters were shooting deer from the air using semiautomatic rifles.

To reduce the hauling distance for the helicopters, Tim bought the *Ranginui*. He built a helicopter pad on her deck and converted the hold to a chilling unit that could take 600 carcasses. The *Ranginui* moved

from fjord to fjord, the helicopters filling her with deer carcasses; she would return to the roadhead at Milford Sound to unload and reprovision.

Kills were enormous: Bill Black, Alpine's top pilot, and his shooter, Jim Kane, regularly killed and recovered 12,000 animals a year. With venison in the late 1960s worth \$.40 a kilogram and carcasses averaging 45 kilograms, the best crews could annually bring in more than N.Z. \$200,000. Ken Miers, retired from the New Zealand Forest Service, told me that killing peaked in 1972, when more than 100,000 deer carcasses went through the processing plants. Sport hunters, he believes, must have killed 20,000 to 30,000 more.

The onslaught decimated the red deer population. It probably declined more than 70 percent between 1968 and 1978. By then



Bug-eyed with fright, a stag pursued by hounds takes to water in a futile attempt to escape during a hunt in England. When brought to bay, the deer is shot by a huntsman. Critics such as the League Against Cruel Sports

the venison industry had created a demand that New Zealand's innovative farmers were quick to exploit. Red deer were needed for breeding stock. Live hinds soon fetched as much as N.Z. \$3,500.

But how to catch them alive? Some tried roping deer from moving helicopters. Tim Wallis used tranquilizer darts. Then catchers developed the "gotcha gun." From a cut-down rifle with two added barrels welded at an angle to the original one, gases from a blank cartridge fired weights fastened to a nylon net. The net was aimed to fall over the deer's head and trip it up as it ran.

But net guns posed hazards. Flying beside a deer galloping across a steep mountainside, an excited shooter could aim too high—netting the machine's main rotor instead of the deer. Few shooters made this mistake twice. Joe Collins, a leading hunter-pilot, recounted one of these incidents in Rex Forrester's book *The Chopper Boys*:

"It was right on dark when we came on to a herd of deer and cut a hind out from the tail end of the mob. . . . the pilot screwed the helicopter into a fairly vicious turn to follow her. During the turn, the blades dipped and the net and blades all met in the same place.



MICHAEL HURKESON

condemn stag hunting as a cruel “primitive ritual.” Hunt enthusiasts insist that the sport culls the deer, leaving healthier numbers. Without this and other controls, they say farmers might wipe out entire herds in an effort to protect their crops.

The blades began hurling the net round and round, with the weights bashing the helicopter . . . until they jammed the controls in the rotor head. . . . Then the chopper started to pick up speed and come back down. . . .

“It hit the ground fairly hard, and bounced back into the air again. . . . It headed down at a 45-degree angle. . . . until the skid on my side dug into the mountain. The helicopter then did a complete cartwheel, which threw me out through the top of the bubble and up through the mess of blades, weights, and nets clattering around. Miraculously, none of them hit me, and I landed

about another 40 metres down the slope. . . . I ran back and helped untangle the pilot. . . .

“I burst out laughing. There seemed nothing else to do. . . .”

Today Alpine’s helicopters carry one four-barreled net gun on the skid, well clear of the main rotor, as well as a hand-held gun. The latest weapon can fire two nets in quick succession. Alpine helicopters flying on deer recovery last year caught 1,200 hinds and shot a like number of stags.

Thanks to men like Tim Wallis, red deer control in New Zealand has succeeded—but at a price. Ground-hugging flight in rugged

country, with heavy loads, is inevitably dangerous. Since 1976, 127 helicopters have crashed while hunting. Twenty-five pilots and shooters have been killed and 38 others seriously injured.

THE HIGH COSTS of helicopter hunting have been underpinned by a keen demand for hinds for breeding stock on deer farms. By 1975 the country counted 25 farms. Today, according to the New Zealand Game Industry Board, more than 3,000 farms produce 35,000 carcasses, or 2,000 metric tons of venison, a year.

In late 1985 and early 1986 the market for live hinds took a sharp downturn. Proposed government adjustments in taxation and valuation of livestock threatened to stifle the industry. By mid-1986 prices had fallen 50 percent—perhaps only a temporary decline.

Deer have some advantages over cattle and sheep as food. Venison is lean, about 10 percent fat compared to more than 20 percent for lamb or beef. Thus it appeals to today's calorie-conscious markets. It is,

however, more expensive—farm prices are almost \$6 per kilogram in New Zealand compared to \$1.60 for beef or \$.70 for lamb.

The profits of most deer farms at first came not from venison but from raising and selling breeding stock. On his 35,000-acre Haldon Station south of Lake Tekapo, James Innes carries 23,000 sheep, 1,800 cattle, and 4,000 deer. His annual gross income is five million New Zealand dollars. Using helicopters, Innes caught a thousand hinds from the wild between 1975 and 1979. During that time the price of hinds rocketed from \$200 to nearly \$3,500 as city investors poured their money into deer farming.



An isolated island nation, New Zealand lacked a large game animal until introduction of red deer from England after 1850. Their progeny now populate much of the two main islands (map) and share space with sheep on such farms as the Innes family's 35,000-acre Haldon Station (right).



"Four-fifths of our income comes from deer," James told me, "and 99 percent of that comes from live sales."

Other deer farmers have focused on improving quality by selective breeding with stags imported from Europe. Another approach has been to cross red deer with the heftier wapiti to produce an animal with a faster growth rate and a larger body size.

The venison industry apart, New Zealand's deer farmers also aim at more traditional markets. In a 2,000-acre enclosure at his Lilybank Safari Lodge, Gary Joll holds about 150 red deer as well as tahr, fallow deer, and chamois. Stags are handpicked

from his deer farm for their large and shapely racks. He offers hunts for trophies of different sizes, from U.S. \$2,400 for a standard trophy to as much as \$4,000 for a likely record breaker. "You could call it trophy farming," he said.

NEW ZEALAND'S deer farms also produce a more bizarre crop—velvet antlers for medicinal use in the Orient. I watched James Innes and his farm manager "velvet" a group of 15 stags. After tranquilizing the animals, they quickly removed the antlers, about two-thirds grown, with a meat saw.



Range riders go airborne for a hunt in New Zealand's high country. As the helicopter maneuvers at dangerously low altitudes, Don Greig uses a net gun to fire a weighted net at fleeing deer (below). Ensnared, a young stag (right) will be bagged and loaded into the craft for transport to a farm.



George Too is a manager in the country's largest processing plant, Wrightson Deer Horn, on the outskirts of Christchurch. At the factory frozen velvet antlers are thawed, then steam cooked for two days. The stainless-steel ovens have a special vent so George can smell the cooking antlers. "Nose very important," he told me. "Good antler smell of peanuts."

Drying and trimming reduce the velvet to a quarter its original weight. Top grades go mostly to Korea, fetching 320 to 350 U. S. dollars a kilogram. Lower grades find their way to Hong Kong and Taiwan. New Zealand produces about 75 tons of velvet a year, along with other medicinal crops from its deer farms, such as tails, penises, and leg sinews. These parts are shipped frozen, mostly to Hong Kong. With the skin, these extras increase the value of each stag.

I asked George, born in Hong Kong, if he used deer products himself. "Oh yes," he said. "I have a very lovely medicine giving much energy. Deer tail, mixed with skin of wild duck and some deer horn, cooked with herbs. I have left-hand kidney problem,







I take medicine, now over." He beamed.

Following the trail of New Zealand velvet, I visited the Dong Jae Dang Raw Medicine Company, one of a thousand Chinese medicine clinics in Seoul, South Korea. A large, well-lit room held armchairs for waiting patients and rack upon rack of small drawers behind a mahogany counter.

Attending a well-dressed couple with a little girl of four or five, who coughed nervously, the herbal doctor wrote out a prescription and passed it to the chemist. The latter took handfuls of herbs, thin slices of antler, and other ingredients and spread them out on 20 squares of white paper that he twisted neatly together and handed to the parents. The contents of each packet would be boiled to make a thick, dark soup that their daughter would take daily. The couple paid and left.

"Chinese medicine is essentially health restoring, not curative," said Jung Kee Park, owner of the firm. "The majority of Korean people take some Chinese medicine but use mostly Western medicine."

At the Chinese University of Hong Kong a team led by Western-trained Dr. Y. C. Kong and Dr. Paul But is conducting research on the chemical constituents and fertility-regulating effects of a variety of Chinese herbal medicines. Funded by a New Zealand deer products company, Kong and research assistant K. M. Ko are also trying, with rats, to find out if velvet antler contains a gonadotrophic substance.

NEW ZEALAND'S deer farmers have always known that the price of live animals would fall as deer farms proliferated. Recent government intervention has caused additional problems. Compared with the 480,000 tons of lamb New Zealand produces each year, its venison output is still tiny. The future depends on the growth of worldwide markets for venison.

"We must sell venison right over the top of beef and mutton," says Herby Whyte, who runs 2,500 red deer on his farm at Ryal Bush in Southland. "It's got the lot—taste, interest, and snob value. I've a hell of a lot of confidence in deer farming as a total industry!"

Herby speaks for New Zealand's deer farmers, who have no doubt that red deer have come to stay. * * *



Bidding to better their stock, deer-farm owners last year paid around N.Z. \$4,000 apiece for breeding hinds at an auction in Christchurch, New Zealand (facing page). The deer industry also profits from antlers. With the stag sedated, the racks are cut off while still in velvet (top). In Hong Kong a slice of antler is singed of its hair (above) before being boiled to make a broth. Some Oriental physicians extol the health-giving attributes of antler; Western scientists remain skeptical.

RED DEER

A Scottish Dynasty

ARTICLE AND PHOTOGRAPHS BY T. H. CLUTTON-BROCK

AS BOSS DROVE him backward, Pincer's hooves left deep scars in the cropped turf. He lowered his antlers, anchoring his brow points in the ground, and the two red deer stags came to a standstill, panting hard.

The challenge had come 20 minutes before. Boss, a lusty seven-year-old, accosted Pincer, who was holding a large harem of hinds on the greens behind Shamhnan Insir Bay on the Hebridean island of Rhum. It was the start of a classic autumn contest between mature stags, whose breeding success depends principally on their fighting ability.

Typically, a shouting match began it all. The two stags roared at each other in a gradual crescendo. Boss, roaring more frequently than Pincer, appeared to listen carefully to the latter's replies.

After 15 minutes Boss made up his mind. Slowly and stiffly, he walked toward Pincer's harem. Pincer went to meet him, and the two stags fell into a tense parallel walk, only ten yards apart. Back and forth they paraded. Suddenly Boss ran up on a knoll and engaged Pincer from above.

To the dry click of antler on antler, they tussled viciously, each trying to poke an antler through the opponent's guard. Pincer began to give way and suddenly, with a quick twist, Boss freed his antlers and lunged. A point caught Pincer under the eye. Wounded, Pincer turned and fled, leaving Boss in possession of most of the hinds. Next day Pincer's left eye was closed, and it seemed that the eyeball had been deflated. He died the following winter.

Boss and Pincer are two of a thousand red deer on Rhum—many of them named and all recognizable as individuals—whose life histories we have been monitoring for 14 years. At our study site my colleagues Fiona Guinness and Steve Albon and I have been



With lordly nonchalance, a red deer stag gently rides herd on his harem on Scotland's isle of Rhum. For 14 years scientists from Cambridge University have followed the mating habits and life cycles of a thousand of the island's deer, noting the diverse factors that lead to reproductive success in males and females.







Proclaiming his potency, a stag emits a deep-throated roar (left). During the month-long mating season a male's voice is his initial weapon in defending a harem against takeover by another stag. When the author repeatedly played tape-recorded roars (below), a would-be challenger gave up after failing to outroar the phantom rival.



investigating the factors that affect reproductive success in males and females.

With red deer, as with many other polygynous animals, males compete more intensely for females than do females for males. This is because males can increase their breeding success by mating with many females, whereas females cannot usually increase their success by multiple matings. It pays males to compete intensely for mates, while females will usually boost their breeding success by maximizing their efficiency in converting food into healthy offspring.

This fundamental difference between the sexes means that the characteristics making males effective breeders are often quite different from those that confer success on females. And, as Charles Darwin originally realized, it's these differences that explain why the sexes in many mammals often differ

markedly in size, weaponry, and behavior.

Scottish red deer are nearly ideal for research on the determinants of breeding success. On treeless Rhum, red deer are easily observed. Because each hind usually mates with only one male, the breeding success of stags can be reliably measured. Breeding-life spans on the island average about ten years for hinds, five for stags.

Over the years, we have followed each individual of our study population through birth, adolescence, and maturity. At last answers are starting to emerge—some as expected, others quite unexpected.

Differences in breeding success between hinds are large and depend mostly on the varying abilities of females to rear calves rather than on the number of calves they bear. Our most successful hinds rear as many as ten calves during their lives; the

least successful fail to breed at all. Hinds born in years when average birth weights ran high were far more likely, as adults, to rear their own calves successfully than those born in years of lightweight calves.

For example, the 1973 average birth weight of female calves was only 6.2 kilograms, whereas in 1974 it rose to 7.3. Tacc, born light at 5.3 kilograms in 1973, consistently gave birth to light calves (mean birth weight 4 kilograms). Mackerel, born heavy at 8.2 kilograms the following year, always produced heavy calves, with a mean birth weight of 7.9 kilograms. Though Tacc produced four calves, none survived to breeding age, and Tacc herself died at six years old. Mackerel is still alive and has produced five calves, and all but one have survived.

Differences in temperature and weather help account for year-to-year variations in birth weight. A warm spring, when the grass starts growing early, produces more heavy calves that will be successful mothers when they grow to adulthood. Other breeding factors include hinds' dominance rank within the group. Large, dominant hinds are able to displace smaller individuals from the best food resources, and they are the most effective breeders.

BREEDING SUCCESS for stags turns on the number of hinds they mate with each year. During their lives our most successful stags sire more than two dozen calves that survive at least a year. The size of their harems depends on the stags' fighting ability and body size. Stature hinges on growth rates as calves and yearlings, which in turn depend on their mother's milk yield and the factors affecting it—her age, body condition, and the quality, in terms of food and shelter, of her home range—as well as on her social rank.

Though it is important for a stag to win his fights, it is also vital that he not fight unnecessarily. During every rut a mature stag fights about four times. Fights are dangerous; one in 20 stags suffers serious injury each year. Since stags rut actively for four or five seasons, starting at about age six, each stands a high chance of permanent injury.

After watching more than a hundred encounters, it dawned on me what all the preliminary roaring was about. The stags were



Antlers clash and tangle as two stags vie for control of a harem (above). Fighting exacts a price in energy loss and leaves one in 20 stags permanently injured. The victor (below) mates with the harem, which can number 20 hinds. After an eight-month gestation, a mother (right) cleans her newborn calf, which will stand and begin nursing within minutes of its birth.





MARION HALL

Fitness for the fight to control females ensures a stag of progeny. For hinds, breeding success depends on access to prime food sources to nourish them and their young.



assessing each other. With the dangers of battle so high, it paid both challenger and challenged to avoid a scrap whenever possible. Roaring contests are a reliable way of assessing a rival's strength and fighting ability, because only a fit and strong stag can sustain a high rate of roaring. Playing back recorded roars at different rpm's (roars per minute) to stags, we found that they always attempted to outdo the taped animal. Roar rate proved to be a close measure of fighting ability, and challengers that were outroared seldom pressed home the challenge.

The larger body size of stags may yield dividends in acquiring hinds, but males pay heavily for their faster growth. Stag calves and yearlings are less likely than hinds to survive periods of food shortage. And adult stags often show high mortality during periods of harsh weather. In competition for resources, stags are the inferior sex.

Since body size is so important to stags, hinds might be expected to treat their sons and daughters differently. We observed that mothers permitted male calves to suck more frequently and longer than females.

The importance of early growth raised another question: How did mothers' size and social rank affect the breeding success of their offspring? We found that a high proportion of the most successful stags had big, dominant mothers. For example, the sons of Crottle, one of our largest hinds, fathered more than twice as many calves as the sons of Colc—a small and subordinate female. A mother's rank had less effect on the breeding success of her female offspring: The daughters of Crottle were only slightly more productive than those of Colc.

The sons of dominant mothers produced more offspring than their sisters: Crottle's sons fathered nearly twice as many offspring as her daughters produced. Conversely, daughters of low-ranking hinds generally left more offspring than their brothers, who often failed to breed altogether.

Given this situation, dominant mothers apparently would increase the number of descendants by producing mostly sons, subordinates by delivering mostly daughters. Comparing the ratio of males to females produced by different hinds, we found that the most dominant indeed gave birth to more sons than daughters: Over 80 percent of the offspring of the most dominant hinds were males. In contrast, subordinates produced mostly daughters.

Though much of the variation in breeding success that we observe is caused by the individual's early environment, part is genetic and can be inherited. The natural weeding out of unsuccessful breeders originally produced the two sexes in the form that we know today and has maintained their characteristics over the past 15,000 years. The cave painter of Lascaux might fail to recognize the helicopter hunters of New Zealand as belonging to the same species as himself, but he would certainly recognize the red deer that they hunt, which could have stepped straight from one of his pictures. □

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America's outdoors: what people think and want

AMERICANS are still an outdoor people, despite—perhaps because of—the urbanization that draws more and more of us toward the cities as the century completes its final 15 years.

And we have become a wiser people about what we have always regarded as the "Great American Outdoors." We have come to realize that our natural heritage of undeveloped lands will neither constantly renew itself nor provide for our needs in recreation and solitude unless we secure, manage, and maintain those lands.

Most of us are willing to pay the price.

That, at least, is what I read in a special survey conducted by our Society for the President's Commission on Americans Outdoors, of which I am vice chairman.

The survey asked 121 questions of 2,000 randomly selected citizens. Seventy-seven percent used a local park, pool, beach, or recreation area last year. Almost the same percentage took all-day trips to a regional, state, or national park. Sixty-two percent had been to a national park or forest or monument within the past five years.

We not only use the outdoors, we cherish it. The single strongest sentiment revealed in the survey was for preservation of natural areas for future generations.

Reading that, I thought immediately of Belt Woods—a very special bit of outdoors some 15 miles northeast of our headquarters in Washington, D. C. Twenty-five years ago it was a 90-acre living museum of the past, a last remaining segment of the great forest that greeted the colonists 350 years ago.

The owner willed that this unique forest never be commercially cut, but the will was challenged, and some 45 of those acres were subsequently harvested. One of the remaining pieces of primeval America was turned into veneer. Thankfully, another 45 acres and a 60-acre buffer are now protected

as wildlands by the state of Maryland.

Today, that sequence of events would trigger a great outcry—and perhaps be prevented—by concerned citizens.

Another survey finding that indicates changing attitudes was willingness to be taxed to protect wildlife and acquire natural areas—and to pay user fees if those fees were spent to *maintain* the natural areas.

While public access to Belt Woods is now carefully limited and controlled, other natural areas used for birding, hiking, fishing, and similar activities face increased demands, with dangers from overuse or reduced maintenance.

That problem is not new, but the idea that the burden of protecting a natural resource for the future should be shared by all levels of government and by users themselves is emerging. People support federal help to state and local governments for recreation projects—and they want governments at all levels to lead in providing access to beaches and waterfronts.

They like local management and maintenance of local resources, and think it more important to protect what we have now rather than add new lands at the cost of deferring maintenance.

Americans want the outdoors to follow them to the cities. Perhaps this deep and native desire for parklands near home will counterbalance the attractions of roads, shopping centers, and new houses that have so dominated our recent past.

I am encouraged by these signs of change and responsibility—too late, perhaps, for some places but clearly not too late to guarantee a quality outdoor experience for our next generation of Americans.

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Scientific abstract available upon request.

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- ★ NordicTrack's unique flywheel resistance provides smoothness and continuity not available on a Shuffle-Type Ski Exerciser.

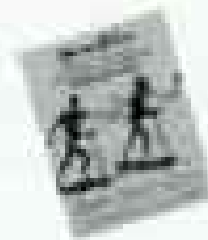
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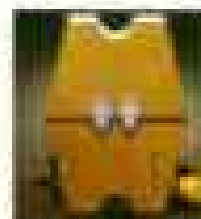
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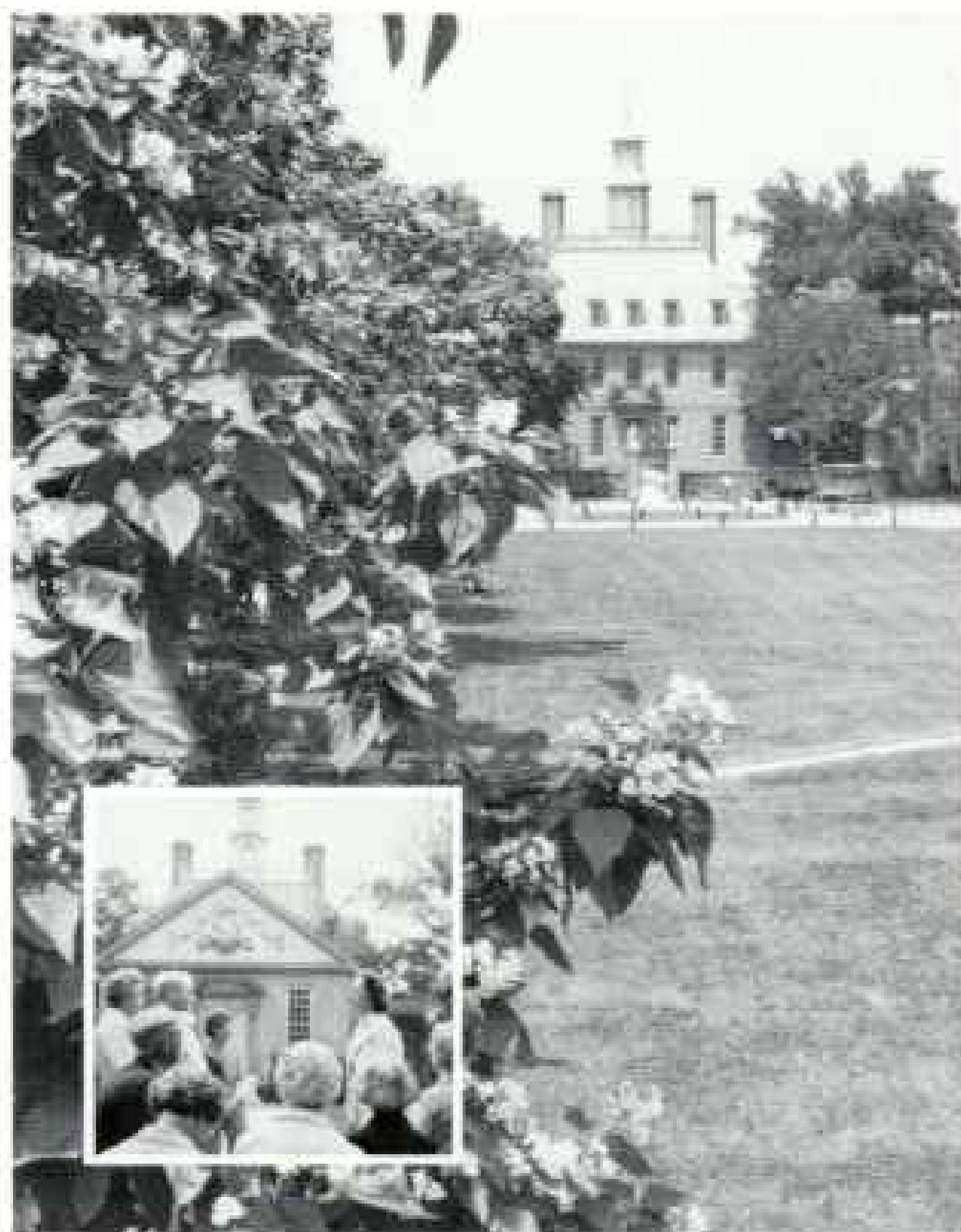
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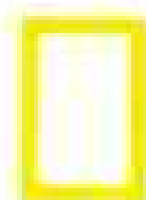


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Members Forum

Immune System

NATIONAL GEOGRAPHIC (June 1986) may have surpassed the excellence to which members have grown accustomed in its exploration of territory (the human body) that, despite its proximity, is understood little more than faraway lands. However, Mr. Jaret's editorializing on AIDS detracted from the objectivity of the article.

Jay Hodin
Portland, Oregon

This type of clear education about the disease AIDS is much needed to help the fight against it, since so many misconceptions are circulated.

Carl A. Siders
Honolulu, Hawaii

Be advised your field of endeavor is geography not biology. Cover our planet Earth first.

Henry Schapp
Quilcene, Washington

Congratulations. Our organization has spent a decade funding research into the immunological aspects of cancer. May I suggest that this incredible article be put in a booklet for sale or distribution to schools and medical institutions.

John Steinbacher
The Cancer Federation, Inc.
Riverside, California

I was dismayed to see your magazine passing on the misconception that the illness systemic lupus erythematosus is rare. The incidence is one in 2,000. More people have lupus than leukemia, muscular dystrophy, cerebral palsy, multiple sclerosis, cystic fibrosis, or many other highly visible diseases.

Mary L. Adler
Ridgecrest, California

Readers may be interested to know that the computer game "Killer T Cell" (shown on page 705) is available by mail order in Apple II, Commodore 64, and IBM-PC versions. Disks cost \$20 each, and all proceeds support cancer research. Write: Killer T Cell, Box 6, M. D. Anderson Hospital, Houston, Texas 77030.

Elton Stubblefield
Houston, Texas

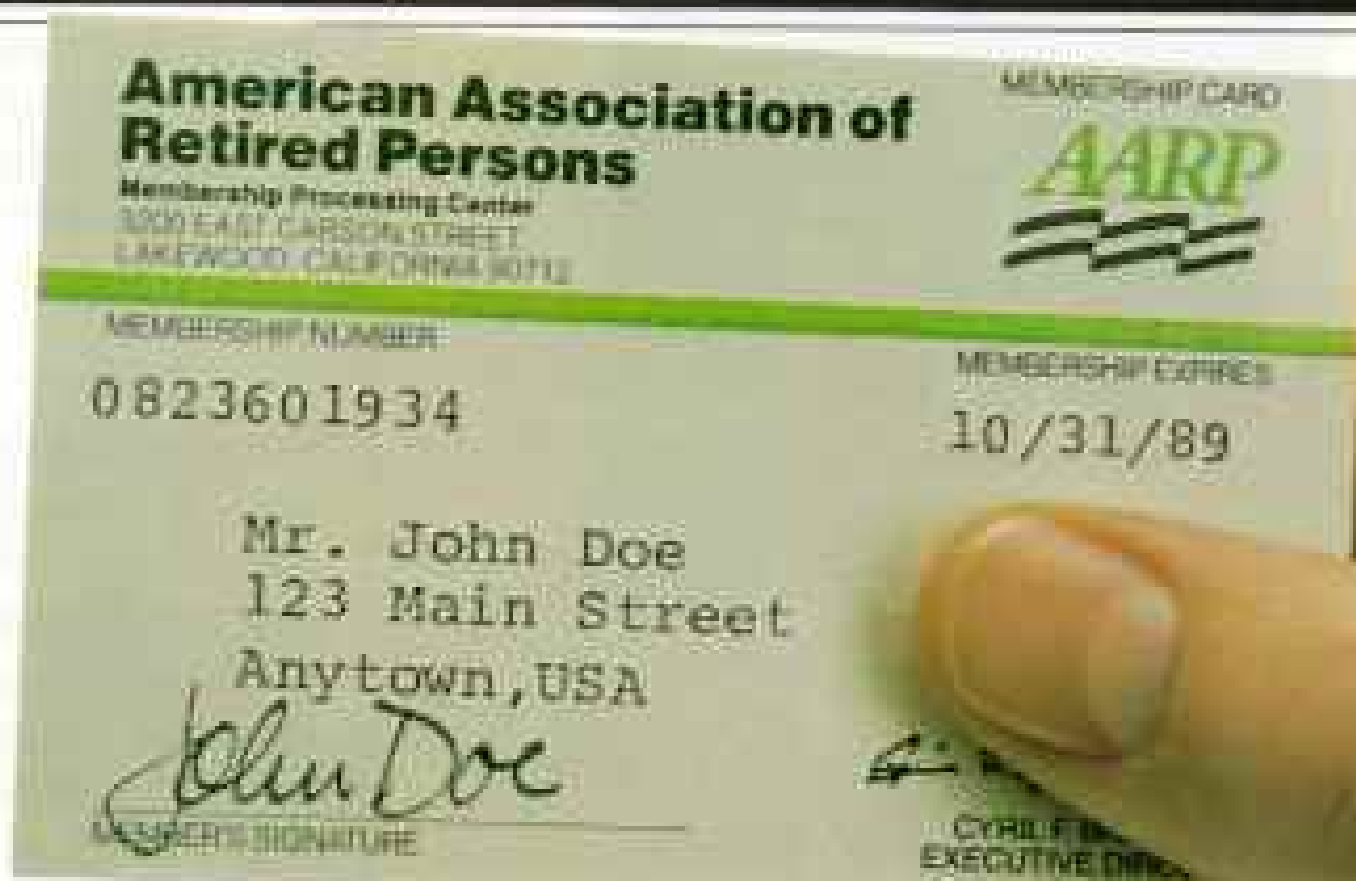
Cigarette smoke depresses the function of the natural killer cells and may help explain why smokers in general have a higher risk of most types of cancer than nonsmokers. Studies show

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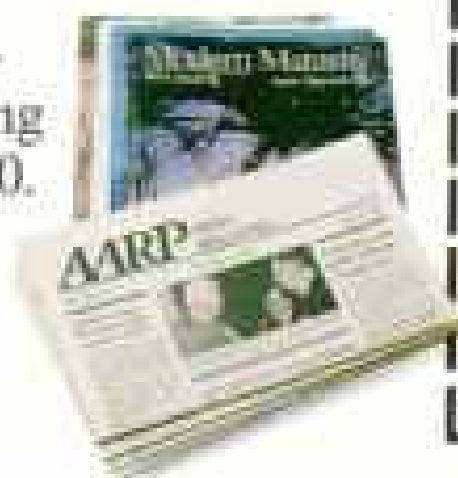
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Ira E. Bailie, M.D.
Turlock, California

It is sobering to read that modern technology still regards Edward Jenner's discovery of vaccination nearly 200 years ago as one of medicine's greatest triumphs. His 1798 report was taken up with enthusiasm in the U. S., but in England it met with strong opposition at first. As a surgeon apprentice in Sodbury, England, Jenner had collected medical folklore, amongst which was the belief that people who caught the mild cowpox were immune from the dreaded smallpox. It had long been observed that milkmaids—for whom cowpox was an occupational hazard—had this immunity. The milkmaid was renowned for her flawless complexion, a rare possession in a population scarred by smallpox. It should be encouraging for today's researchers to know that the answers they seek are lying all around, waiting for someone to take that one step further.

John R. Edwards
Stourbridge, England

Tolstoy

"The World of Tolstoy" (June 1986) was a masterpiece. Many of us hope that it marks the start of a new series: "The World of . . ." (Jane Austen, Gustave Flaubert, Thomas Mann, etc.).

Sol S. Shalit
Milwaukee, Wisconsin

There was undue stress on this hero as a social reformer and international humanitarian. He was neither. He was no lover of Jews; he was no lover of anyone, including himself. But no novelist can match Tolstoy in describing a human situation.

Alex Tobias
Brooklyn, New York

You start by saying "when a widely hated regime is at last overthrown, what follows is often no better and sometimes worse." This thinly veiled canard is repeated toward the end of the article. Even the most virulent anti-Communist has never accused the Russians of allowing conditions to exist such as Tolstoy found among the starving and homeless under the tsar.

Frances Wilson
Albany, California

In 1965, as a child, I visited with my family the Tolstoy Foundation farm and met Alexandra Tolstoy. I wonder what became of her.

Suzanne M. Uzoff
Houston, Texas



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Alexandra Tolstoy became a U. S. citizen in 1943. She helped set up the Tolstoy Foundation and its farm in Valley Cottage, New York, to help refugees. She died in 1979 at age 95 and was buried in the Russian Orthodox cemetery in Spring Valley, New York.

With great interest and emotion, I've read your article on my grandfather Leo Tolstoy. Your text is so true and full of feeling. I spent part of my childhood in Yasnaya Polyana and was very near to my grandmother until her death in 1929. There is nothing in your article against which I can protest. That does not happen too often.

Tania Albertini Tolstoy
Rome, Italy

Bikini Atoll

We are very grateful for your article on Bikini Atoll (June 1986). My husband was stationed on Enewetak Atoll (1977) and was all over those islands, including the deadly Runit. The Army claims he was exposed to a safe amount of radiation. But your article has caused us to question the Army and to contact the Veterans Administration so that proper tests can be made.

Mr. and Mrs. Curt Norris
Leesville, Texas

The Defense Nuclear Agency, which monitors effects of tests on U. S. personnel, has a toll-free number for veterans: 800-336-3068.

In 1982 a Defense Nuclear Agency report surfaced confirming that test-site authorities knew hours prior to the Bravo shot that winds at 20,000 feet were headed for Rongelap to the east. Despite these reports the bomb test went ahead. Islanders living on Rongelap and Utirik Atolls, downwind from Bikini, were not evacuated.

Phil Esmonde
Victoria, British Columbia

The information available to decision makers at the time is still disputed. The Bravo shot was several times stronger than predicted, blowing the column of radioactive debris higher and wider than expected. Islanders and U. S. servicemen were evacuated during the following three days.

We never read this side of the story in history books. Thanks for the information. Maybe it will help these people.

Elsie Kelly
Del Mar, California

As one of 40,000 servicemen who participated in the bomb tests, I was privileged to observe a target atoll before a test and in an aerial view afterward. All that remained was a depression in the ocean floor; the entire atoll had been sucked up into that lethal mushroom cloud. With

Hiroshima-Nagasaki, the Three Mile Island and Chernobyl nuclear accidents, and all the extensive testing by "Atomic Club" nations, perhaps we indeed can avoid World War III. The awesome potential and actual destruction of these events has truly been for the good of mankind.

Lt. Col. Norman Schultz
Robbinsdale, Minnesota

You have unwittingly given credence to one of the canards of the nuclear age: "There remain loose on Runit 160 grams of plutonium oxides . . . enough of this toxic metal . . . to wipe out an entire population." Even the 26 workers at Los Alamos who in 1944-45 inhaled plutonium particles accidentally have developed no cancer or adverse health effects. Like sand, the insoluble particles simply pass through the intestinal tract.

Waldo E. Cohn
Oak Ridge, Tennessee

The timely appearance of your article coincident with this spring's crisis at Chernobyl serves as fair warning about the risks inherent in nuclear technology. Let us hope that we Americans are as "smart" as the Bikinians think us to be.

James A. Gilmer
Glenmont, New York

Tea and Sugar Train

As a longtime subscriber and avid reader of both NATIONAL GEOGRAPHIC and *Smithsonian*, I was in a quandary as to who scooped whom with the tea and sugar sagas in the June issues of both magazines. And I still don't know the length of the longest stretch of straight railroad track in the world. The GEOGRAPHIC says 310 miles, *Smithsonian* says 299.

J. J. Lancaster
Gainesville, Georgia

No one was scooped. Both magazines prepared the articles months in advance and happened to publish simultaneously. The Australian National Railways Commission verified the kilometer-post numbers for that straight stretch: 781 to 1,279, a total of 498 kilometers, or 309.4 miles.

We used to stand in line at Pimba with Aussies and Aborigines to get our supplies—and if the train was late, we waited till midnight or 2 a.m. It was our main source of fresh meat. We don't always realize until we look back how much we enjoyed the inconvenience.

Nancy Hemby
Mountain Home, Idaho

Letters should be addressed to **Members Forum**, National Geographic Magazine, Box 37448, Washington, D. C. 20013, and should include sender's address and telephone number. Not all letters can be used. Those that are will often be edited and excerpted.



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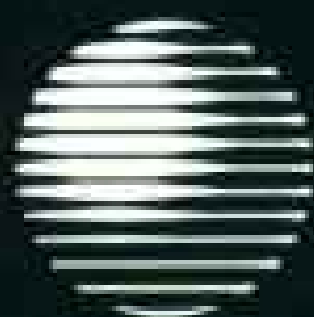
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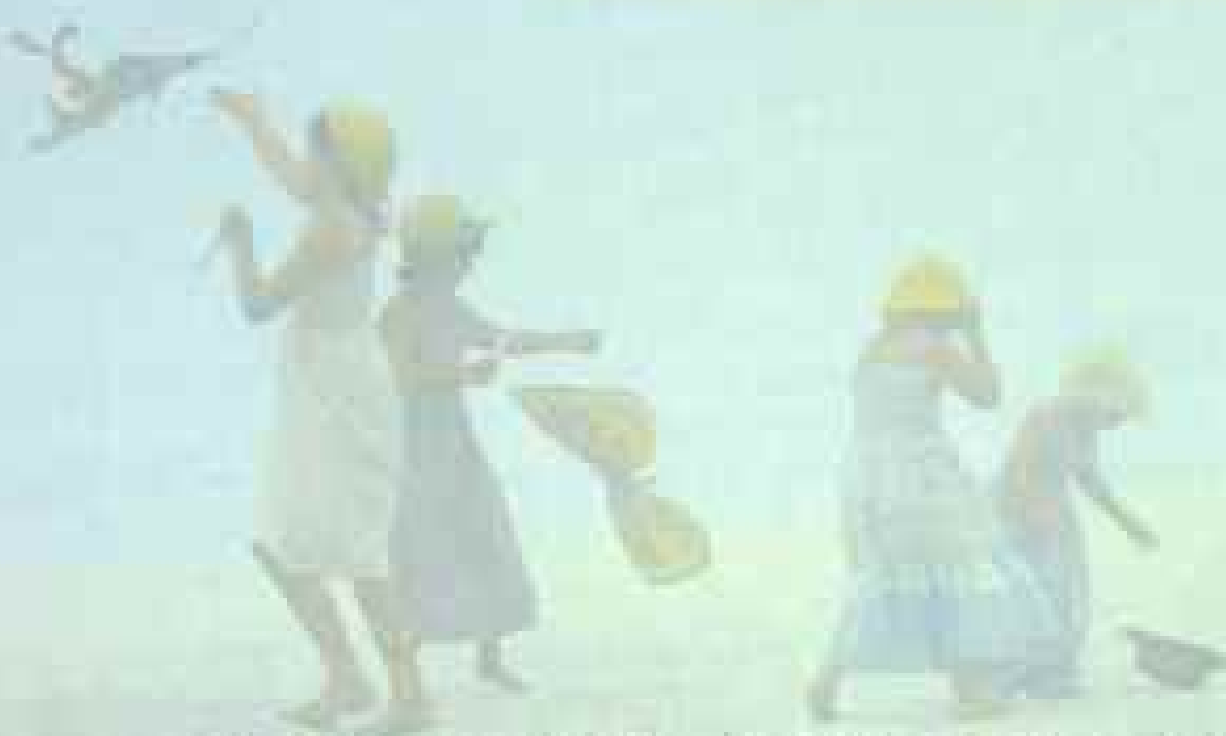
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MORE EASILY. INDOORS OR OUT.**

Introducing the solid state Pro Wonder. If you settle for less than RCA's new Pro Wonder Camcorder (model CMR 300), that's exactly what you'll get. Less performance. Less convenience. Less recording time.

Why? Because RCA's solid state technology lets you capture picture perfect memories even in low light. (Its 7 lux low light rating lets you shoot with confidence indoors or out.)

Pro Wonder is also fully automatic. So you never have to worry about adjusting for focus changes or shifts in light levels. You just aim and shoot. And, because Pro

Wonder uses standard VHS cassettes, you can record a full 2 hours and 40 minutes of uninterrupted magic.

And even though RCA packs so many professional style features into a all-in-one unit, Pro Wonder only weighs a scant 5.5 lbs.

Pro Wonder CMR 300 available with optional carrying case. If you settle for less than RCA's Pro Wonder, you'll miss more than its ability to capture picture perfect memories. You'll miss a chance to get this optional, hard-shell camera case. See your participating RCA dealer for details.



RCA

TECHNOLOGY THAT EXCITES THE SENSES

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C A M C O R D E R

AIM HIGH

Now. For the future.

Technology is moving faster than science fiction. And, it's more exciting. But to be part of it — to make it work — we have to learn. We have to grow.

The Air Force has thousands of fascinating opportunities. Many in technologies still being developed. But, young Americans will be left out if they're not prepared.

It takes training to use technology. The Air Force offers such training. But only to those who can handle it. Those who have taken advanced courses in math and science.

We've got a choice. America's youth can watch technological developments being made. Or they can help make them. Encourage our children to AIM HIGH. To tackle the tough courses. Then they'll be equipped to tackle the future.

America and the Air Force of tomorrow are depending on them.

AIR FORCE

A great way of life.



DODGE DAKOTA

THE FIRST TRUE MID-SIZED PICKUP EVER MADE.



Smaller than a full-sized pickup. Larger than a compact. Dakota is the first true mid-sized pickup ever made.



A WHOLE NEW SIZE

More fun to drive than a full-sized pickup. More truck than a compact.



THREE ACROSS SEATING

With more head, shoulder and hip room than any compact you can buy. Import or otherwise.



WIDE OPEN CARGO SPACES

2,550 pounds, maximum available payload. With room enough for a full 4' x 8' sheet of plywood in our long bed model.

The new state of the American truck.

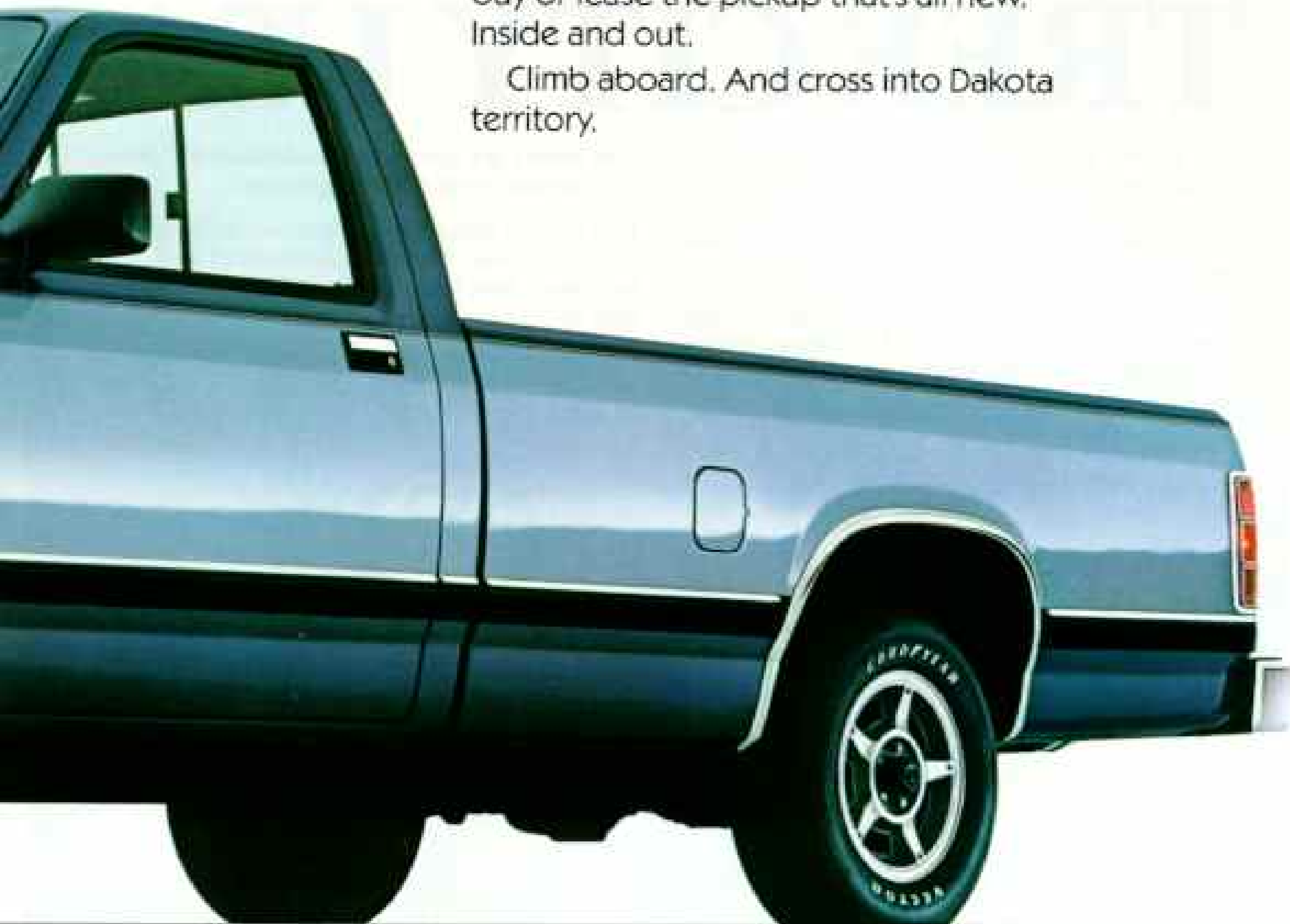
There's never been a truck quite like this before. Because there's never been a truck quite this size before.

It's smaller than a full-sized pickup, but it's big under the hood and roomy on the inside.

It's larger than a compact, but it's fun to drive and easy on the wallet.

So if you're in the market for a new truck, buy or lease the pickup that's all new. Inside and out.

Climb aboard. And cross into Dakota territory.



AND THE BEST TRUCK WARRANTY IN AMERICA.

Five years or 50,000 miles. Covering the engine, powertrain and outer body rust-through. See a copy of this limited warranty at your Dodge Dealer. It excludes imports and non-Gold Key leases. Restrictions apply.



THE BEST BUILT, BEST BACKED AMERICAN TRUCKS ARE RAM TOUGH

"Best Built" based on survey of owner problems with '86 light trucks designed & built in No. America and sold Oct.-Nov. '85 (5 mos. avg. usage).

BUCKLE UP FOR SAFETY.



3.9L V-6 POWER

All new optional engine with 195 lbs.-ft. of torque and, when properly equipped, 5500 lbs. of towing capacity. More than any compact.

Keep A Great Thing Growing AMERICA

TREE CITY USA

All across America hundreds of cities, large and small, are joining a growing movement...Tree City USA. From Manchester, Maine, to Pacific Grove, California, people are planting and caring for trees.

What is Tree City USA? It is a national urban forestry program designed to make every community a better place in which to live. It is a proven program where American cities

and towns are given the guidelines for effective urban forestry management.

Be a part of this growing movement. Join New York, Chicago, Anaheim, Greenleaf and Broken Bow and support Tree City USA where you live.

For more information, write: The National Arbor Day Foundation, Nebraska City, NE 68410.



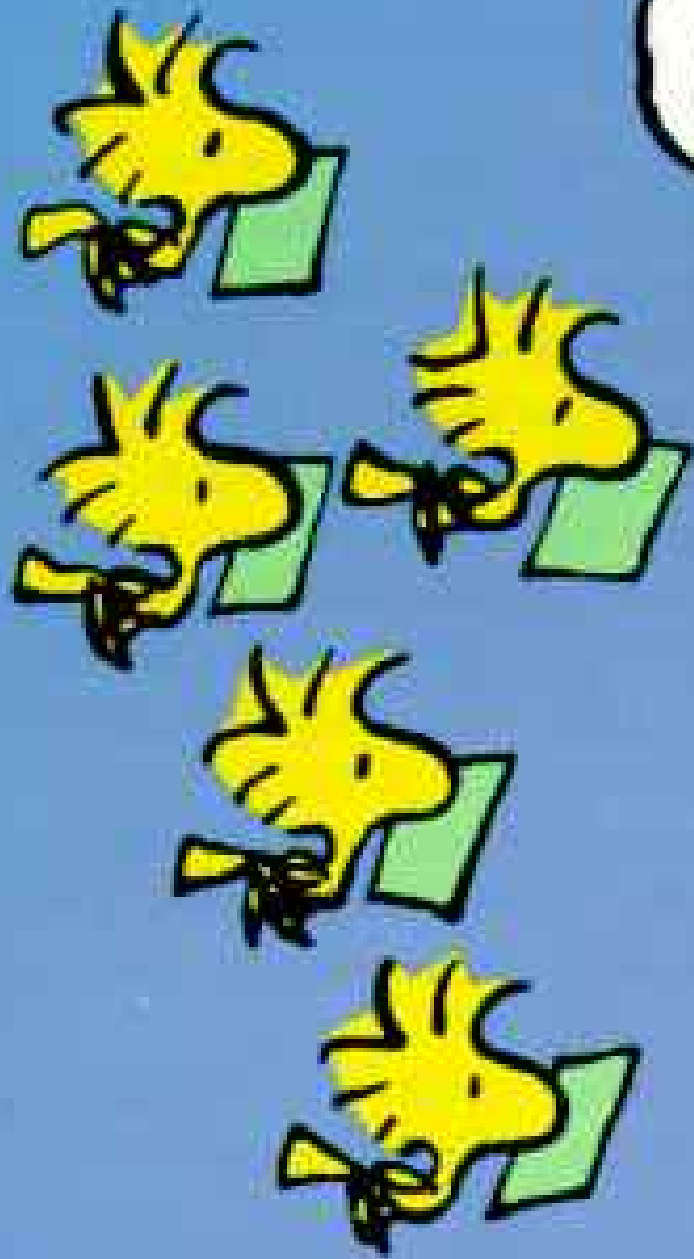
The
National
Arbor Day
Foundation
Nebraska City, Nebraska 68410



TREE CITY USA

WE'RE CONSTANTLY IMPROVING OUR
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NEXT YEAR, CHECKS
WITHOUT BEAK MARKS?



SCHULZ

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Snoopy makes sure Met Life claim checks are delivered very, very promptly. He can deliver in a lot of ways. To find out about Metropolitan's Life, Health, Auto, Home or Retirement Insurance, contact your local Met Life representative.

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Metropolitan Property and Liability Insurance Company, Warwick, R.I. Auto and homeowners insurance available in most states.

On Assignment

REPORTING on a Soviet space program traditionally hidden under the cloak of official secrecy was the dilemma faced by science editor *Thomas Y. Canby* (below, right). Yet he found in Moscow that times have changed a bit.

Cooperation was warm and unstinting when the topic was the successful Soviet manned space program. Canby interviews one of the U.S.S.R.'s most celebrated cosmonauts, Air Force Maj. Gen. Vladimir Dzhanibekov, at left. The five-flight veteran of 145 days in space had recently salvaged the unmanned space station Salyut 7 after an electrical failure left it dead in the sky. The busy space hero not only described in detail the ordeal he and a colleague endured to revive the maimed spaceship, but he also agreed—as an avid part-time artist—to sketch his recollection of the reactivation for the *GEOGRAPHIC* (pages 432-3).

In the five years that Canby has monitored Soviet advances in space, he has observed a growing openness about the

manned program and about planetary, meteorological, and earth sciences research. "The Soviets' relaxation in these areas could be a result of the self-confidence that comes with success," he notes. "But they are still reticent about their military space activities."

For this, Canby turned to a coterie of space-watchers in the West who ingeniously piece together information from scattered international sources. Their data served as a basis for the article's revealing portrayals of Soviet space hardware.

Carrying a preliminary layout to Moscow that included the drawing below, Tom recalls being "a little edgy at the customs inspection—loaded with documentation of secret cosmodromes, rockets, even paintings of rockets not yet operational. But they took it in stride." Officials of Novosti Press Agency made only one comment: "Do you do this to everyone?"

Canby's answer: "We do. *NATIONAL GEOGRAPHIC* tries to be thorough."



NATIONAL GEOGRAPHIC PHOTOGRAPHER STEVE BAYMER



South Andean Huemul Genus: *Hippocamelus* Species: *bisulcus* Adult size: Length 140–180cm, shoulder height 79–104cm, male; length 135–160cm, shoulder height 78–84cm, female Adult weight: 50–100kg, male; 40–75kg, female Habitat: Temperate forest, shrubland and open areas in the south Andes in Chile and Argentina Surviving number: Estimated at 1,300 Photographed by Anthony Povilis

Wildlife as Canon sees it: A photographic heritage for all generations.

A national symbol of Chile since 1883, the South Andean huemul is featured on the country's coat of arms. Considered fairly common in the early 1800s, it started to decline later in the century. The huemul's remarkable lack of wariness towards people made it an easy target for hunters.

Today, the huemul continues to face pressures from hunting as well as habitat loss. Wildlife guards have protected huemuls from poachers in some areas of Chile for nearly ten years, but additional conservation measures are needed to ensure the survival of the species. Photography can benefit the huemul by promoting a greater understanding of this rare, gentle Andean deer and its importance as an irreplaceable member of the ecosystem.

And understanding is perhaps the single most important factor in saving the huemul and all of wildlife.



EOS The world's most intelligently designed SLR camera.

Canon
Images for all time