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The Coming Revolution in Transportation

BY FREDRIC C. APPEL

Illustrations by National Geographic Photographer
DEAN CONGER

WHEN I FIRST SAW SRN4, she was resting peacefully on a wide concrete ramp at the edge of the English Channel at Dover. Surely this squat 130-foot creature was feminine, for she was wearing a skirt. Rumpled and sagging, but definitely a skirt.

Walking inside, I took a seat. The door clanged shut, muffled gas-turbine engines began to throb, and the lady came to life.

Air pressure from four great fans ballooned her limp skirt into a rounded fullness. Carrying 254 passengers and 30 automobiles, the SRN4 slowly glided down the ramp, hovered over the water for a moment—and then raced toward France at a mile a minute!

Of all the vehicles I've ever ridden, this propeller-driven Hovercraft ferry fascinates me the most (following pages). She crosses land and water with equal ease, supported on the cushion of air that billows her rubberized fabric skirt. Tides, floating debris, and Channel ice bother her not at all, for the skirt lifts her hull seven feet above the surface. And at the end of her runs she needs no elaborate docks, only rough-poured concrete ramps.

As we skimmed the choppy sea, SRN4 seemed as much an airliner as a ship. In our cabin, pretty stewardesses—purserettes they are called on this British craft—patrolled the aisles, pouring wine and plumping pillows for the passengers.

No Pitch, No Roll—Only a Faint Popping

I wangled an invitation to visit the control cabin and felt even more like an airline passenger. Pilot, copilot, and radar-navigator worked in the instrument-lined cockpit, and the busiest of the three seemed to be the man at the radar screen. Travel 60 miles an hour across a busy sea lane, often in fog, and you *need* a radar set!

Through the big forward windows I could see endless files of foam-flecked, three-foot waves marching toward us. The Hovercraft sped over them with eerie smoothness. No rolling on this ship. No pitching. Just a faint staccato popping sound as the front of the craft's bulging skirt slapped the wave tops in rapid succession.

To me, SRN4 symbolized the transportation revolution that lies ahead of us. Exciting

machines? A vast array has already reached or passed the experimental stage.

What are they like? When will they become commonplace? And—most important—what problems lie between our traffic-choked, smog-shrouded transportation systems of today and the alluring systems of the future?

In search of the answers, I have journeyed from Seattle to Stockholm, from London to Los Angeles, and talked with scientists, engineers, architects, transportation officials, and city planners.

"People Capsule": Dial Your Destination

Everywhere I found signs that a revolution in transportation is on the way.

The automobile you drive today could probably move at 100 miles an hour. But you

Half fish, half fowl, Britain's air-cushion *Princess Margaret* roars into Dover after a Channel crossing, her black ramp poised for lowering. The SR.N4—for Saunders-Roe No. 4—rides seven feet above the water on air blown downward by powerful fans and trapped in a rubber skirt. British Hovercraft Corporation, Ltd., successor to the original maker, manufactures the swift vessels on the Isle of Wight. Two are now in service with

average closer to 10 as you travel our clogged city streets.

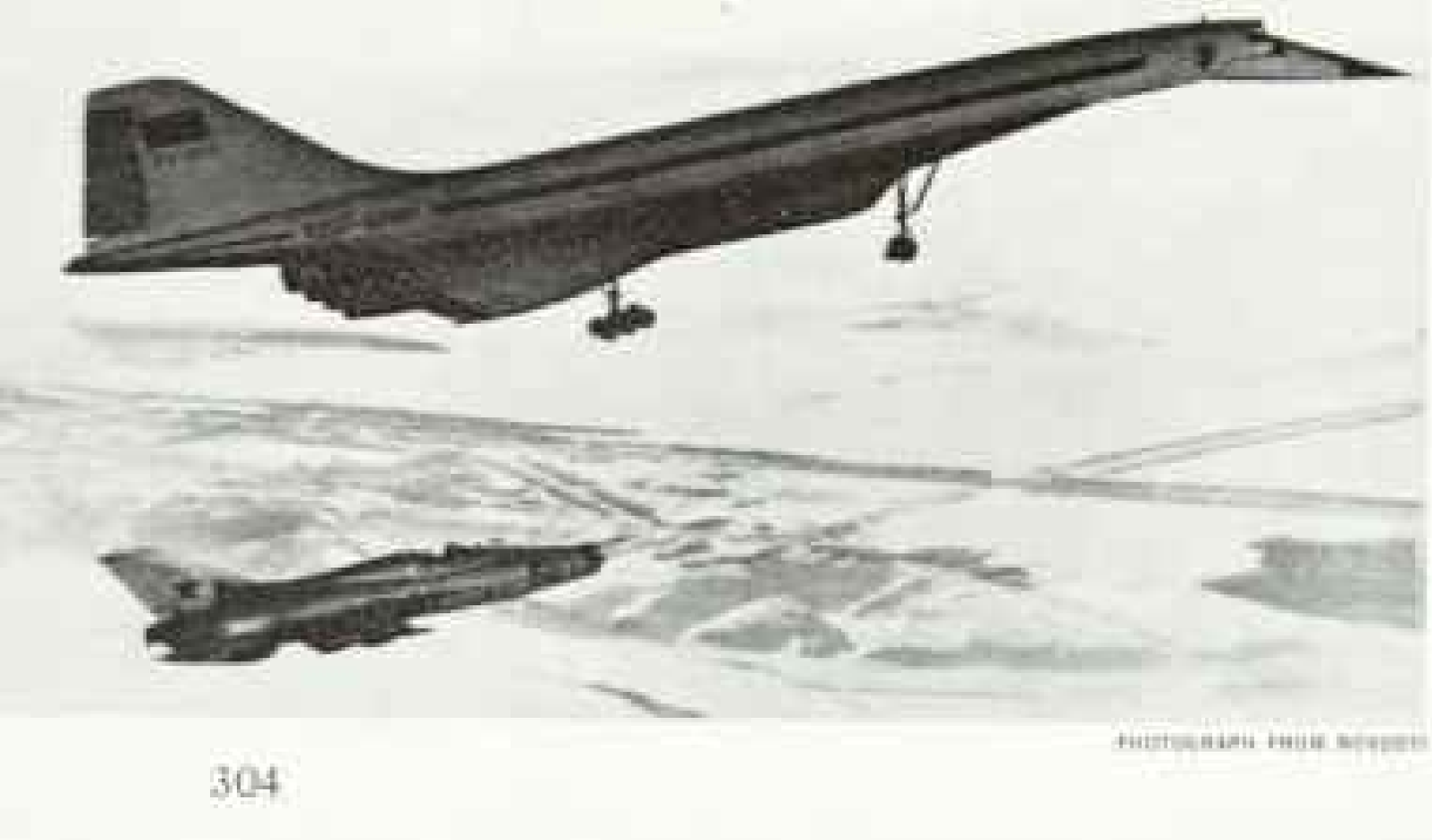
Someday, perhaps in your lifetime, it could be like this. . . .

You ride toward the city at 90 miles an hour, glancing through the morning newspaper while your electrically powered car follows its programmed route on the automated "guideway."

You leave your car at the city's edge—a parklike city without streets—and enter one of the small plastic "people capsules" waiting nearby. Inside, you dial your destination on a sequence of numbered buttons. Then you settle back to finish reading your paper.

Smoothly, silently, your capsule accelerates to 80 miles an hour. Guided by a distant master computer, it slips down into the network

the Seaspeed Division of British Railways, whisking as many as 254 passengers and 30 automobiles at a mile a minute between Dover and Boulogne-sur-Mer in France. Despite time lost in slow harbor traffic, the 30-mile trip takes only 40 minutes—less than half as long as required by conventional ferries. The new air-cushion craft flies in the vanguard of exciting carriers and concepts that promise man better ways of getting from here to there.



PHOTOGRAPH FROM BOEING

Soaring into a new age, fledgling supersonic jet transports flex their wings. The British-French Concorde 001 surges skyward for the first time at Toulouse, France, last March 2 (above). Designed to fly the Atlantic in three hours, it will carry as many as 132 passengers at speeds up to 1,400 miles an hour—twice as fast as sound.

The Soviet Union's TU-144 makes a maiden flight with a MIG-21 escort last December (left). The Russian supersonic transport and the Concorde possess similar capabilities and vie for first entry into commercial service—perhaps by 1972. Both have a "droop snoot," a nose that hinges downward slightly on take-off and landing to help pilots see the runway.

In the United States, Boeing plans an 1,800-mph SST that will carry 300.

ILLUSTRATIONS BY MARC CHAGALL, RAPHO GUILLUMETTE © W.D.N.Y.

of tunnels under the city—or into tubes suspended above it—and takes precisely the fastest route to your destination.

Far-fetched? Not at all. Every element of that fantastic people-moving system is already within range of our scientists' skills.

Car-trunk Computer Issues Orders

Consider automated cars—and when you do, look at the modern automobile. Think of the rapid increase, in the past decade, of electric servomechanisms on automobiles. Power steering, antiskid power brakes, adjustable seats, automatic door locks, automatic headlight dimmers, electronic speed governors, self-regulated air-conditioning.

Detroit designers, already preparing for the day your vehicle will drive itself, are getting practical experience with the automatic devices on today's cars. When more electric devices are added and the first computer-controlled highways are built, the era of the automated car will be here.

At the General Motors Technical Center near Detroit, I drove a remarkable vehicle. It was the Unicontrol Car, one step along the way to the automated family sedan.

In the car a small knob next to the seat (some models have dual knobs) replaced steering wheel, gearshift lever, accelerator, and brake pedal (page 339).

Moving that knob, I learned, sends electronic impulses back to a sort of "baby computer" in the car's trunk. The computer translates those signals into action by activating the proper servomechanism—steering motor, power brakes, or accelerator.

Highways May Take Over the Driving

Simple and ingenious, I thought, as I slid into the driver's seat. Gingerly I pushed the knob forward. Somewhere, unseen little robots released the brake and stepped on the gas.

So far, so good. Now I twitched the knob to the left—and very nearly made a 35-mile-an-hour U-turn!

But after a few minutes of practice, I found that the strange control method really did feel comfortably logical. I ended my half-hour test drive with a smooth stop in front of a Tech Center office building and headed upstairs to call on Dr. Lawrence R. Hafstad, GM's Vice President in Charge of Research Laboratories.

The Unicontrol Car—a research vehicle built to test new servomechanisms—is easy to drive. Still, it does have to be driven. I asked Dr. Hafstad about the proposed automated highways that would relieve the driver of all responsibilities except that of choosing a destination.

"Automated highways—engineers call them guideways—are technically feasible today," Dr. Hafstad answered. "In fact, General Motors successfully demonstrated an electronically controlled guidance system about ten years ago. A wire was embedded in the road, and two pickup coils were installed at the front of a car to sense its position in relation to that wire. The coils sent electrical signals to the steering system, to keep the vehicle automatically on course.

"More recently, we tested a system that also controlled spacing and detected obstacles. It could slow down an overtaking vehicle—even stop it, until the road was clear!"

Other companies are also experimenting

(Continued on page 310)

Airport of tomorrow

WITH THIS YEAR'S CRUSH of 150 million air passengers destined to triple in a decade, planners foresee future airports as vast automated complexes such as portrayed here by artist Pierre Mion in consultation with Richard J. Barber, Deputy Assistant Secretary for Policy and International Affairs in the Department of Transportation.

Dispersed to avoid congestion, glass-domed terminals range the perimeter of the 20,000-acre facility; parallel runways permit simultaneous take-offs and landings. As a supersonic transport screams in, jumbo jets disgorge and load their hundreds of passengers.

To the right of the skylighted lounge, a wing of the terminal shelters passenger waiting areas and automated ticketing and baggage-routing machines (pages 322-3).

Cars park on upper levels of a local traffic hub, left, while the roof serves as a mini-port for V/STOL (vertical or short take-off and landing) planes. Wheeling overhead, a Sikorsky Skycrane helicopter carries a passenger-filled lounge to a metroport in the city, left background. Faster V/STOL's shuttle to nearby cities; these craft could evolve from the British Hawker-Siddeley Harrier (opposite), shown taking off vertically in a demonstration at the Norfolk Naval Base in Virginia. Scheduled to begin service with the Royal Air Force late this year and under consideration by the U. S. Marine Corps, the Harrier pivots four nozzles on the fuselage to go up, down, backward—and even sideways—or shoot forward at nearly the speed of sound.

As a hydrofoil scoots upriver, an air-cushion vehicle takes on fares, and trains roll in and out. An automated highway rushes traffic along computer-controlled routes; tubes whisk "people capsules" (pages 340–41) between terminals and the city.

PAINTING BY PIERRE MION © B.S.E.L. KODACHROME BY PHC DANIEL S. DOSS, U. S. NAVY

A train flashes by at 130 miles an hour while rice harvesters go about their timeless task; Fuji's snowy crest hangs like a cloud 20 miles beyond this scene on Japan's New Tokaido Line, the world's most highly automated and successful intercity rail system. Every 20 minutes during morning and evening rush

hours, trains roar from the terminal cities of Tokyo and Osaka laden with a thousand passengers each. Locals, stopping at 12 cities en route, run the 320-mile course in four hours; expresses shrink the trip almost to three. On a record day early this year the New Tokaido moved more than 350,000 travelers.

(Continued from page 305)

with guideways. In some systems, the car's power comes from an electric transmission line built into the road. In others, vehicles would simply be carried on a high-speed conveyor, or perhaps in a container. Computerized guidance systems vary, too.

"Before the first mile of automated highway is installed," Dr. Hafstad pointed out, "everyone will have to agree on just which system is to be used."

Electric Cars Could Solve Smog Problem

In looking at the problem of air pollution, Dr. Hafstad foresees the day when as-yet-undeveloped batteries will make electric vehicles feasible. Engineers are striving to reduce the pollutant emission of today's engines—but they expect the number of automobiles to double within two decades.

Turbine engines, which burn fuel more efficiently than do piston engines, may be an interim step.

"But right now," Dr. Hafstad commented, "turbine technology is very young, while our conventional engines are very advanced. It will take years for the turbines to catch up."

Electric cars are on the market today, but the driving range between battery charges is limited to 50 miles or less. Some auto firms are experimenting with hybrid electric vehicles, which use battery-powered motors in town and low-pollutant gasoline engines on the highway (page 338).

Scientists are also working hard to improve batteries. One answer may be a variation of the fuel cell that powers equipment aboard space capsules. The fuel cell—unlike ordinary batteries, which just store electrical energy—converts fuel directly into electricity.

Almost surely the day will come when we will drive electric cars on our way into the city. Will we drive into even more nightmarish traffic tangles on city streets?

I found a tantalizing bit of the answer near Stockholm, Sweden, last summer, as I strolled across a fountain-dotted plaza lined with attractive shops. No noisy traffic intruded here; this was a "walking plaza." At its perimeter, beyond the stores, high-rise apartment buildings stood like sentinels guarding it from the outside world.

It was a peaceful "people place," and the key to its success was a network of tunnels beneath it. Down there, trucks were supplying the stores with merchandise, and a subway ferried people back and forth from nearby Stockholm.

Roads Beneath Surface Defy the Weather

Underground highways? Most transportation experts I've talked to don't consider them extravagant at all. Byron A. Bledsoe, principal engineer of the Highway Research Board in Washington, D. C., pointed out to me that transportation is basically a utility, like sewage, electricity, and telephone service.

"Open sewers have gone underground," he said. "Electric lines and telephone lines are doing so now. In the future, surface roads—especially the ones in downtown areas—may disappear too, leaving the surface for people."

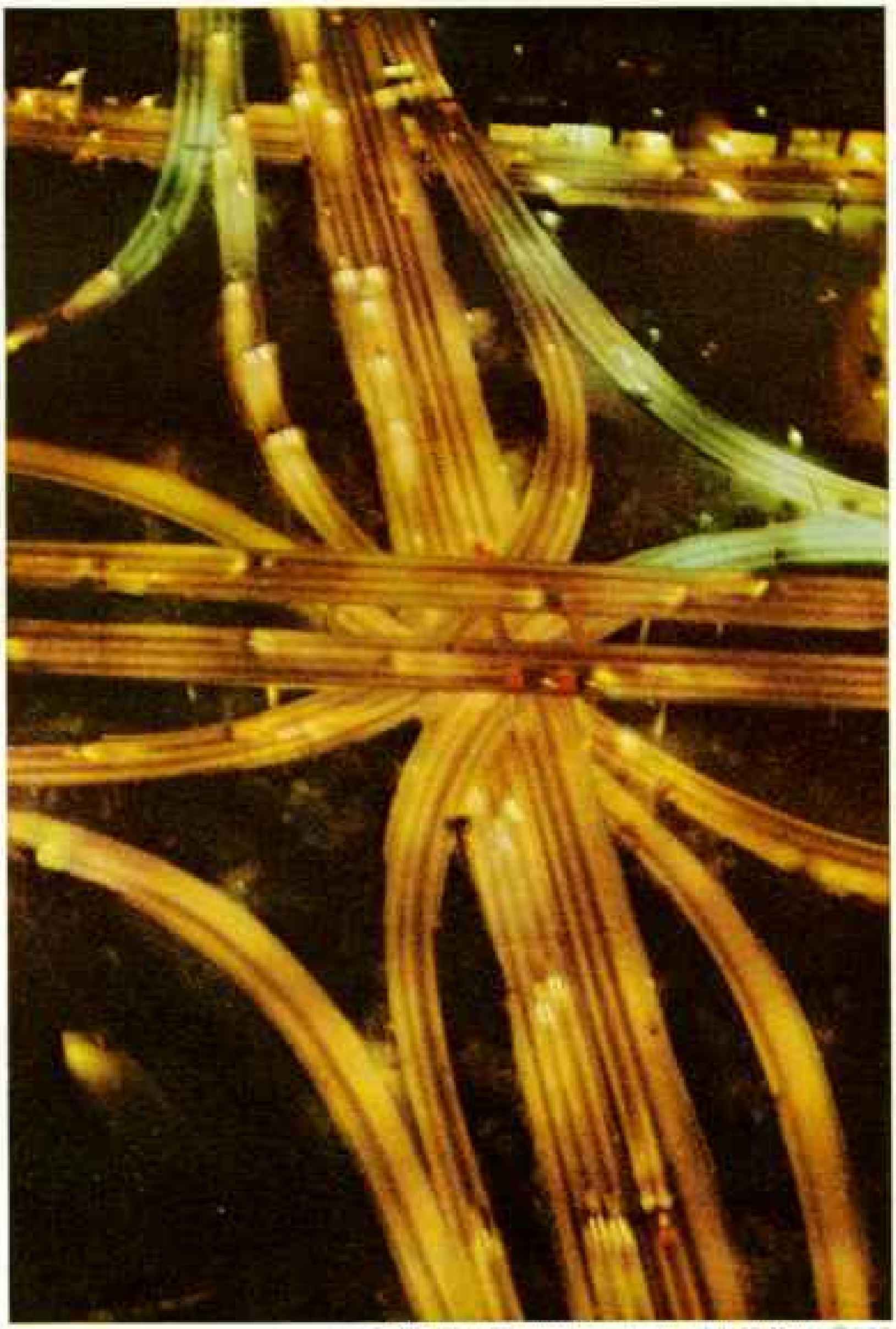
EKTACHROMES © N.G.S.

Running a robotized shuttle

In a sweeping electronics-age panorama, lights flicker along a 70-foot panel at a Tokyo control center, revealing the frenetic movements of New Tokaido Line trains. Whirring computers dictate every arrival and departure, diverting locals onto side tracks as expresses blink by. Highly trained controllers guard consoles aglow with countless safety dials and maintain radiotelephone contact with each train's operator (below).

Here a motorman eases the throttle forward to accelerate—the only instance in which manual operation proves smoother than automation.

In a buffet-car bar (above), passengers sip beer or tea without fear of its sloshing, while a wall speedometer records nearly top speed, 210 kilometers—130 miles—an hour.



EICHROME BY MAGNUM (ABOVE); KODACHROME BY BRUCE DALE © N.G.S.

Unscrambling the national traffic jam

GLEAMING, POWERFUL, BUT STOPPED COLD, cars and trucks back up five abreast. The scene is in St. Louis, Missouri, but it could be Anywhere, U.S.A. To unsnarl such tie-ups, car-crammed Los Angeles builds labyrinthine "spaghettis," such as the four-level downtown intersection shown here, which links freeways leading to Hollywood, Santa Ana, Pasadena, and the harbor. Los Angeles's titanic road-building exertions have laced the city with freeways—and paved a fourth of the surface of its downtown area.

So incredibly car-oriented are Americans that they own a total of 100 million autos—36 for each mile of paved road. To cope with the proliferation, federal and state governments construct the Interstate Highway System, adding 42,500 miles to a Nation whose paving and rights of way now occupy as much land as the state of Kentucky. But new roads often become clogged the instant they open, and proposed freeways threaten parklands and displace city residents. Social planners grow ever more appalled at the auto's insatiable demands and look longingly toward mass-transit systems.

The average cost of a surface freeway in an urban area runs about four million dollars a mile.* Deep-tunnel mileage costs are now averaging about seven million. But improved technology will make tunneling cheaper, while land costs climb. As the two opposing trends continue, tunnels will become increasingly attractive to highway planners.

The U. S. Department of Transportation, through its Office of High-Speed Ground Transportation, is investigating new tunneling methods. Tunnels of the future may be bored by jets of flame or hyper-velocity jets of water. Chemicals, laser beams,† or plastic-encased pellets of water fired from powerful gas guns may be used to cut through or break up the rock.

Underground highways are not affected by weather. Another point: Underground freeways will avoid the bitter debates that have erupted in many cities over the displacement of people by surface construction.

Remember the people capsules that, a few pages ago, were going to thread the maze of tunnels beneath the city and take you to your destination? More than 30 such systems are in the development stage.

Most of them have common characteristics. They are controlled externally by a central computer. Vehicles move at high speed and at close intervals through a network of one-way passageways. Most are designed to carry small groups of people, affording privacy equal to that of a taxi.

Computer Eliminates the Reckless Driver

Consider the system under study by researchers at the Docutel Corporation, just outside Dallas, Texas. Electrically powered cars, each seating as many as four persons, travel on aluminum tracks suspended from graceful arches over the city or threading through tunnels under the ground.

Passengers board their waiting car in a spur tunnel, insert a destination card in a slot, and relax. The car, electronically controlled, merges smoothly into the traffic speeding through the main tube and travels to its destination by the most direct route.

No, it hasn't happened yet. As I write this, no city has begun construction of such a system. But it can be built.

You may have reservations about surrendering control of your vehicle to a faceless computer. I did—until I remembered that the computer will be controlling the other vehicles as well. There will be no reckless driver to swerve into my lane, or thunder past on the wrong side of the road. Traffic experts and life-insurance agents will be happy to see the unpredictable human element taken out of our transportation system.

The experts agree on another point, more disheartening: The path to a safe, efficient transportation system will be a rocky one.

I sat one day in the book-lined office of Dr. Paul Cherington, at that time Professor of Transportation at Harvard and since then named Assistant Secretary of Transportation for Policy and International Affairs. He gave me some rather startling statistics:

"In the United States, we have enough car seats on the road for every man, woman, and child—with enough seats left over to hold the entire population of continental Europe."

"People Go Where Transportation Is"

Dr. Cherington paused for a moment, and the muted noise of city traffic drifted in through the open window as if to underscore his point.

"In New York City a truck moves at a slower pace today than a horse-drawn cart did 60 years ago. A fourth of downtown Los Angeles is paved for the use of automobiles.

"Actually," he said, "we have been operating on a mistaken principle—that the transportation routes should go where the people are. It's wrong. People tend to go where the transportation is!"

As an example, he named a road close to my home—Shirley Highway, feeding cars into downtown Washington and into the vast parking lots of the Pentagon.

"Shirley Highway was a terrible old road, with traffic jams every day." And then Dr. Cherington gave me a quizzical smile. "So what did you do? You widened it into six lanes. Then what happened? Developers constructed high-rise apartments all along the new highway, and now five times as many people use the road. And what do you have today? A six-lane traffic jam instead of a two-lane traffic jam. People go where the transportation is."

There are two basic approaches to the transportation problem: Increase the capacity of the system, or reduce the requirements. Many

*Robert Paul Jordan wrote of "Our Growing Interstate Highway System" in the February 1968 NATIONAL GEOGRAPHIC.

†See "The Laser's Bright Magic," by Thomas Meloy, NATIONAL GEOGRAPHIC, December 1966.

KIDDER-HORNE BY JOHN CONGER © N.A.S.

Airways pioneer, manufacturer Donald W. Douglas compares his first plane, the 1921 Cloudster, with a new McDonnell Douglas jet.

City planner William Pereira unveils a proposed underground air terminal for Los Angeles. Telescoping legs lift lounge to planes.

They keep man on the move

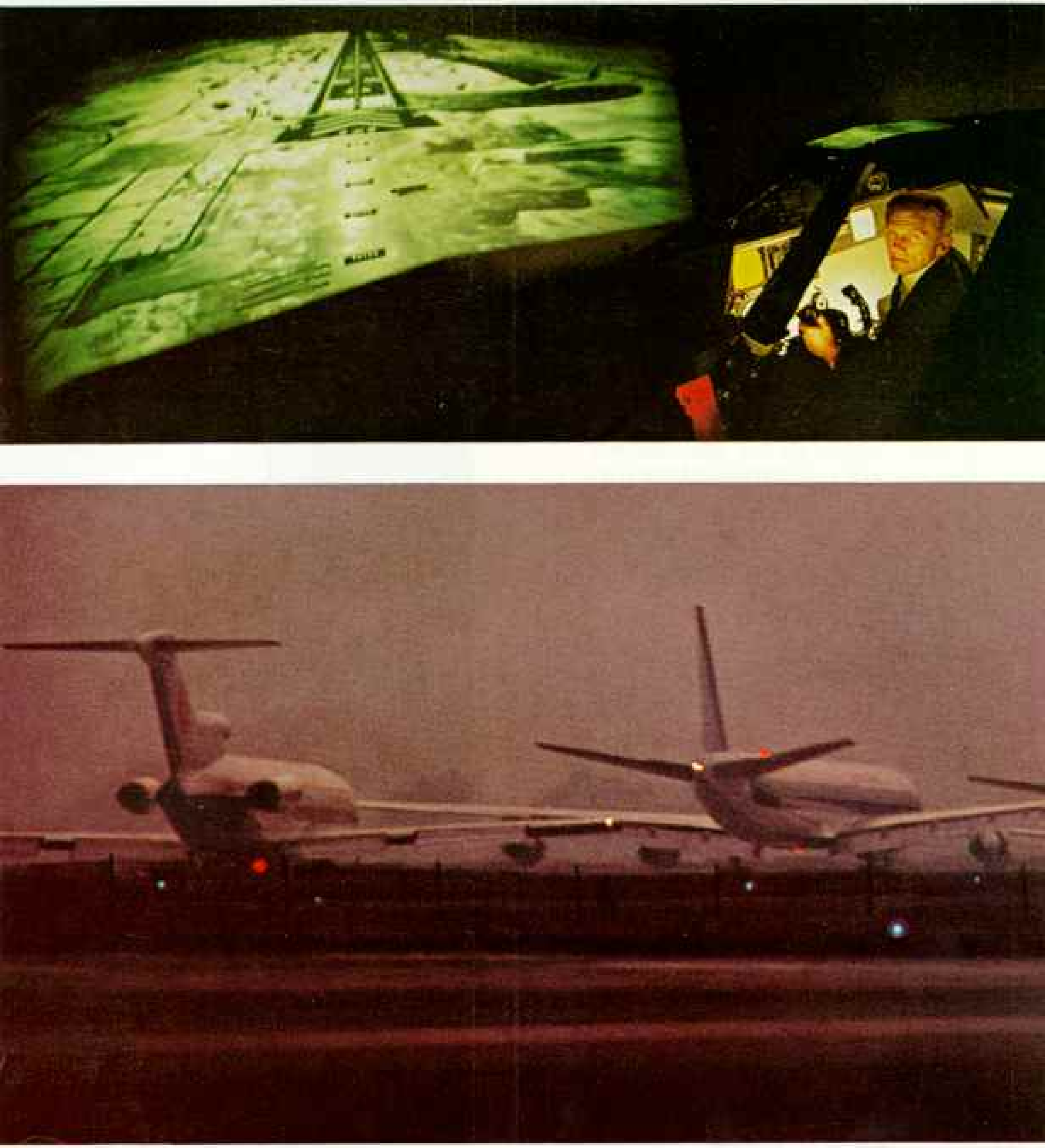
AMERICANS EXPEND more energy and wealth on transportation than in any other field. In the evolution of today's dizzying whirl, an army of innovators explores ways to flick travel lights from red to green—a boon to the struggling rush-hour commuter as well as to the cross-country traveler. Here is a sampling of the many who work to expand man's mobility by giving him greater speed and range, or by simply untangling the traffic jams besetting him as he goes where he is going.

Tube-train designer Joseph V. Foa of Rensselaer Polytech heads a team developing a torpedo-shaped, 350-mile-an-hour carrier.

SIKORSKY AIRCRAFT

Father of the helicopter, Russian-born Igor I. Sikorsky arrived almost penniless in the United States in 1919 and built an aircraft empire.

Air-cushion train creator Jean Bertin of France has built a working prototype capable of speeds up to 240 mph (page 329).



of the authorities I interviewed favor the latter approach.

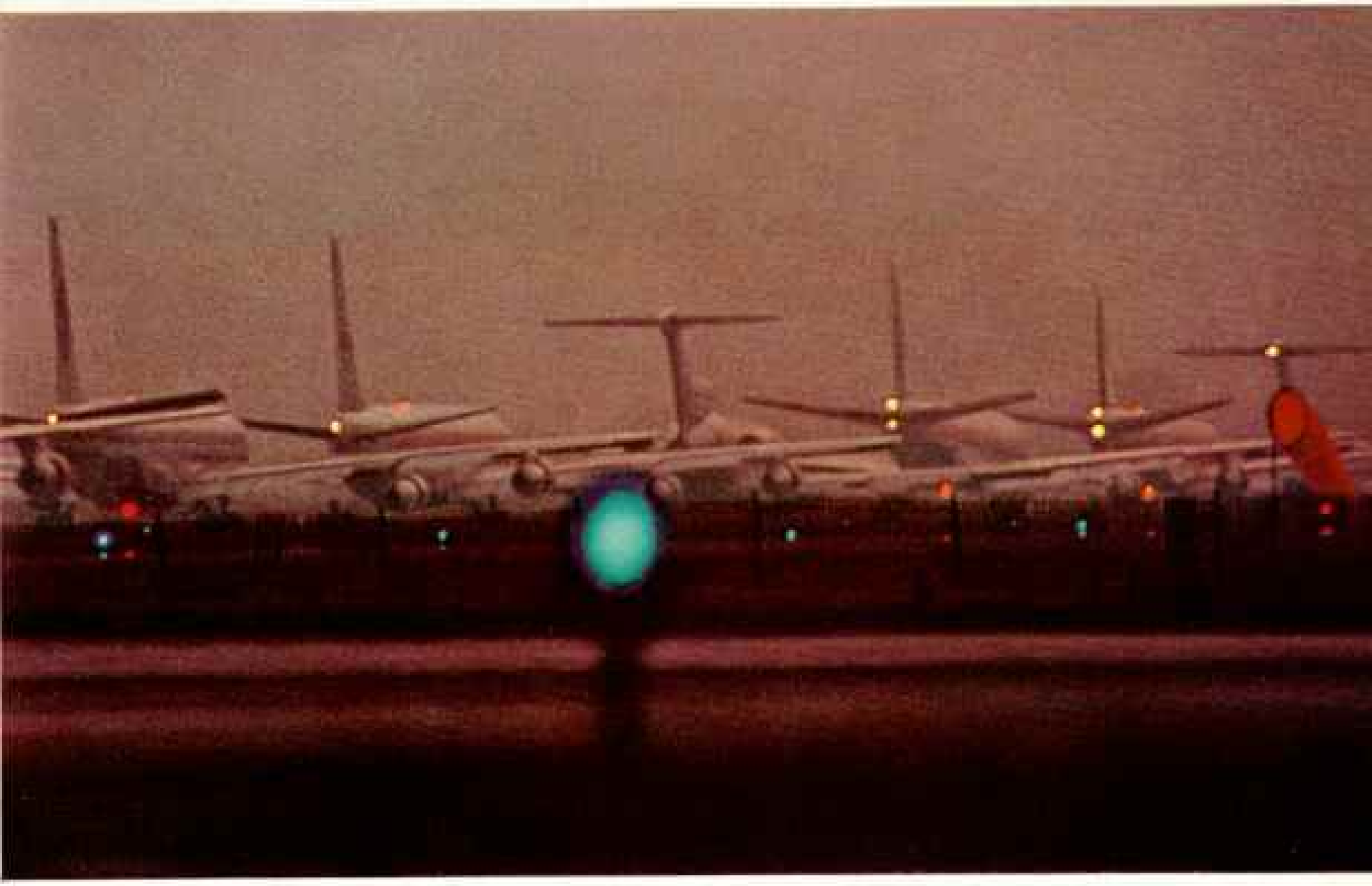
"The idea," explained architect and city planner William Pereira of Los Angeles (preceding page), "is to shorten the desire lines of the people. In other words, to provide for almost all their needs in a more concentrated area, so that they have less reason to travel outside their own community."

Mr. Pereira and other transportation planners contend that most of our cities are too large to manage—and that it is from their size that traffic congestion, air pollution, high crime rates, and other social ills flow. They are enthusiastic about Stockholm's "walking plaza" concept. They advocate urban dispersal—breaking our big cities into smaller, workable units able to satisfy within their

Roosting room only: In a scene familiar across the Nation, jets wait like grounded birds for runways at New York's John F. Kennedy International Airport (below).

Pressures often grow intense inside Kennedy's Common Instrument Flight Rules Room (right), where controllers shepherd 3,200 flights a day into and out of the world's busiest terminal area. Beyond radar consoles, a wall screen displays traffic at New Jersey's Newark Airport, left, and another gives a combined view of Kennedy and La Guardia. Blips represent planes; irregular lighted lines trace holding patterns for stacked craft.

Looking to the SST era, a supersonic flight simulator trains pilots at Boeing's Space Center near Seattle (opposite). A specialist mans controls as a mock runway rushes toward him on a TV screen.



borders most of the residents' daily wants.*

"Basically," Mr. Pereira said, "people need access to stores, to schools, to doctors, dentists, and hospitals, and to their places of work. Suburban shopping centers are filling some of the needs. Now other facilities—medical-arts buildings, theaters, hotels—are being added."

Today, we see that new-town concept coming into existence in the United States. I saw it near Washington, D. C.—at Reston, Virginia, and at Columbia, Maryland. Many such towns already have gone up in Europe.

One human need poses a problem for almost all new towns: employment. People

*For an experiment with this concept, see "Atlanta, Pacesetter City of the South," by William S. Ellis, NATIONAL GEOGRAPHIC, February 1969, page 250.

must travel to their place of work—which is not necessarily near where they live.

Dr. John Pierce, Executive Director of Research at Bell Laboratories, Murray Hill, New Jersey, offered one long-range solution. "I believe many workers of the future won't commute to work. They will *communicate* to work. Their homes will be connected to their offices via electronic communications. It's entirely within the realm of existing technology."

For the present, though, cities are still faced with the problem of moving large numbers of people. Mass transit is an almost universal problem in our cities.

"There is a social stigma attached to riding mass transit," commented Mr. Bledsoe of the Highway Research Board. "And people also would rather drive their cars because of the convenience and flexibility."

The bus service of the future, he thinks, will offer more seating room, better lighting, more ventilation, and more personalized service. Recent demonstration studies, financed by the Federal Government, point the way.

In Peoria, Illinois, a bus line made local stops in a neighborhood, picking up passengers practically at their doors and carrying them directly to their places of work. The commuters paid a monthly rate for the service, which included such luxuries as reserved seats, coffee and doughnuts, and the morning paper to read on the way.

Modern Aladdin's Lamp Calls Up Bus

In Washington, D. C., special mini-buses, each carrying as many as 30 people, move through the streets of the downtown business district. For a dime fare, passengers board and depart anywhere along the route.

The more personalized commuter service, say planners, may include mini-buses picking up people at the door. One proposal calls for

AUTOCHROMES © NATIONAL GEOGRAPHIC SOCIETY

As if poised for flight, the Dulles International Airport terminal gleams beside a 187-foot control tower 26 miles from the Nation's Capital. A departing jet trails a streak of light (opposite), and a mobile lounge with ramps out-thrust hustles passengers from the terminal to a waiting plane. Dulles's buslike lounges, now being adopted by other airports, eliminate passenger walking and exposure to weather, and relieve congestion caused by planes taxiing to terminal buildings to load and unload. Though sleek and spacious, Dulles finds it difficult to pry traffic from Washington's swarming National Airport, which lies 22 road miles closer to the heart of the Capital.

special metal plates, connected to a central computer, installed on utility poles throughout a neighborhood. When someone rubs a metal plate, it signals the computer, which orders the nearest mini-bus to pick him up.

Still, people probably will continue to cling to their cars. The automobile, with all its commuting faults, does offer privacy, comfort, and flexibility of routes.

"There will be a continuing demand to drive to work," Professor Cherington told me, "even if attractive, low-cost mass-transit systems are offered. People are paying a great deal now for the privilege of driving to work. They will pay a lot more in the future."

Professor Cherington predicts a time, not far off, when driving in the city cores will be discouraged by restrictive laws. All incoming automobiles will be charged very high tolls, he believes; drivers without reserved parking places will pay even more. Eventually, authorities may even prohibit all parking on the streets—a step which, in the average American city, will triple the vehicle-moving capacity.

Awesomely complex—and bogged down in its own complexity—our transportation system has outgrown patchwork repairs. In 1967 a new Federal Department of Transportation was created to bring order out of chaos, and Alan S. Boyd became the first Secretary of Transportation.

Forecasts Mingle Hope and Caution

Secretary Boyd and I discussed vehicles of the future last year, and he sounded a warning note. "Don't forget that future innovations in transportation will have to be superimposed on a system which already exists—a system which is being expanded and being built to last for a long, long time."

Early this year, President Nixon's new

Debut of a jumbo: Amid milling spectators at Everett, Washington, the Boeing Company rolls out its first assembly-line model of the world's largest commercial airliner. Slated for service by the end of the year, the 231-foot-long 747 promises greater comfort and may eventually bring lower fares.

Slightly speedier than today's 600-mile-an-hour jets, the new giant could seat 490, although most purchasers plan to carry only about 350, using remaining space variously for staterooms, conference rooms, and movie theaters. In this cutaway, double aisles, patrolled by stewardesses in red, separate passengers sitting nine abreast. Partitions divide the main deck, giving a feeling of coziness. Lower level holds baggage and galley.

Secretary of Transportation—John A. Volpe—foresaw a greater prospect of change.

"Of course, our immediate problem is to implement the transportation we have now and make it safer," Secretary Volpe said. "But I feel we'll need some entirely new systems within the next ten years.

"Airport problems are horrendous, even before the first jumbo jets and SST's go into service. Mass transit in metropolitan areas must be improved. Research is showing us that there are better ways to transport people on those short city trips than the methods we're now using.

"In the congested 'Northeast Corridor,' between Washington and Boston, we need high-speed rail transportation: trains that can achieve speeds of 150 to 200 miles an hour."

He paused thoughtfully, then summed up the problems. "What we need most is a coordinated policy—a balanced transportation plan that can bring this Nation efficient, economical, safe ways of traveling."

"Tube Train" Might Outspeed Sound

The Department of Transportation is financing research and development of vehicles just as fantastic as people capsules. One of them is a "tube train," suspended and propelled by compressed air. Someday it may carry passengers along the Northeast Corridor at speeds of 350 miles an hour. On coast-to-coast runs, it conceivably could become supersonic!

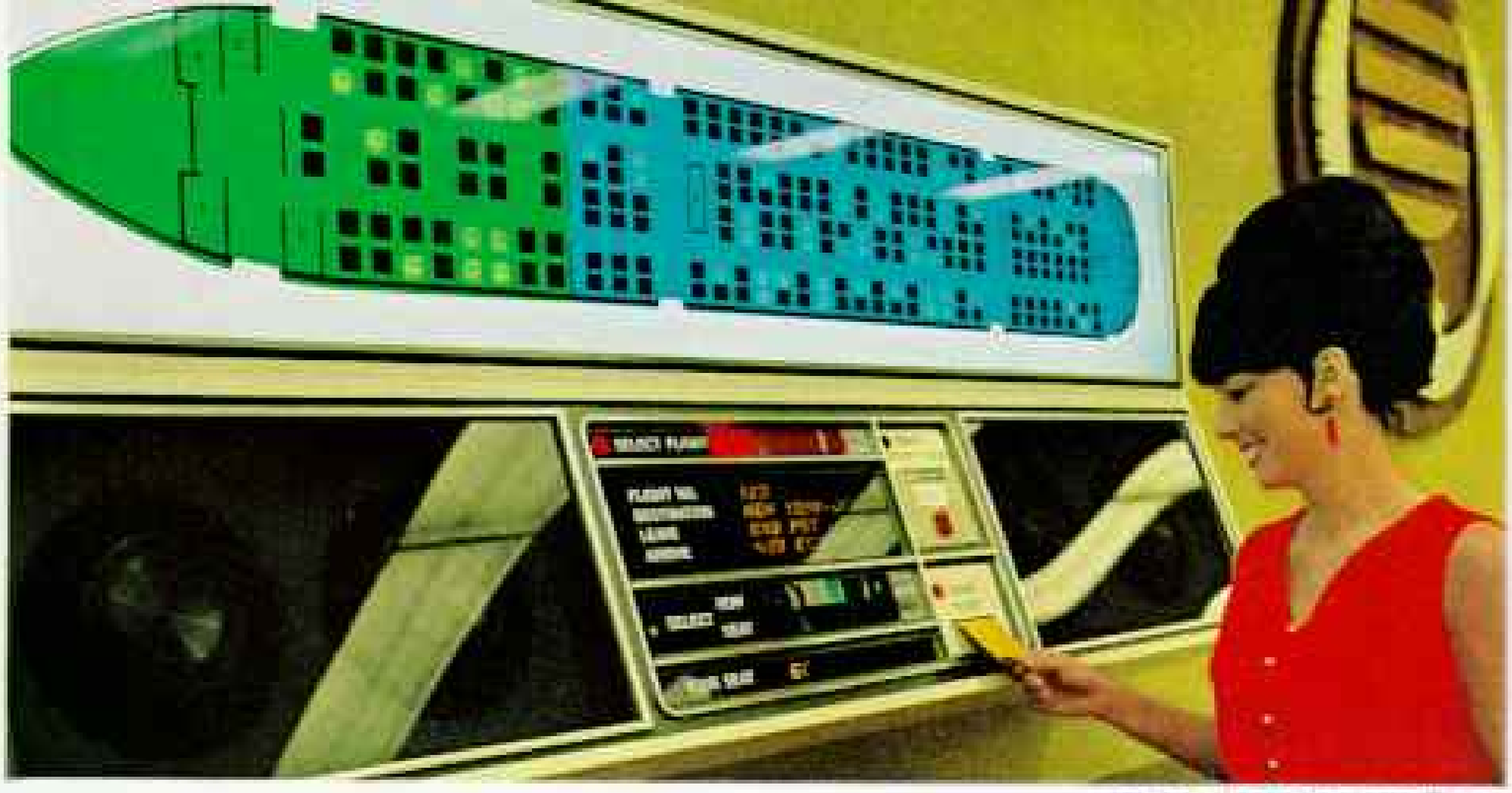
This incredible idea lost its science-fiction aura for me when I visited Rensselaer Polytechnic Institute in Troy, New York. Dr. Joseph V. Foa, Professor of Aeronautics and Astronautics—hardly a "mad scientist" type—led me down into the wind-tunnel room to examine a model of a strange new train that

BOE

Douglas Chaffee

DETAIL FROM THE BOEING COMPANY PAINTING BY DOUGLAS K. CHAFFEE © M.C.M.

BOEING 747



Automated ticketing... Punch the button for the flight you desire, and a seating diagram of the airplane lights up, top, on this model of Lockheed Aircraft's computerized reservation machine. Black squares indicate spaces already reserved. Here, pushing the button representing her choice—seat 6-C—a passenger inserts a credit card, and out pops a ticket. Similar devices will speed traffic in San Francisco's Bay Area Rapid Transit system when it opens in 1972, and soon could become common in ticket offices and major airports across the continent.

he and his team of researchers are designing (page 315).

He gave me a quiet smile when I asked about the supersonic aspect. "We think it has supersonic capabilities," he said, "but that's further into the future. At this point we'll settle for a few hundred miles an hour."

As we stared at the model—a 12-foot-long aluminum torpedo designed to travel in the institute's 2,000-foot testing tube—Dr. Foa described the full-size train of his dreams. It would race through its 18-foot-diameter metal tube at 350 miles an hour, with huge propellers pumping the air from the front to the rear of the train.

Passengers Would Ride a Whirlwind

The air-cushion suspension would maintain a large clearance between the train and the tube walls. Thus a relatively inexpensive rough-surfaced tube could be used.

Because of the soft air-cushion suspension, however, metal propeller blades would create clearance problems in the tube, so Dr. Foa is working on a special propeller—with blades of compressed air!

"The 'blades' of this propeller will maintain contact with the tube walls and still operate efficiently," he explained.

Mentally I could see this train of the future speeding along, banking within its tube like a bobsled on turns. But my imagination failed when I tried to picture a transportation executive daring enough to offer to pay for a tube-train system.

I mentioned that to Dr. Foa, and my remark earned me another grin plus some interesting facts.

"Train speeds upward of 150 miles an hour aren't practicable on existing track systems," he said. "Any high-speed line would have to be built from scratch—the Japanese did it when they put in their 130-mile-an-hour rail line from Tokyo to Osaka [pages 308-11].

"So if you are going to start from the ground up, a tube system has many advantages. A tube train passing through a city creates little noise. The tube can be suspended, buried, or even run through buildings. Inside the tube you have a controlled environment; maintenance costs would be low, and you're protected from weather and vandalism."

He paused a moment. "Another thing: You have a natural braking system in the tube. When the propulsion unit is shut off, the air ahead of the train compresses and brings the vehicle to a smooth stop."

I asked Dr. Foa about power. What would spin that air propeller?

"Gas turbines would be the first step," he said, "but there are other possibilities for the future. Nuclear power, for example. Another interesting prospect suggested by my colleague Professor Dean N. Arden is the use of the tube as a wave guide for the transmission of energy to a receiving antenna on the train to power electric motors."

Though wheels may seem old-fashioned by contrast to air-cushion suspension, three pioneering high-speed trains are already rolling on this continent. The U. S. Department of Transportation has helped finance two of them—an 85-mile-an-hour experimental unit linking Boston and New York, and a 120-mile-an-hour train between New York and

. . . and baggage routing: Sinuous trails of lights attached to luggage reveal its movements in an automated baggage system developed by the Docutel Corporation of Dallas, Texas. A traveler's bags trundle in from the plane on their own robot electric car; in this time exposure red and blue lights trace the paths of two cars. A computer reads and stores the ticket identification, then shunts the car into a circular holding area, lighted amber. To retrieve the bags, the owner inserts a baggage claim check into an electronic reader. A computer locates the right car and directs it to the waiting passenger—here to a lady traveler—along a path marked in green.

V/STOL—straight up and away

DUCTED PROPELLERS *pull the Bell Aerosystems X-22A onto a runway near Niagara Falls, New York (below). The props pivot upward and with a roar yank the 15,000-pound plane aloft (opposite). A hundred yards up, they point ahead again, and the experimental V/STOL—for vertical or short take-off and landing—leaps forward (above).*

BOUNDING UPWARD *from a postage-stamp pad and traveling twice as fast as a helicopter, the X-22A could link downtown metro-ports with jet-age airports, located ever farther into the country as they expand in size and noise. A similar role awaits STOL's, planes built for short take-off and landing.*

Propeller hoods, or ducts, on the X-22A increase efficiency by containing air at the prop tips; they also are circular airfoils that give lift like wings.

Washington, which promises to be a commercial success. And in Canada, the 90-mile-an-hour Rapido links Toronto and Montreal.

Though these speeds do not equal those attained in Japan, all three North American trains run on existing track systems. Three types of propulsion are being used: electric motors fed by a trolley on the New York-Washington line, a variation of the aircraft jet engine for the Boston run (opposite), and the time-tested diesel in Canada.

Traffic Jams in the Sky Fan Frustration

As many a harried airport employee can tell you, city streets have no monopoly on traffic jams. Last month, for instance, I streaked across the sky in a 600-mile-an-hour jet airliner, only to end up sighing in frustration while the plane circled for 50 minutes, awaiting its turn to land.

Runways are being lengthened to handle the bigger jets. Still—and it's as true today as it was when flying began—only one plane at a time can land on a runway.

A proliferating family of aircraft called V/STOL (for vertical or short take-off and landing) may be part of the answer. Such planes can help alleviate aerial traffic jams by using separate, shorter runways or smaller airports nearer town.

Jack Brewer, of the National Aeronautics and Space Administration's Office of Advanced Research and Technology, defined the V/STOL aircraft for me as "one in which a significant increase in lift is attained during take-off and landing through the use of engine power. Conventional aircraft, of course, rely on their wings for lift. Essentially, their engines provide only forward propulsion."

At Edwards Air Force Base in California's Mojave Desert, I inspected a boxy-looking transport called the XC-142. Four engines turn huge propellers along the stubby wing. On take-off, the wing—engines and all—tilts skyward, enabling the XC-142 to lift vertically and hover. Then the wing tilts forward, and horizontal flight begins.

NASA officials believe that the tilt-wing offers great promise as a commercial passenger plane operating directly from downtown V/STOL ports.

Another type of V/STOL gets its lift from ducted (or hooded) propellers mounted on each side of the fuselage. The propellers, also called fans, can be pivoted to provide either vertical thrust or horizontal thrust, while the wing remains stationary (preceding pages).

Like the tilt-wing, ducted-propeller aircraft can hover as well as move horizontally or vertically. Near Niagara Falls, New York, I watched the Bell Aerosystems X-22A demonstrate these talents. Later, over coffee, red-haired Jim O'Malley, Bell's Aeronautical Systems Product Manager, explained the ducted propeller's advantages.

"These fans are quieter than other thrust devices," he said, "an important quality when you're operating in a downtown environment. The ducts make them still quieter. And they don't kick up as much wind on the runway."

There are other types of craft in the versatile V/STOL family. Some use one set of engines for lift and a different set for horizontal flight. Others, equipped with jets, deflect thrust downward for take-off and landing.

V/STOL planes are used more and more as air taxis between neighboring metropolitan airports. Some fields—La Guardia in New York and National in Washington, for example—have special runways for the craft.

Helicopters Leap the Atlantic

And of course there is the helicopter, the original vertically talented aircraft. Today it serves as a fast downtown-to-airport link in such cities as New York and Los Angeles.

"In the intra-city range," Jack Brewer of NASA told me, "we're convinced that it will be impossible to beat the helicopter."

Acknowledged "father of the helicopter" is Igor Sikorsky (page 315). He began his experiments around 1910 and finally achieved the first practical helicopter in 1939.*

I stood next to him at the 1967 Paris Air Show, to watch two Sikorsky helicopters land. They had just completed the first nonstop helicopter flight across the Atlantic, refueling from aerial tankers nine times en route.

As the two craft settled on the runway, I couldn't keep my eyes off Mr. Sikorsky, more than 50 years an aviation pioneer. His only comment as he watched his helicopters set another world record: "The Air Force crews did a wonderful job, didn't they?"

Talk to Igor Sikorsky, a man past 80, and you get the impression that here is a young man with his eye very much on the future.

Years ago—in the late 1950's—I had chatted with him in his office in Stratford, Connecticut, about future applications of

*See "The Incredible Helicopter," by Peter T. White, NATIONAL GEOGRAPHIC, April 1959.

With a pull and a push from its gas-turbine engines, one at each end, a TurboTrain breezes toward Providence, Rhode Island, on Penn Central's 230-mile run between New York and Boston. Passengers, here lounging in the rear dome (right), enjoy jetliner decor and panoramic views. Tested at 170 miles an hour, the train loafs at half that speed on tracks built for an earlier era. The Department of Transportation helps finance the experimental TurboTrain and the commercially promising high-speed electric Metroliner linking New York and Washington, D. C.

Its road both land and water, the air-cushion vehicle SK-5 skims across the island-strewn Niagara River near Buffalo, the home town of its manufacturer, Bell Aerosystems. Six sister ships patrol the riverine coast of Viet Nam for the U.S. Army and Navy. During a federally sponsored, year-long experiment in

helicopters. He began with already established uses: air-sea rescue, fire fighting, and military tasks. But then he moved on to ideas that, to me, seemed preposterous.

Buses and Houses That Fly

One of his ideas concerned a kind of bus with detachable wheels. It would travel around downtown, picking up air passengers, and drive to the heliport. There a giant helicopter would lift the bus body off its wheels, carry it to another airport, and lower it gently onto another set of wheels, enabling it to drive off to distribute the passengers.

Preposterous? The Budd Company of Philadelphia has already built the vehicle—a "Sky Lounge"—designed to be lifted by Sikorsky's S-64 Skycrane (pages 307 and 330).

During that conversation a decade or so ago, Igor's ideas grew even wilder. "In the future, I think people will not construct houses on lots," he said. "Houses will be manufactured in factories, with furnishings, appliances, carpeting, and whatever else you want put in. Then a helicopter simply brings the house to your lot."

Unlikely? Recently a new 300-seat restaurant was transported in five parts, via helicopter, to a New Jersey mountaintop.

Because a helicopter's control system differs radically from that of a conventional plane, "whirlybird" flying has always been a spe-

California's Bay Area, the 15-passenger SK-5 proved its mettle as a swift congestion-skirting ferry connecting downtown San Francisco, the city airport, and Oakland's International Airport.

Snug on its single rail, an Aerotrain, creation of French inventor Jean Bertin (page 315), whirs on a test track near Paris. Blowers lift it 5/8-inch off the concrete track; a propeller pulls it.

cialized art. But aircraft companies are experimenting with a new, easier-to-fly version, the rigid-rotor helicopter.

NATIONAL GEOGRAPHIC staff photographer Dean Conger, whose photographs illustrate this article, climbed aboard one of these copters last summer. A few minutes later, he was startled to find himself flying it.

Pilot to Passenger: "Here, You Take It"

Dean, a licensed pilot of conventional planes, told me about the flight. "We had climbed only a few feet up over the runway when the test pilot casually said, 'Here, you take it.' And I flew the thing as if it were a Piper Cub! Stick and pedals reacted the way they would in a standard plane—even though they were hooked up to whirling blades instead of hinged control surfaces."

V/STOL aircraft and helicopters probably will be able to ease the aerial traffic jams—and leap over the surface traffic that creeps between most city airports and downtown hotels. But what will solve the jam that will occur inside the terminals when jumbo jets begin their scheduled flights?

Baggage is the major problem. Its short ride from the airplane can seem the longest trip of all to an impatient passenger.

One solution may lie in an automated system developed by the Docutel Corporation. Airlines are considering it for installation

Mile-long conveyor belt on wheels, a "unit train" of the Atchison, Topeka, and Santa Fe line rumbles across northern New Mexico. It shuttles 8,400 tons of coal every four days from New Mexico's York Canyon mines to mills of Kaiser Steel in Fontana, California—a round trip of 2,200 miles. Though unit trains travel empty half the time, efficient loading and unloading and constant operation cut costs so dramatically that railroads increasingly turn to such "trains with a one-track mind."

Grasshopper on the jump, a Sikorsky Skycrane hauls 16,600 pounds of parts for an oil rig off Louisiana. Capable of carrying 10-ton loads at 132 miles an hour, versatile Skycranes find an expanding role in transporting heavy cargo to inaccessible places; a construction firm employed one to lift and position sections of a prefab restaurant atop a mountain in New Jersey's Great Gorge Ski Area. Other Skycranes shuttle supplies to the rich Prudhoe Bay oil field on Alaska's Arctic coast.

Flying freighter, Lockheed's L-500 will hold 64 standard automobiles when it begins service in 1972. The 246-foot-long behemoth, represented here by a model, is the civilian version of the Air Force C-5A, world's largest aircraft and a source of Federal concern because of production costs. Cutaway sides of the model reveal cavernous holds for the autos or an alternative cargo of packaged freight.

in a few major gateway airports, such as Kennedy at New York.

In the Docutel system, baggage moves quickly from the plane to small wheeled carts, called Telecars, which travel to receiving stations in various parts of the airport, rather than to a crowded central baggage counter (pages 322-3). A deplaning passenger simply goes to the most convenient receiving station—perhaps one in the parking lot. He inserts his coded baggage check into a slot there, and a central computer sends his baggage car to the proper location.

No longer will embittered passengers remark, "Breakfast in Paris . . . lunch in New York . . . baggage in Beirut."

Those baggage cars, incidentally, are powered by an ingenious new device called a linear induction electric motor. In this beautifully simple concept, the baggage car itself is the only moving part. Conventional electric motors contain an armature that spins in a coil—but here the baggage car will travel on a track that is, in effect, a flattened coil. Result: The car becomes the "armature" and the track becomes the "coil."

Most transportation scientists expect the linear induction motor—and a close relative called the linear synchronous motor—to play a very significant role in urban areas. Virtues include extreme simplicity, quietness, the ease with which computers can be hooked into such systems, and the fact that no air pollution results. That people capsule that may whisk you through tunnels under the city could, like the baggage car, be powered by a linear induction motor.

Planes May Carry 1,000 Passengers

While automated baggage remains speculative, the jumbo jetliners are almost here. Three United States firms now busily compete for the market: McDonnell Douglas with its 250-passenger DC-10, Lockheed with its 300-seat L-1011 Tristar (page 339), and Boeing with the largest of them all—the 490-passenger 747, which may be flying passengers by the end of this year. Actually, most purchasers of the 747 plan to install only about 350 seats and use the space remaining for conference rooms or staterooms (pages 320-21).

Initially, jumbo-jet fares will probably be comparable to today's rates. Later, after the mammoth capital investment has been partly repaid, fares may drop to considerably below the present level.

The Boeing 747, large as it is, does not represent the upper limit in aircraft size. Lockheed is building the giant C-5A for the U.S. Air Force. Though its cost has stirred controversy, its ability to lift huge payloads has not. In fact, its performance has revised thinking that planes were approaching the ultimate in size. Experts now foresee the day of the megaplane—titans of more than a million pounds that will transport thousands of people on a single flight.

Within a decade airline passengers will flash across the sky at almost three times the speed of sound—and it is fervently to be hoped that they won't find an aerial traffic jam at journey's end. Boeing hopes to have its 1,800- to 2,000-mile-an-hour supersonic transport in service by the mid-1970's. Europe's Concorde, joint venture of French and British firms, should be making supersonic passenger flights by late 1972. The Soviet Union reported that 18 orders already have been placed for its supersonic TU-144, which may be in service ahead of the Concorde. Both planes have begun their test flights (pages 304-5).

Scientists Battle the Sonic Boom

Boeing's chief test pilot for the SST is Jim Gannett. As we sat in his instrument-studded office one day, I asked him what it feels like to fly at 1,800 miles an hour.

He grinned: "It's just another number on the airspeed indicator. Passengers will find the flight a lot smoother and quieter than on today's jetliners. The sky will appear darker, because we'll fly at about 60,000 feet—twice as high as today's jets."

Later, in the London offices of the British Aircraft Corporation, co-builder of the Concorde, I learned of another effect the shortened flight times will have.

Sir George Edwards, Managing Director of BAC, chatted with me in the wood-paneled board room, not far from St. James's Palace.

"When two places become less than half a day's travel time apart," he said, "traffic and trade between them increases dramatically. Twelve hours seems to be a magic number, somehow. The SST will suddenly produce many of those city pairs and have a profound effect on emerging nations."

Almost any airport on earth, he pointed out, will be half a day's journey or less away.

"Today, jetliners from London to Sydney, Australia, take 27 hours," Sir George said. "A Concorde will make the trip in 12."

The supersonics, however, are not without their critics. Much of the criticism centers around the sonic boom—a cone-shaped wave of air pressure that trails behind the aircraft during supersonic flight. It can cause annoyance to people and structural damage to buildings within its range. Engineers are working on designs and devices to reduce the boom's effect, but no one knows yet whether they will be successful.

If the problem remains insoluble, supersonic flight may be permitted only over water. Airlines point out that, except in Russia and mainland China, 70 percent of today's air routes are over water, and another 20 percent probably could be rerouted, so the matter is not as serious as it would at first seem.

Thus the SST, sonic boom or not, will make an important contribution to future travel, in the opinion of most experts. Former Secretary of Transportation Boyd made this prediction: "I think the SST will become the major long-haul unit of personal transportation—I would guess by the late 1980's."

Cargo concealing her decks, the *American Legion* passes Verrazano Narrows Bridge on her way to Port Elizabeth, New Jersey, which leads the world in the handling of containerized cargo. The prepacking of goods in standard containers has slashed handling costs 50 percent, revolutionizing ocean shipping.

In a continuous flow, containers from the United States swing onto trucks in Bremen, West Germany. Each crate serves as a warehouse and strongbox, preventing pilferage that otherwise devours 10 percent of such cargoes as radios and liquors.

EDACHROME © N.G.S.

None of this, of course, means that the experts are giving short shrift to other modes of transportation for the future. Last summer at the little French village of Gometz-la-Ville, 13 miles outside Paris, I boarded a sleek aluminum vehicle. Its engine roared into life, and a propeller suddenly blurred into a shining disk. Then, smoothly, we were airborne—at an altitude of 5/8 of an inch!

This experimental Aerotrain, one of three being developed by the French research firm Société Bertin et Cie., has already reached 244-mile-an-hour speeds on its 4½-mile test track (page 329).

Can this be the train of the future? Many experts think so. Built to run without wheels, it straddles a single concrete rail. Straddles it, but does not touch it, for engine-driven fans within the train ram cushions of compressed air onto the top and sides of the rail to create a virtually friction-free surface on which the train glides. An aircraft engine and propeller at the rear furnish propulsion that sends the train racing along its course.

The Aerotrain is actually just an upside-down monorail—but with one important difference. The monorail, hanging from its overhead track, presents such knotty switching problems that the few now in use are on closed-loop tracks. Switching Aerotrains from track to track will be simplicity itself. The train will glide onto a section of retractable rail. When the rail is lowered, the train—still creating a cushion of air beneath it—can move in any direction, even sideways!

Another air-cushion train, this one still in the scale-model stage, was operating in Southampton, England, when I visited the research center of Tracked Hovercraft Limited. Its propulsion unit was a linear induction motor—the same principle used in that airport baggage system. Trains that ride on air can operate efficiently with engines of relatively low horsepower. And their simple concrete track systems, or guideways, can be built and maintained economically.

Other vehicles—for example, the SR.N4 Hovercraft that carried me across the English Channel—glide on air over land and water. But even these versatile air-cushion vehicles have their limitations. They cannot climb steep slopes. Cross winds make precision maneuvering difficult. Tracked air-bearing vehicles are probably more suitable for heavily populated areas, officials of the British Hovercraft Corporation told me.

Stroll on Deck Like Wing-walking

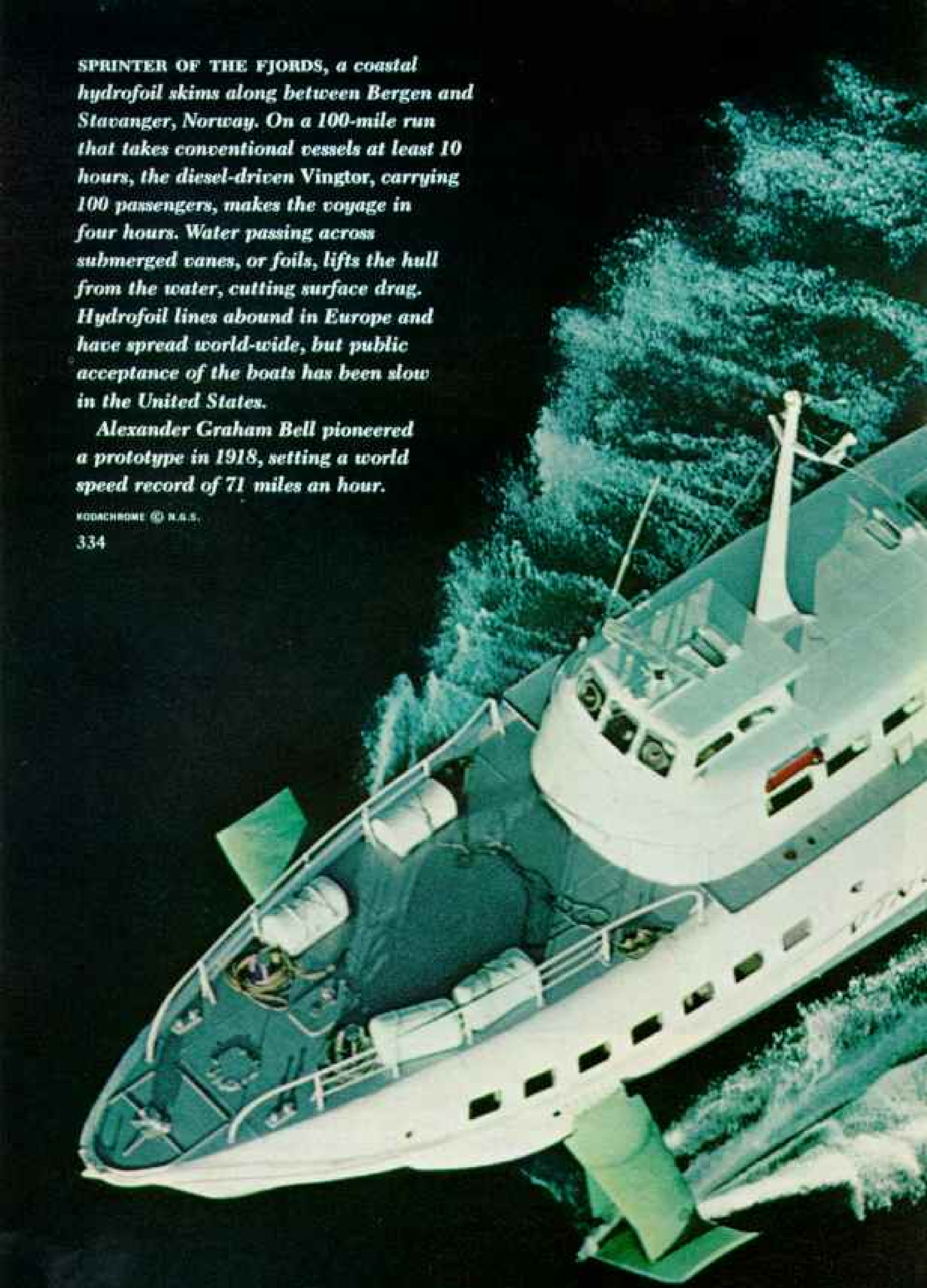
While air-bearing vehicles are relative newcomers, hydrofoils are not. The first hydrofoil boat was built more than 60 years ago, and by 1918 Alexander Graham Bell had designed a 60-foot model that attained 71 miles an hour. Today hydrofoil vessels serve as high-speed passenger ferries on lakes and rivers in many parts of the world.*

Dean Conger, my photographer friend, has ridden many a hydrofoil on NATIONAL

*See "Hydrofoil Ferry 'Flies' the Strait of Messina," by Gilbert H. Grosvenor, GEOGRAPHIC, April 1957.

SPRINTER OF THE FJORDS, *a coastal hydrofoil skims along between Bergen and Stavanger, Norway. On a 100-mile run that takes conventional vessels at least 10 hours, the diesel-driven* **Vingtor,** *carrying 100 passengers, makes the voyage in four hours. Water passing across submerged vanes, or foils, lifts the hull from the water, cutting surface drag. Hydrofoil lines abound in Europe and have spread world-wide, but public acceptance of the boats has been slow in the United States.*

Alexander Graham Bell pioneered a prototype in 1918, setting a world speed record of 71 miles an hour.



GEOGRAPHIC assignments. One of his first voyages was on Lake Baykal, in Siberia.

"I sat in the cabin for a while," Dean told me, "trying to watch the scenery through a thick sheet of spray that was being kicked up by the foils. Then I decided to go on deck to get a better view. That was a mistake."

He chuckled at the memory. "When I opened the hatch and moved outside, a blast of air hit me and told me how fast we were really moving. It was like—well, like trying to take a stroll on the wing of an airliner!"

I talked with Dr. Jean C. Meier, Director of the Compagnie Générale de Navigation de Lac Leman, which operates a hydrofoil ferry on Lake Geneva. "Hydrofoils make sense on any route that takes two hours or longer by conventional ships," he said. "The ride is sometimes bumpy, but a hydrofoil doesn't roll like a ship."

Hydrofoils—planes attached by struts to a basically conventional hull—generate lift in much the same way that an airplane's wings do. As the boat gains speed, the hydrofoils lift the hull completely out of the water, eliminating much drag (preceding pages). That is why the hydrofoil on Lake Geneva can make the trip from Lausanne to Geneva in less than half the time taken by conventional ferries.

"Hydrofoils are generally restricted to sheltered waters," Dr. Meier told me. "Rivers, lakes, and estuaries. And the water must be reasonably free of debris."

He pointed out that the foils, skimming the surface, are subject to severe damage if they strike logs or other objects.

New Warship Gives Memorable Salute

Not long ago on Puget Sound, I boarded a new type of hydrofoil craft, the Navy's U.S.S. *High Point*. This ship utilizes submerged foils. Attached to the hull by long, thin struts, they remain entirely below the surface. Since they "fly" beneath the waves, the vessel rides more smoothly, and only the struts come into contact with floating debris. Lt. S. W. McGanka, captain of the *High Point*, told me that those delicate-looking struts had sliced logs in half.

By changing the settings of the submerged foils, he could vary the height of his ship above the surface. Very handy, he pointed out, in a rough sea.

On our test cruise, an oncoming Navy destroyer churned past us. Heeding naval etiquette, the sailors on the decks of both warships gave hand salutes. Lieutenant McGanka then added what I hope will ultimately become a tradition in the U. S. Navy—he solemnly dipped his ship!

This exciting new generation of vehicles—more versatile hydrofoils, air-cushion boats and trains, automated cars, V/STOL aircraft, jumbo jets, supersonic transports—can revolutionize our transportation system.

Will they?

As I look back, the statements heard during my travels seem to blend into one composite voice: *Yes, the transportation revolution is on its way. Society can no longer tolerate traffic as it is today . . . its high death toll . . . its contribution to air pollution . . . its noise . . . its frustrations.*

But over that enthusiastic clamor I hear the cautioning words of former Transportation Secretary Boyd: *"Don't*

For thirsty leviathans, a super filling station: Beyond a flaring oil derrick, huge tankers gulp Iranian oil at Khark Island, a deepwater loading terminal 25 miles offshore in the shallow Persian Gulf. With oil piped from the mainland, Khark can service a new generation of mammoth super-tankers (right).

Whale among minnows, the *Universe Ireland*—one of the world's biggest ships—dwarfs specklike fishing craft in Bantry Bay, Ireland. The Japanese-built behemoth rides high in the water after discharging 2½ million barrels of crude oil at the Gulf Oil Corporation's giant storage complex in Bantry. Every 60 days the *Ireland* and five sistertships make the 25,000-mile round trip to the oil-rich sheikdom of Kuwait, which like Iran has built loading facilities far out in the Persian Gulf to handle such deep-draft tankers.

Today both Europe and Japan plan vessels that will hold 4,000,000 barrels, and marine architects dream of vessels twice that size. But conservationists shudder at the threat of superwrecks and superfloods of seashore-polluting oil.

ACRYLIC PAINTING (ABOVE) BY TOM CONNER, ENTHUSIAST, VOLT INC. CORPORATION © M.C.C.

Answer to air pollution? Concerned with the auto's noxious exhalations, experts see cars of tomorrow powered by batteries like this General Motors experimental Opel. A low-pollutant combustion engine in the rear can charge the batteries as quickly as they are drained during low-speed city travel. Highway speeds, however, use electric power faster than it can be regenerated.

forget, innovations will have to be superimposed on a system which already exists . . . a system being built to last a long, long time."

Yet, among all the opinions that I heard during my interviews, certain points seem to crystallize into near certainty:

Electric cars should be common within a decade. They will be "pure" electrics, if batteries become lighter, more powerful, and longer lasting; otherwise, "dual-mode" vehicles—battery-powered in town but propelled by gasoline engines on cross-country trips.

Computer-controlled highways will almost surely become a reality, for when the human element is removed, vehicles can travel safely at faster speeds, closer together. In fact, most experts believe that each lane of automated highway could move the traffic of three or four of today's uncontrolled lanes.

There will be heated debates about which type of guideway to use, but remember this: A similar decision was faced, and resolved, before our universal system of color television went into operation.

Few people expect that entire cities will be torn down and rebuilt just to solve the transportation problem, but something like the "super-block" concept (painting, pages 340-41) may be superimposed on existing streets.

In theory, it works like this. Spread out a map of your city, and with a pencil mark it off into squares eight city blocks to a side. Those squares are super-blocks; your grid of pencil lines traces boulevards which serve the blocks along their perimeters.

Refine your plan, now, by barricading most streets within each super block to channel the traffic into logical, efficient routes—and you will be looking at your city as it may appear a decade or so from now.

Streets Take Up a Lot of Space

Planners expect each super block to evolve into a city within a city. New stores will cluster in a shopping center at the core, making it easy for residents to confine most of their shopping trips to brief rides on the bus. The desire lines have been shortened; trans-

Power everything! A single knob electrically steers, accelerates, shifts gears, and works the brakes in General Motors experimental Unicontrol Car. Second knob is for right-handers.

Individual climate control: As lamps simulate body heat, scientists study ways for passengers to control their own ventilation in a cabin mock-up of the Lockheed 1011. A ceiling blower drives air laden with powder so its movements can be seen. Hand-held anemometer detects drafts. The 300-seat Tristar will fly by 1971.

portation requirements have been reduced.

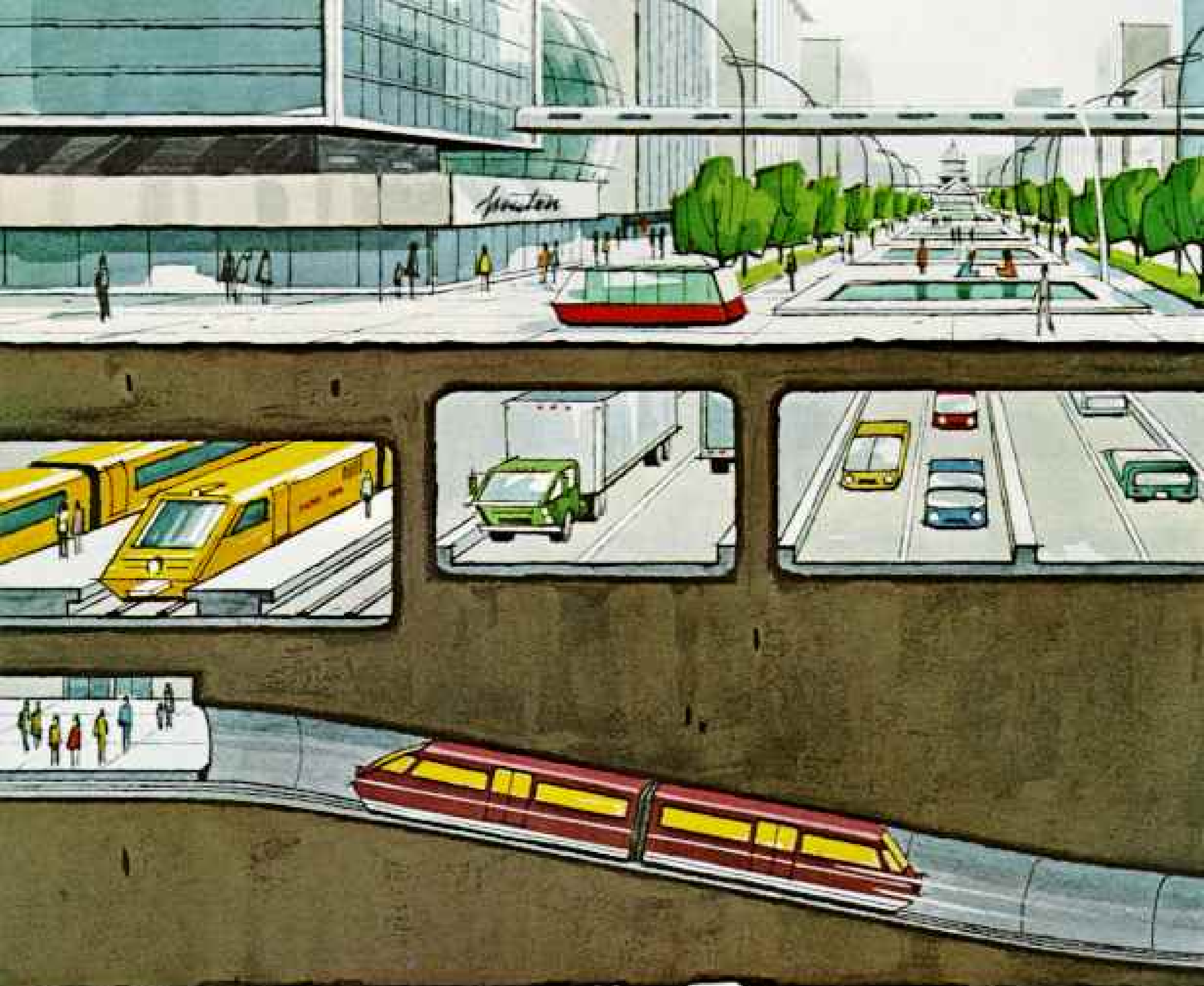
Look again at your city of super blocks. Streets still occupy precious land that might be used for other activities. Since subways have proved feasible, why not put virtually all roads underground? Planners in the 1980's may well be thinking along those lines.

And along these: If you dig tunnels under a city, why not tailor them for computer-controlled people capsules? Able to travel at high speed and at close intervals, they can move more passengers more rapidly than buses or subway trains could.

Ships and railroad trains will surely continue to carry the bulk of long-distance freight, but their share of passenger traffic may continue to dwindle.

Can railroads really compete with airlines? Opinions vary. Soon, though, increasing numbers of high-speed passenger trains will run along the Northeast Corridor; the degree of their success will give transportation men a clearer picture of the railroads' future.

Don't write off the passenger train yet. In this increasingly mobile society, the pressure will grow to improve any transportation



Underground arteries quicken the city's heartbeat in a downtown area a generation hence, as envisioned by urban planners and distilled by Richard J. Barber of the Department of Transportation and artist Pierre Mion. Free of the automobile, streets become "people places," disturbed only by mini-buses. Overhead, travelers use an elevated and covered moving sidewalk, upper right, and an express tube for "people capsules" three stories above the walking plazas.

Linking the surface with the noisy realm below, an escalator delivers pedestrians to a station where more capsules parade endlessly by. Passengers consult an electronic map for their destination code, far right, then as many as four enter a capsule, punch their code numbers on a keyboard, insert credit cards, and zip homeward.

Beneath the subterranean network of autos, trucks, trains, and subways, a pneumatic train utilizes the pull of a vacuum to scurry between stations at speeds of as much as 140 miles an hour. To leave the station, the train coasts downhill past airtight tunnel doors, and it slows for the next stop by running uphill again. Comfortable and economical, the swift pneumatic train already intrigues New York City officials.

PAINTING BY PIERRE MION © N.G.S.

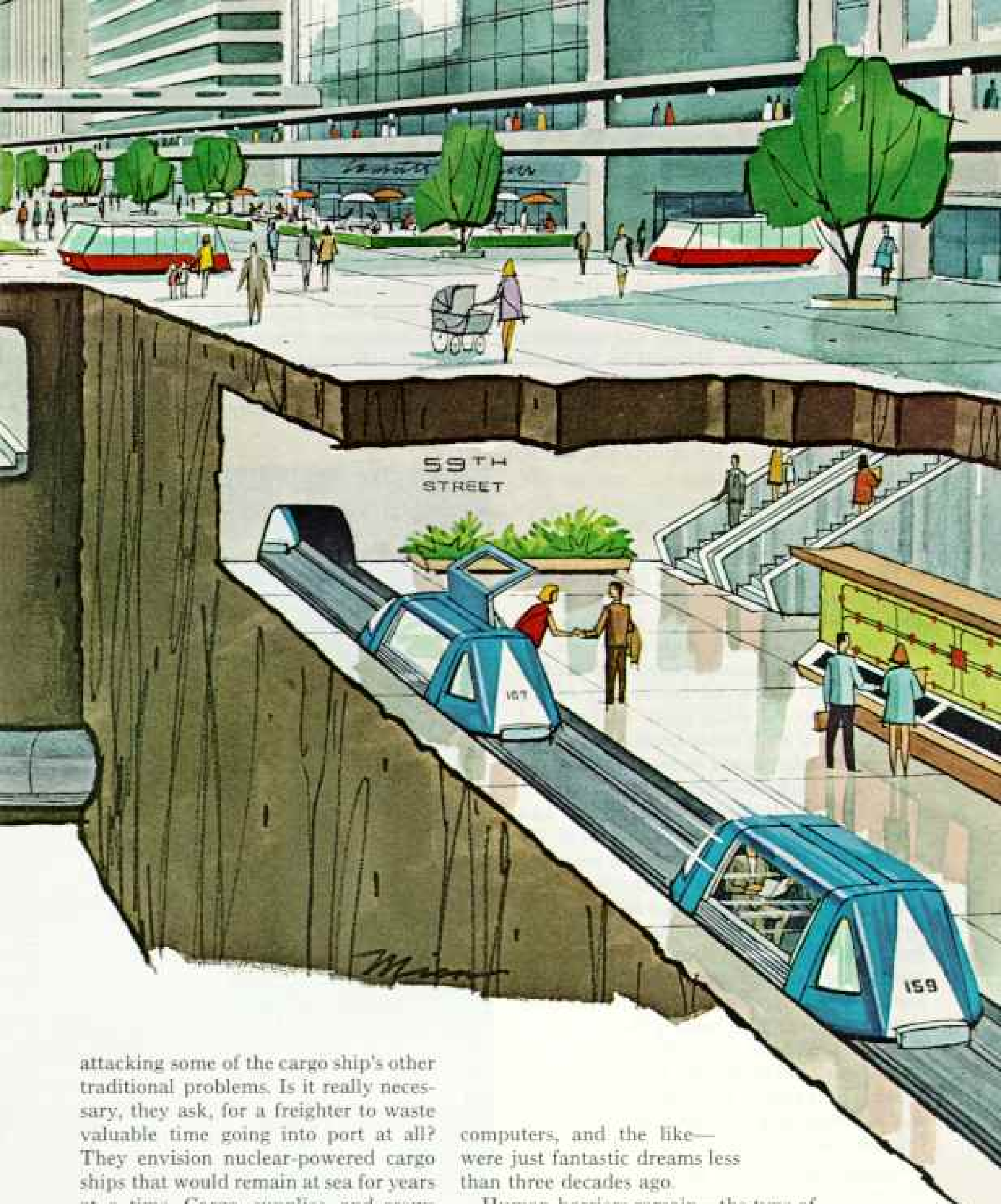
systems that can move large numbers of people safely and comfortably. You may ride at 130 miles an hour in a train resembling Japan's Tokyo-to-Osaka streamliner. Your children may even ride a compressed-air tube train.

Automated Ship Seems Lonely

On the sea, cargo ships will become even more highly automated. Already super-tankers more than a thousand feet long are sailing with crews of fewer than 30 men.

Dean Conger last year took his cameras aboard a huge freighter operated by a crew of only 14. "It was strange to see all that acreage and so few men on deck," he told me. "The crew was so small that the off-duty sailors always had trouble rounding up enough for a four-handed card game!"

Imaginative marine experts are now



attacking some of the cargo ship's other traditional problems. Is it really necessary, they ask, for a freighter to waste valuable time going into port at all? They envision nuclear-powered cargo ships that would remain at sea for years at a time. Cargo, supplies, and crews would be transferred by giant helicopters as ships sailed along the coast.

Yes—on land, in the air, and on the sea—the transportation revolution is ready to be launched.

The planning has been done. Most of the machines are in existence. If those other machines seem like fantastic dreams, consider how many of today's realities—supersonic planes, television, computers, and the like—were just fantastic dreams less than three decades ago.

Human barriers remain—the type of problems that the Secretary of Transportation encounters each day in his work. But even those problems can be solved, if the urge to solve them becomes great enough.

Will it become great enough? Ask yourself that question tomorrow—while you're creeping through city traffic at 10 miles an hour in your 100-mile-an-hour automobile. THE END

Florida's Manatees,

"WEDNESDAY the ninth of January . . . when the Admiral went to the River of Gold,* he said he saw three mermaids . . . they were not as beautiful as they are painted though they had something like the human face. He said he had seen some before off the coast of Guinea. . . ."

The year was 1493 and the admiral Christopher Columbus. Less than three months had gone by since he had first sighted the New World. What he saw was undoubtedly the manatee, found in African as well as New World waters and linked to this day with the mermaid of legend.

My own introduction to the American mermaid was not as glamorous, but equally impressive—to me, at least. As a biology student, I had chosen the Florida manatee as the subject for my doctoral dissertation. From a punt on the spring-fed headwaters of the Crystal River, 65 miles north of Tampa, I saw a pair of dark noses break the surface. The clear water would be ideal for this, my first chance to observe manatees from beneath the surface. I eased myself off the bow and swam toward them, reassuring myself all the while that, of course, manatees are harmless.

I passed over gardens of algae, over beds of wild celery, water milfoil, and spires formed by the rank growth of emerald waterweeds. Suddenly I was upon them, or rather, they were upon me, looming forth some twenty feet away, spectral gray leviathans, colossi, ridiculously imposing, looking like something that had eluded the fancy of Jules Verne.

One was heading directly for me. Scientific inquiry be hanged! I swallowed my pride, and rocketed back into the boat.

I was safe, a confessed coward. But how was I ever to conduct my research if I was afraid to study my subjects?

That was nearly two years ago. Since then I have spent many days snorkeling with the very animals that "chased" me out of the water that fall morning. I have named them Hobe and Paralee, and they are but two of a population of forty to fifty manatees that

*Probably the Rio Yaque del Norte, in the present-day Dominican Republic.

A manatee named Zachary takes the author on a guided tour of the sea cow's iridescent realm. With pencil and waterproof plastic chart for recording details, Mr. Hartman pursues his beneath-the-surface study of these gentle giants—members of a mammalian order called Sirenia because of a fancied resemblance to the mythical siren, or mermaid.

By DANIEL S. HARTMAN *Photographs by JAMES A. SUGAR*

Mermaids in Peril

return each fall to the warm waters at the source of the Crystal River.

I have now learned that, far from threatening me, ten-foot, thousand-pound Paralee approached me that morning out of cautious curiosity—and was undoubtedly more terrified by my eruption from the water than I had been by her approach. Manatees have the dispositions of contented cows—and are about as dangerous.

These large and gentle creatures are almost exclusively confined to the tropics (map, page 347). Florida is one of the few places where they have ventured into a temperate zone. Here the coastal water is sometimes too cold in winter, and they must find warmth where

they can—in spring waters welling from the warm earth or in the tepid discharge of factory cooling systems. When not resorting to springs for warmth, manatees typically inhabit turbid waters. This makes observation difficult, and the literature is full of irresponsible anecdotes based on surface glimpses.

The choice of Crystal River for my 18-month study came after a careful survey of Florida's coasts. I concluded that there was no better place to observe manatees below the surface than in the limpid "bay" at the river's headwaters. It provided a natural laboratory replete with such manatee amenities as a constant water temperature of 74° F. and abundant food. Thousands of normally marine fish shared the warmth of the freshwater springs (page 347).

There was one drawback: it was too crowded. The main spring, 60 feet deep and with underwater caves to boot, was a popular place for skin-divers, who amused themselves by poking, grabbing, riding, or chasing any manatee that happened across their path. Each day when the divers arrived, the manatees and I would depart for quieter reaches.

Southern Names for Gentle Beasts

An average winter morning would find me snorkeling for three or four hours among my animals. I spent afternoons tracking their movements in a runabout, identifying them, and checking social behavior by peering into the water through a glass-bottomed bucket.

Most individuals were recognizable by a combination of size, shape, and scars. Nearly all had been hit by propellers, and the scar patterns on their backs and tails were unmistakable (following page). Because of their love for warm climes, I gave some of them southern-sounding names: Flora Merry Lee, Pearly Mae, Gallatin, Creola, Lavaliere.

Their temperaments varied. Most were wary and would not allow close approach. A few were so tame that, when soliciting a back scratch, they would hamper my work by lolling directly in front of my mask.

Seemingly weightless in the emerald headwaters of Florida's Crystal River, the author snorkels among his manatee friends —to all of whom he has given names. Flirtatious Lavaliere, a favorite, nibbles at his leg. As many as fifty of the lumbering vegetarians journey here each fall, attracted by the steady 74° F. outflow of sparkling underwater springs. Winter over, they migrate elsewhere along Florida's warm-water fringes.

One young female, Lavaliere, was a notorious flirt. She was brazenly fond of "kissing" my mask and of chewing on my hands and diving suit. She once took the liberty of cuffing off my mask, albeit inadvertently, and of pulling me under with her flippers.

At play, manatees touch muzzle to muzzle in what can best be described as a kiss (pages 350-51). This behavior is one facet of a whole repertoire of nuzzles, nibbles, nudges, butts, and embraces. The performance as a whole becomes a serene ballet, a slow-motion ritual of lazy posturings and positionings, twistings and turnings. This intimate activity is not necessarily performed in a sexual context; calves participate with adults, as do subadults with other adolescents of the same sex.

This should not be interpreted, however, as meaning that manatees are normally gregarious. Though cold weather forces them to congregate temporarily in the sanctuary of warm water, the sole lasting association is that between a mother and her calf. Otherwise, manatees are most often found alone.

Groups, when they form, usually consist of but two or three individuals. These associations are unstable and ephemeral, lasting from a few minutes to a few hours. If you were to follow Hobe, say, on his daily rounds, you would soon appreciate that he owed allegiance to no one, that he joined a certain friend to feed, swam away with others to rest, cavorted awhile with a reluctant female, but spent most of his time idling, cruising, and exploring by himself.

Seventeen Bulls Escort One Cow

The one exception is the herd composed of a cow in heat doggedly followed by courting bulls. Such a herd may remain together for more than a month. Younger males come and go, but a nucleus of mature bulls is always present to escort the cow wherever she leads them. One day a cow and her train filed past me as if in review. There were 17 escorts in her retinue—nearly the entire male constituency of Crystal River!

Throughout the antic performances of manatees, an alert snorkeler, if he holds his breath, will be treated to a weird serenade of chirp-squeaks, squeals, and screams—manatee talk. These high-pitched sounds are emitted in a perplexing variety of unrelated circumstances. They are apparently not echolocating noises, such as porpoises make, but seem to be associated with emotional states, especially alarm. One predictable vocal reaction is the alarm duet between a mother and

Double insulation: The author ties off the entry chute of his outer suit, donned over a skin-tight inner suit to conserve body heat during a three-hour session of manatee watching. A grant from the National Geographic Society supported his pioneering underwater study of these increasingly rare coastal denizens.

Ugly scars, carved by a speedboat's slashing propeller, pattern the back of a lounging manatee. The animals often loll just beneath the surface, invisible to boatmen, and many bear marks of similar encounters.

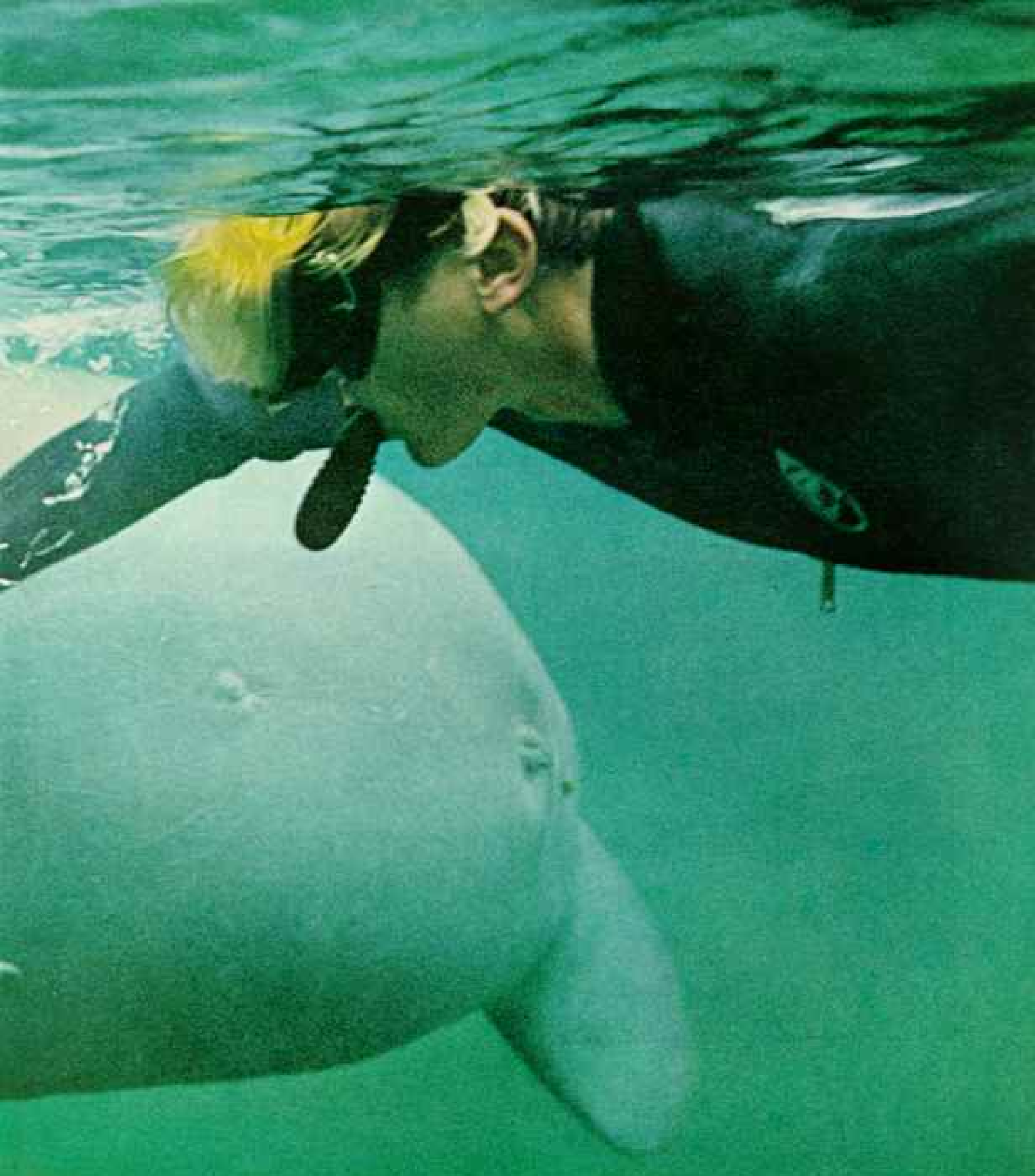
Making a last stand on both sides of the Atlantic, three species of manatee steadily retreat before man's encroachments. The subspecies *Trichechus manatus latirostris*—now found only along Florida's coast—once ranged by the thousands from North Carolina to the Texas Gulf Coast.

Sporting a patchwork coat of algae, a yearling calf named Uggams shares the warmth of a spring with a school of gray snappers. Long hunted for meat, hide, oil, and ivorylike bone, his kind may go the way of Steller's sea cow, a 25-foot, 6,000-pound relative discovered in the Bering Sea in 1741 and hunted out of existence in less than thirty years. Florida law now protects the manatee, but occasional poaching and thoughtless shooting by thrill-seekers persist.

her calf as she calls it to her side before fleeing.

Manatee vision is relatively unspecialized and probably myopic. These animals, after all, have little use for their eyes. In their normal environment of silt-laden rivers and turbid estuaries, visibility may be no more than a foot. Their sense of smell is in all likelihood rudimentary, if not altogether absent; their nostrils are tightly closed by valves while they are submerged and open only during the few seconds when they surface to breathe.

Voracious feeders, they spend a quarter of the day consuming indiscriminately whatever submerged aquatic plants happen to be at hand. Each day they eat more than a pound of vegetation for every ten pounds of body weight. They do not, as was formerly held, use their flippers to guide vegetation to their lips. They don't need to. It's enough for a manatee just to evert its horrendous lip pads



KODACHROME BY JAMES A. SUGAR © NATIONAL GEOGRAPHIC SOCIETY

and tuck the plants into its mouth with the attached bristles.

When they are not feeding, manatees are apt to be resting, either prone on the bottom or hanging suspended near the surface. Periodically they ascend slowly to the surface, as if pulled upward by guardian hands manipulating invisible strings to ensure that their charges don't drown. They stay up approximately four seconds, half devoted to exhaling,

Scratch right there. Ahhh. . . ! Ten-foot-long Adelaide—mother of Uggams—blissfully accepts the attentions of snorkelers. Though usually sluggish, the blimplike beast can approach speeds of twenty miles an hour, propelled by up-and-down strokes of her tail. Flippers serve as steering aids. One of her two teats appears as a bit of folded skin at the base of the right flipper.

half to inhaling. They then sink once more with a grace belying their bulk.

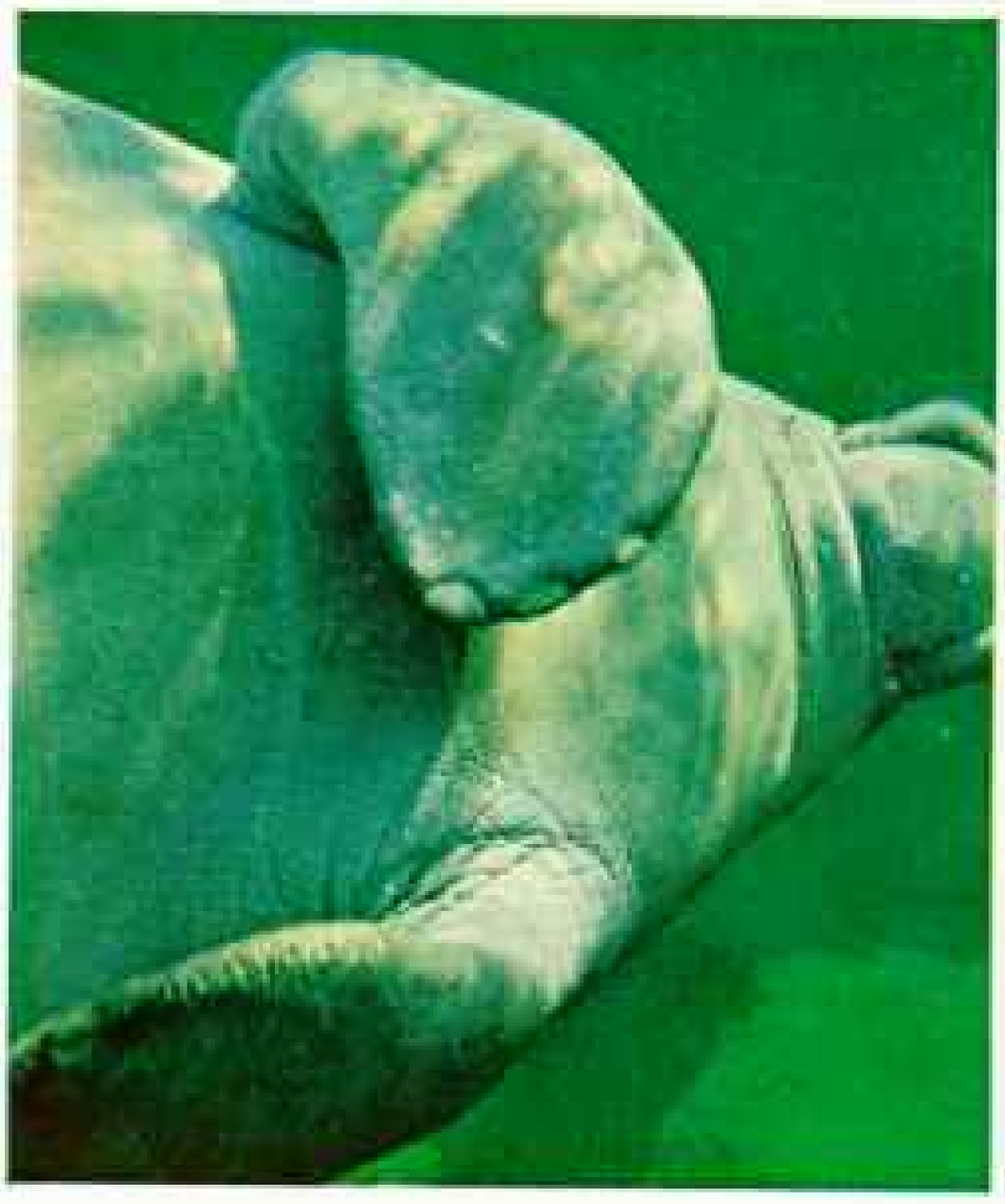
Manatees remain submerged longest while resting on the bottom. During my observations the record was set by Immer, a young male who stayed down nearly thirteen minutes. His time was exceptional. The usual submergence interval while resting is closer to five minutes. But an actively swimming manatee needs more oxygen and may surface once a minute.

In waters frequented by these great animals, the informed visitor is alert for the telltale snout proclaiming a surfacing manatee. It's as much as he's likely to see. Yet when frightened a manatee may light out at speeds close to twenty miles an hour, churning the water to a froth.

Many visitors who fish the Crystal River have never heard of manatees and are understandably dumbfounded when the monsters appear. I have seen stunned fishermen actually drop their rods and scan their minds' eyes for rational explanations—muskrats, beavers, otters, porpoises, whales, even divers. One teen-ager was heard to insist, "Mullet don't grow that big, Pa."

As the Gulf of Mexico cools in October, the Crystal River manatees move upstream, where they remain off and on until March. For the rest of the year the animals are seldom present in the headwaters.

Discovering where they went occupied my summer hours. The Florida Board of Conservation generously provided me, from time to time, with a light plane and a pilot. From



Telltale toenails hint at the manatee's terrestrial origins. Scientists believe that both the manatee and its distant cousin the elephant evolved from a common ancestor, a four-footed herbivore that browsed primordial marshes. The elephant's progenitors remained landbound, but the manatee's forsook the land for a totally aquatic life. Forelegs ultimately flattened into flippers; hind legs disappeared altogether.

Muzzle-to-muzzle "kiss," a manatee custom, may aid the weak-eyed beasts in recognition as well as in signaling affection. Manatees also communicate by chirplike squeaking, especially when alarmed. They rarely fight. Bulls may squabble over a female, but only the loser's ego is injured.

Underwater nursery: Uggams suckles at Adelaide's teat. Born at 25 to 60 pounds, calves may weigh 400 when weaned at up to two years. The author estimates a gestation period as long as 400 days. This contributes to a laggardly reproductive rate: Calves are produced at intervals of no less than three years.

While swimming or feeding, manatees normally bob up every minute or two, but remain submerged longer when at rest. One observer reported seeing a captive female place a newborn baby on her back, where she held it above water for 45 minutes. Then she dunked it repeatedly until it learned to breathe correctly.

the air my quarry was easily spotted, often grazing on the pastures of widgeon grass that thrives in the brackish inshore waters. With an anxious eye out for sharks, I dived into these murky estuaries—and, lo, met familiar animals! I encountered them in rivers as far as twenty miles from "home." I suspect that some go even farther.

To determine the migration routes, I interviewed scores of crabbers, mullet fishermen, and guides. Their replies were colorful, in the idiom of the Florida Cracker. One crusty old crabber complained that the manatees rubbed on his traps, embedding them in the mud so that he couldn't haul them.

"Takes two things to be a crabber, son. A strong back and a weak mind. Don't yo' never be a crabber. Stick with yore sea cows, boy, but keep 'em off'n my traps."

The answer to the puzzle of migration is not complete, but it is definite that manatees migrate offshore, and that they avoid the extremely shallow flats and waterways which snake around the network of coastal islets. Seeking the open water, they travel long-established corridors through the complex of sand bars, oyster reefs, and limestone shelves characteristic of this part of the Gulf Coast.

Distant Cousins: Elephant and Manatee

Mermaids—*sirenas* in Spanish—have been tempting men's imaginations since the time of the most primitive coastal cultures. Columbus's linking of the myth with the manatee is the earliest European reference to the animal in American waters.

One vestige of the mermaid legend has been preserved by science. A 19th-century taxonomist, perhaps echoing Columbus, gave the order the scientific name Sirenia. The name *manati* was probably appropriated by the early explorers from the Caribs of the West Indies, who referred to the creatures as *manatioui*.

Today it is generally agreed that the sirenians have descended from the same ancestor as the elephants. Evidence for this belief is to be found in fossil specimens which show, among other things, a progressive reduction of the hind limbs. And even present-day manatees have molars that in some respects resemble those of elephants.

There are today only four species of sirenians. Three are manatees; the last is the marine dugong of the Indo-Pacific region. A fifth, Steller's sea cow, existed until relatively recent times. Three tons in weight and twenty-five feet long, it lived in the Bering Sea near Kamchatka. Hunters, killing it for meat, exterminated the species by 1768.

Manatees and dugongs may be going the way of their Bering Sea kin. Throughout their range, they are rare or endangered. Many former manatee haunts in the rivers of West Africa and Central and South America are now empty. The animals have been hunted and harpooned; manatee steaks are a prized supplement to native diets. Even in Florida, where a poacher risks a $500 fine, manatees are occasionally killed for food or so-called sport.

Manatee's Enemy Must Become a Friend

In the United States manatees were once found as far north as the Carolinas and all the way around the Gulf Coast. Now they survive only in Florida, and there only in isolated pockets. Their comeback is handicapped by a slow reproductive rate: at best, one calf per adult female every three years. They cannot sustain any further depletion.

Yet the encroachments of civilization are being felt. The current Florida boom is preempting wildlife habitats. Pollution has already destroyed the manatee's food resources in several rivers. Waterfront developments temporarily avert catastrophe. They usually entail the dredging of canals which, when colonized by aquatic plants, provide new manatee pastures. But ultimately they mean an increase in human population and more power boats, the scourge of manatees. As soon as the toll taken each year by propellers exceeds the annual production of calves, the manatees in an area are doomed. This could happen soon at Crystal River.

Manatees are harmless. They have no defense but flight, no natural enemies but man. Their future rests entirely in our hands.

THE END

Improbable siren: Orville, a 1,203-pound manatee, presents a visage that few close-range observers could confuse with a lovely mermaid. Valvelike nostrils, tightly sealed when under water, open wide when the manatee comes up for air. Crusts on the skin may be caused by shuttling between salt water and fresh.

THE FRIENDLY IRISH

By JOHN SCOFIELD
Senior Assistant Editor

Photographs by
JAMES A. SUGAR

"DON'T ORDER THAT, LOVE," a waitress warned me one day when I asked for corned beef in a tiny Dublin restaurant. "It's awful. Nothing but fat. Have the chicken now."

I needed some pennies to make a phone call. "Why break a pound note?" the young lady behind the desk of my hotel objected. "It'll slip away soon enough. Here, I'll lend you the fourpence."

And a motorcycle-mounted *gárda*, as the Irish Republic calls its policemen, refused to give me either directions or a ticket for blocking traffic, but led me instead through block after glutted block of downtown Dublin to an address I had just spent half an hour trying to find.

The warmth that has always charmed the stranger in Eire is still very much at work. But change flavors the air, too. Fewer Irishmen (and women) leave to seek their fortunes these days in England or America. There's a healthful influx of new industry, and a desire to be involved in the world's problems. So it was a new Ireland as well as an old one that my wife Audrey, my 16-year-old son Ken, and I set out to explore (map, page 363).

Angels Scarred by Bullet Holes

First on the schedule, of course, was the capital. Amid the throbbing hurly-burly of Dublin's broad O'Connell Street, double-deck buses reminded us of London, and exhaust fumes and swarming tangles of traffic made us think of Times Square. But to the people of the "twenty-six counties," as Irishmen sometimes call their republic to distinguish it from the six northern counties that remain loyal to the Crown, this is much more than the busy heart of their largest city.* For on O'Connell Street on Easter Monday of 1916, the Irish Republic was proclaimed.

I had heard that marks of the 1916 "Rising" were still visible along O'Connell Street, so I walked up and down it one morning, head in the air to scan the building fronts for bullet scars, until I bumped blindly into a policeman.

"Whatever is it you're looking for?" he asked.

I told him, and he led me toward the river, past the statue of Sir John Gray, who gave Dubliners their modern water supply, and the one of temperance advocate Theobald Matthew, who tried to make them drink it. Then we came to a tall and stately plinth from which a likeness of 19th-century patriot Daniel O'Connell surveys O'Connell Bridge from the foot of O'Connell Street (pages 356-7).

"There," the policeman said as he walked me around the base, where four gauzily clad bronze angels stared off in as many directions. "There, and there." Two of

*See "The Magic Road Round Ireland," by H. V. Morton, NATIONAL GEOGRAPHIC, March 1961. The six counties were described in detail in "Northern Ireland: From Derry to Down," by Robert L. Conly, August 1964.

"A plenteous place . . . for hospitable cheer," wrote an unknown poet in the 18th century, and so Ireland remains today. Farmer John Larry Cavanagh and his son greeted the author and his family on the Dingle Peninsula. Over the years, famine and strife forced millions of Irish sons and daughters to emigrate. Now, growing prosperity enables increasing numbers to stay at home, where they welcome a steady stream of visitors to their doors.

REDACTED BY JOHN SCOFIELD © N.G.S.

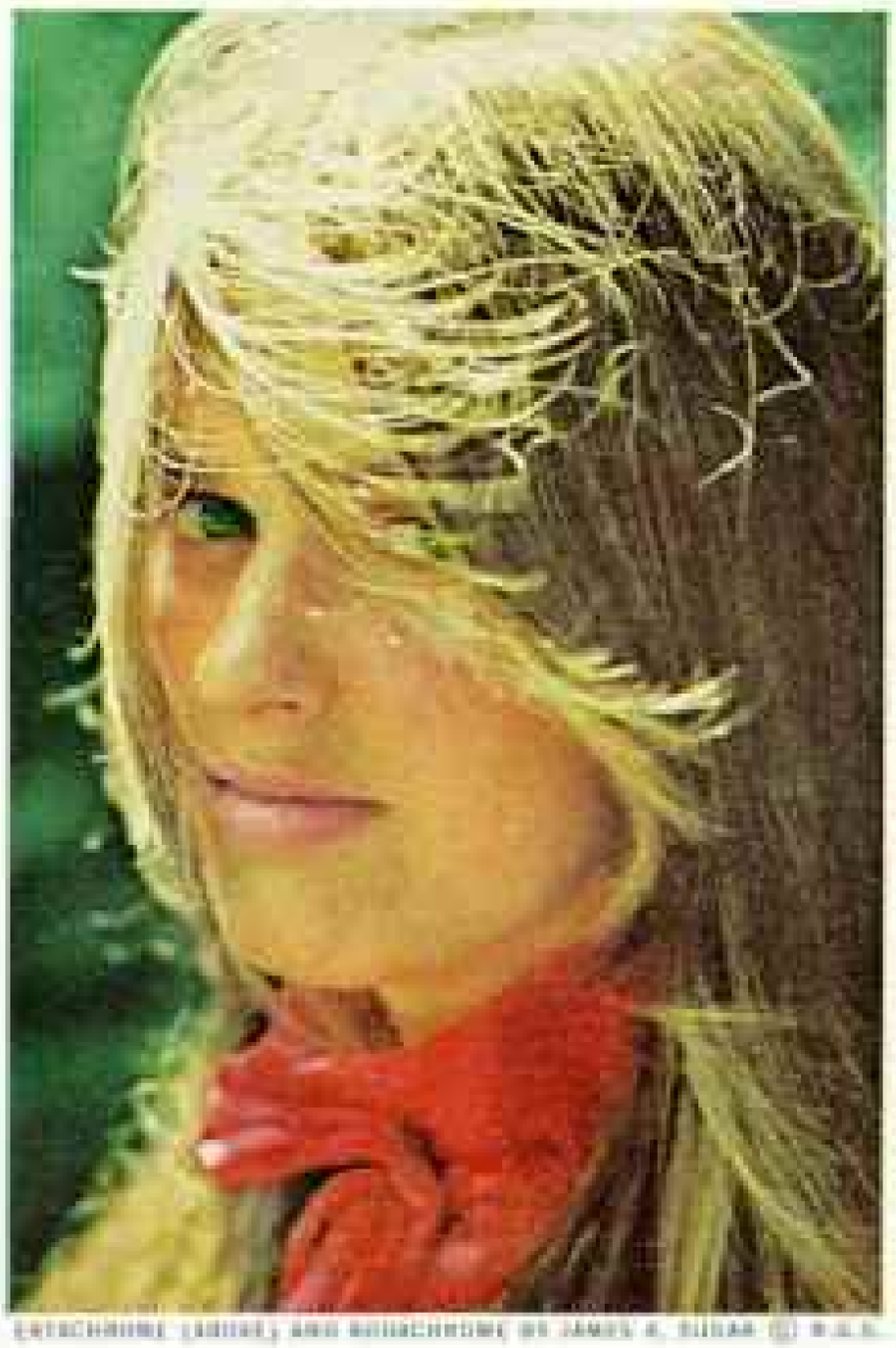
the angels still wear grievous wounds in the breast, and holes remain where a rifle bullet pierced the arm of another.

"We wouldn't think of patching them," the gárda said reverently. "Those bullets were fired 53 years ago by Padraig Pearse and his men. And there," he pointed back up the street to the brooding General Post Office, "in front of that building Pearse asserted 'the right of the people of Ireland to the ownership of Ireland.'"

In fact, the bullets may just as easily have been fired by the British forces—which included a gunboat anchored in the River Liffey—forces that routed Pearse's little band of patriots and, in doing it, left much of downtown Dublin a shambles. But the seed had been sown. Standing in front of the Post Office, Pearse had boldly proclaimed the Irish Republic a sovereign, independent state.

For his pains—and despite a public outcry in England as well as in Ireland—Pearse and

Staging ground for independence: On Easter Monday, 1916, Irish Republicans stood before the General Post Office (shrouded by cleaners' tarpaulins at left) on Dublin's O'Connell Street and proclaimed the Republic after 700 years of British rule. In the battle that followed, bullets scarred the monument to Daniel O'Connell, 19th-century champion of Roman Catholic rights, and artillery left the street in ruins. Today it witnesses a stream of businessmen, shoppers, and students like 17-year-old Judith Woodworth (below and cover).



EKTACHROME (ABOVE) AND KODACHROME BY JAMES A. SUGAR © N.G.S.

Ireland's magical art

IN THEATER, college, and pub, Dubliners joyfully parade their skill with words. Abbey Theatre actors in Thomas Murphy's play, *Famine*, re-create the disaster of 1845-47. The 65-year-old Abbey specializes in the works of such Irish playwrights as W. B. Yeats, Sean O'Casey, John M. Synge, and Brendan Behan.

Scarlet-robed doctoral graduate of Trinity College poses for keepsake photographs after a ceremony conducted in Latin. In 1591 Queen Elizabeth I chartered Trinity for "the banishment of barbarism, tumults, and disorderly living."

In Mulligan's pub on Poolbeg Street men savor pints of Guinness and the roll of words on the tongue in a scene reminiscent of *Ulysses*, James Joyce's novel about his fellow townsmen.

14 of his comrades died before a firing squad. Another 33 years had to pass—years of bloody "Troubles" and civil war—before the green, white, and orange standard would flutter over a completely independent Ireland.

"It was the executions that aroused the Irish and made independence inevitable," an elderly Dublin civil servant commented. "Of course there was another side of it," he went on thoughtfully. "Europe was in the throes of World War I just then. America hadn't come in, and Britain had her hands full. She couldn't put up with a desperate war and a revolution here in Ireland at the same time.

"But that kind of talk isn't always popular here," he added, "even after so many years. So don't use my name."

To this day regal Dublin Castle, from which the king's deputies ruled Ireland, entertains few Irish sightseers, but grim Kilmainham Gaol, where the executions took place, admits streams of them. We visited the old prison, a hulking horror of gray stone and peeling plaster, on a Sunday blessed with sunshine; had it been a day of rain and gloom, the experience would have been unbearable.

The names of those who died mark ghastly cells in the old prison. In the high-walled stone-breakers' yard, the Irish flag hangs limply at half staff where Padraig Pearse and his compatriots faced the firing squad.

Back in the heart of the city, Sunday afternoon crowds clotted O'Connell Street. Thousands of blue and green paper hats with white visors, marked "Up Laois" or "Up Longford," bobbed like so many St. Patrick's Day carnations as sports-mad Dubliners streamed out to Croke Park for an afternoon of Gaelic football. Buses disgorged English tourists at downtown hotels. In the morning the "Radio

Snakes St. Patrick missed: Only in the Zoological Gardens of huge Phoenix Park are Dublin youngsters likely to see serpents. On sunny days Keeper of Reptiles Tom Kelly, right, even takes young pythons and boas outside, where children can handle them. Irish tradition has it that the island's patron

Train," with its taped commentary to tell them what they were seeing, would whisk them across the green countryside to Killarney and County Galway. The old, turbulent days of the Troubles between Irishman and Briton seemed as far away as last week's bad dream.

And yet it was only three years ago that "persons unknown" planted explosives around the shaft of the 134-foot Nelson Pillar, from which a statue of the English naval hero had gazed down on O'Connell Street since 1809, and toppled it to the ground.

"Very skillfully, too," a shopkeeper remarked to me. "Hardly a window was cracked. Who did it? I wouldn't say anyone tried very hard to find out. After all, to most of us old Nelson was an embarrassing symbol —another nation's hero strutting up there above our main street."

Mention of Unmentionable Sparks a Riot

Only a block from bustling O'Connell Street stands a Dublin landmark almost as familiar to the world as the Nelson Pillar, and one that also lay in ruins not so long ago. The original Abbey Theatre building had done duty as

HIGHCHRUME BY JAMES A. SUGAR © N.G.S.

saint drove out the snakes in the fifth century, though scientists have no evidence that the creatures ever existed there. For 250 years Phoenix Park has drawn Dubliners for recreation and enlightenment—from bare-knuckle boxing to band concerts, from military reviews to temperance meetings,

music hall, bank, and morgue before it triumphed with the magic of such plays as W. B. Yeats's *The Countess Cathleen*, J. M. Synge's *Riders to the Sea*, and Sean O'Casey's *Juno and the Paycock*.

"People sometimes called it the Shabby," veteran actor Gabriel Fallon reminisced. "In those days the company could afford only half a dozen full-time actors. Barry Fitzgerald and I were part-timers. We were civil servants, actually. We'd work for the government all morning, then rush to the theater at lunchtime to rehearse. Back at our offices by two, and to the Abbey again at five for more rehearsals and our only meal of the day. Then we'd start the performance at eight.

"It was a kind of lunacy," he acknowledged, "but we did it because we loved the theater."

Along with its triumphs, the old building saw the Abbey's stormiest hours. In 1907 Synge's *The Playboy of the Western World* precipitated a week of fighting inside the theater and in the streets outside. Why? Because Synge allowed one of his characters, a 21-year-old Irish girl, to mention a feminine undergarment. To judge by the tumult, it was

the first time in the history of holy Ireland that the word "shift" had been spoken aloud!

In 1951 fire swept the old Shabby. Director Lennox Robinson, watching as flames engulfed the building, exulted.

"It's the best thing that ever happened," he told a reporter. "Now the government will have to build us a new theater."

The government did (page 358). But 15 years passed before its curtain went up—years during which the company made do in Dublin's old Queen's Theatre amid peeling paint, criticism, and dwindling audiences.

Now the Abbey has come full circle again. Manager Phil O'Kelly greeted us in the 2½-million-dollar building's dramatic new lobby as a capacity audience filed in for a performance of Brendan Behan's lusty *Borstal Boy*.

"I'd say we're 105 percent booked," said Mr. O'Kelly happily. "Standing room only."

Dusk Lasts Late on Summer Nights

It was barely ten o'clock when we left the Abbey, and a hazy sun had just dropped below the chimney pots. We wandered off in the fading light to savor the leafy grandeur of St. Stephen's Green, with its quiet walks, its tree-shaded pools, and its meticulously tended beds of blossoming begonias.

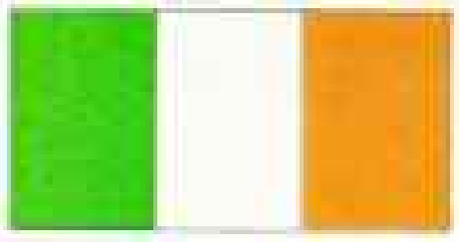
Dozens of these greenswards dot the gray face of Dublin. They range from handkerchief-size churchyards to the vast reaches of Phoenix Park, with a seven-mile circuit of walls, the Irish President's home, a herd of deer, and one of the most delightful zoos in Europe (preceding pages).

The most surprising open space in Dublin lies even closer to the heart of this jumbled city. Founded by Queen Elizabeth in 1591, Trinity College occupies 37 acres of prime mid-city real estate—and keeps much of it shaded by trees and covered with neatly clipped lawns. Its undergraduates affect the same fondness for mini-skirts, beards, and sideburns as do students in New York City. We followed a book-laden group displaying some of each into Trinity's new, starkly modern concrete library.

I was disappointed—not because I disliked the idea of Vienna-born architect Paul Koralek's functional structure in the midst of Trinity's vintage scene. But I had wanted to see the Long Room of the *old* library, where I expected to find the college's greatest treasure, the ninth-century Book of Kells.

"I'm afraid the Long Room's temporarily closed," a librarian apologized. "After several centuries of dry rot, it's taking rather a long

AIR-CONDITIONED BY WESTERLY WINDS and ocean currents, Ireland flourishes under 30 to 50 inches of rainfall a year and temperatures ranging from 32° to 70° F. In *John Bull's Other Island*, George Bernard Shaw had an Irishman thus describe his land to an Englishman: "Your wits can't thicken in that soft moist air. . . . You've no such colors in the sky, no such lure in the distances, no such sadness in the evenings. Oh, the dreaming!"



The Irish Republic occupies roughly 80 percent of the Emerald Isle. Half the nation is pastureland and supports the major industry: cattle raising. In the 1840's, the Irish, then more than eight million strong, suffered a staggering catastrophe when blight destroyed their chief crop—potatoes. Hundreds of thousands starved and about a million emigrated. During the next century five million more left, most of them for British, Canadian, and U. S. cities. Today the Republic's population shows a slight increase.

OFFICIAL NAME: Eire (in Gaelic, first official language), Irish Republic (in English, second official). **POPULATION:** 2,910,000. **AREA:** 27,136 sq. mi. (slightly larger than West Virginia). **ECONOMY:** Agriculture (60 percent of total exports). **CURRENCY:** The pound ($2.40). **MAJOR CITIES:** Dublin (pop. 568,772), capital; Cork, Limerick. **FLAG:** The Republic keeps Ireland's 19th-century tricolor with the green of the south's shamrocks and grass, the white of peace and unity, and the orange of the Protestant North, despite the six counties' decision to remain loyal to the Crown.

COUNTIES OF IRELAND

Carlow (Car)	Leitrim (Leit)	Waterford (Wat)
Cavan	Limerick (Lim)	Westmeath (Westm)
Clare	Longford (Long)	Wexford (Wex)
Cork	Louth (Lou)	Wicklow (Wick)
Donegal (Don)	Mayo	**N. IRELAND**
Dublin (Dub)	Meath (Mea)	Antrim (Ant)
Galway (Gal)	Monaghan (Mon)	Armagh (Arm)
Kerry	Offaly (Off)	Down
Kildare (Kild)	Roscommon (Ros)	Fermanagh (Fer)
Kilkenny (Kilk)	Sligo	Londonderry (Derry)
Laoighis (Leix)	Tipperary (Tip)	Tyrone (Tyr)


Ireland
Northern Ireland, made up of 6 predominantly Protestant counties, voted in 1922 to continue its ties with Great Britain. Its border with the 26 primarily Roman Catholic counties of the south was ratified in 1925.
In myth, this causeway into the sea was built by the Irish giant, Finn MacCool, to attack his rival in Scotland. In fact, it is a series of polygonal basaltic columns formed when cooling caused the volcanic flow to crack.
The galleass Girona, a ship of the Spanish Armada, went to the bottom here in 1588. In 1967, nearly four centuries later, an expedition supported in part by the National Geographic Society, rediscovered the wreck and recovered many of its priceless relics.
Round towers are a common sight in Ireland's landscape. They were built in the Middle Ages by monks and often used by them for protection and for hiding church treasures during Viking attacks.
Much of William Butler Yeats's youth was spent in Sligo. Later the memory of an island in Lough Gill inspired his well-known poem, "The Lake Isle of Innisfree."
The word "boycott" originated when Captain Boycott, an Achill Island land agent, was ostracized by his tenants for charging unjust rents.
Battle of the Boyne near Drogheda on July 1, 1690, brought all Ireland under the domination of Protestant England, where it remained for 250 years.
Prehistoric grave mounds—Huge burial mounds at Newgrange, Knowth, and Dowth indicate the existence in Ireland of a "highly organized Stone Age culture 4,000 years ago."
Probably built by the Fir-bolg (Belgae), this cyclopean fort with a circular tower dates from the first century A.D.
Anticipating the time when aircraft would no longer depend on Shannon as an intermediate refueling stop for Atlantic flights, Irish officials created the first duty-free shop. Now a duty-free industrial zone brings Shannon added importance.
The shillelagh, a knotty oak sapling carried as a walking stick, or cudgel, took its name from this town because of the oak forest nearby.
Irish legend traces the use of the shamrock as a symbol for the Trinity to an Easter message given on the Rock of Cashel by St. Patrick. The three-leafed plant has since become the national emblem of Ireland.
Here, 12 miles off Old Head of Kinsale, American divers are salvaging the Lusitania. A German submarine sank the 790-foot liner on May 7, 1915 with a loss of 1,198 lives.
NORTHERN IRELAND
NORTH CHANNEL
ST. GEORGE'S CHANNEL
CONNAUGHT
LEINSTER
MUNSTER
ULSTER
Malin Head
Lough Swilly
Inishtrahull
Giant's Causeway
Rathlin I.
Ballycastle
Lough Foyle
Tory Island
Muckish Mt.
Aran Island
Errigal Mt.
Letterkenny
Buncrana
Londonderry (Derry)
DERRY
ANT
DON
Larne
Ballymena
Carrickfergus
Belfast Lough
Bangor
Belfast
Strangford Lough
Glencolumbkille
Glengesh Pass
Malin More
Killybegs
Donegal
Donegal Bay
Ballyshannon
Inishmurray
Omagh
TYR
Lough Neagh
Irvinestown
FER
Enniskillen
DOWN
Armagh
ARM
Downpatrick
Newcastle
Mourne Mts.
Newry
Monaghan
MON
Drumcliff
Sligo
Lough Gill
Innisfree
SLIGO
Tubbercurry
Mullet Peninsula
Belmullet
Ballina
Lough Conn
MAYO
Achill Island
Castlebar
Clare Island
Croagh Patrick
Westport
Boyle
Carrick on Shannon
LEIT
Cavan
Carrickmacross
Dundalk
LOU
CAVAN
Ballaghaderreen
ROS
Longford
Hill of Slane
Kells
MEA
Drogheda
An Uaimh
Hill of Tara
Boyne Valley
LONG
Roscommon
Lough Mask
Tuam
Mullingar
WESTM
DUB
Dublin
Slyne Head
Connemara
Lough Corrib
Athlone
GAL
Galway
Ballinasloe
Tullamore
Dun Laoghaire
Sandycove
Galway Bay
OFF
KILD
Naas
Bray
Loughrea
Portumna
Aran Islands
Inishmore
Inishmaan
Inisheer
Port Laoighise
Wicklow Mts.
Wicklow
Lough Derg
Roscrea
LEIX
WICK
CLARE
Ennis
Shannon Airport
Knappogue Castle
Quin
Bunratty
Nenagh
Carlow
Arklow
Shillelagh
CAR
TIP
Thurles
Kilkenny
Kilrush
R. Shannon
Limerick
KILK
LIM
Listowel
Tipperary
Cashel
Enniscorthy
Kerry Head
New Ross
WEX
Cahir
Clonmel
Wexford
Tralee
Dungarvan
Waterford
Rosslare Harbour
Waterford Harbour
Dunquin
Dingle Peninsula
Dingle
Blasket Islands
Great Blasket I.
KERRY
Killarney
Mallow
Fermoy
WAT
Inishfallen
Ross Castle
Muckross Abbey
Valentia I.
CORK
Blarney
Macroom
Youghal
Cork
Cobh
Bolus Head
Castletown
Caha Mts.
Kenmare River
Bandon
Bantry Bay
Ballineascarthy
Kinsale
Old Head of Kinsale
Dursey I.
Skibbereen
Clonakilty
Mizen Head
Clear Island
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Places with Scheduled Air Service
Ruins
Elevations in Feet

time to fix. But you'll find the Book of Kells over there."

Modestly displayed in a small glass case in the entrance hall, and opened to the Gospel of St. Mark, lay what many bibliophiles have called the finest illuminated manuscript in existence (page 366). It has lost several pages; been stolen, stripped of its golden cover, and buried; and a century ago was thoughtlessly trimmed by a careless binder, who even cut away the edges of some of the illuminations.

Despite its misadventures, this ornately decorated Gospel survives as the crowning accomplishment of Celtic art. Scholars can detect the hands of at least four of the monk artists of St. Columba's Monastery of Kells, in County Meath, in the microscopic tracery of its initial letters. In them are entwined such light-hearted Celtic fancies as acrobats, birds and dragons, cats chasing mice, and men pulling each other's beards.

Outside again, we sought some tangible reminder of Trinity's best-known graduate—though they could hardly have claimed him as such at the time. Jonathan Swift attended Trinity for four years, beginning in 1682, but he squeaked through only by special dispensation.

There was nothing at Trinity to evoke the ghost of Gulliver's creator, so we took our search next morning to a more obvious place. The caustic dean himself occupies a tomb beneath the paving of Dublin's hallowed St. Patrick's Cathedral, where he presided for 32 years. His beloved Stella rests only a few feet from him. But even here we got no sense of Swift the man.

Indignation Lives On in Penciled Notes

I mentioned my quest to Tom Sheehy of Ireland's admirable Tourist Board, which operates under the Gaelic name Bord Failte—literally Board of Welcomes. Tom packed us off to St. Patrick's again.

"You'll find Marsh's Library just back of the cathedral," he directed. "Oldest public library in Ireland. Ask to see Clarendon's *History of the Rebellion*."

Inside a building obviously unchanged for centuries, a helpful librarian showed us the book—the great dean's own copy of the Earl of Clarendon's chronicle of the Cromwellian wars. A passage detailing the fate of Scotland's Marquis of Montrose caught my eye:

"That he was . . . to be hanged upon a Gallows thirty foot high, for the space of three hours, and then to be taken down, and his head to be cut off upon a Scaffold, and hanged on *Edenborough* Tolbooth; his legs and armes to be hang'd up in other publick Towns of the Kingdom."

In the margin beside it, a note penciled some 250 years ago still crackled with indignation. No admirer of the Scots for their support of Cromwell's revolution against the Crown, the intemperate Dean Swift had testily scrawled, "Oh if the whole Nation to a Man were just so treated. . . . Mad treacherous damnable infernall Scots for ever."

Scholars love Marsh's Library, for it survives almost exactly as it was in Swift's day. One, who came twice in 1902, did so to consult the *Prophecies of Joachim*, printed in 1589. Budding novelist James Joyce was then only 20.

Joyce's flavorful Dublin probably attracts as many literary

Rough-and-tumble game of hurling—an Irish version of field hockey—pits determined rivals swinging three-foot-long ash sticks. They battle to swat the *sliothar*, or ball, under the goal's crossbar for three points, or over it for one. Teams compete for an hour with one time-out and three substitutions—for injuries only.

In this semifinal game before 45,000 spectators at Limerick, blue-and-gold-suited Tipperary bested Cork, then was defeated by Wexford for the all-Ireland championship in Dublin last September. Legend traces the popular sport to ancient times, when Irish heroes proved their invincibility on the hurling field.

pilgrims as does the city Swift knew—and more of Joyce's Dublin survives. At nearby Sandycove, beside the Irish Sea, stands the 150-year-old tower in which he set the opening chapter of *Ulysses*. Davy Byrne's public house in Duke Street—the "moral pub" of *Ulysses*—still opens its doors daily, though the sawdust-littered floors have given way to wall-to-wall carpet, mellow lighting, and the buzz of cocktail-hour conversation. Mr. James Mulligan's establishment in Poolbeg Street, on the other hand, goes its way agreeably unchanged; printers from the *Irish Press* still crowd the backroom "snug" where Joyce wrote some of the short stories in *Dubliners*.

Davy Byrne's and Mulligan's bring up another subject, not necessarily literary—Ireland's nearly 12,000 licensed drinking establishments. The Dublin institution that caters in turn to the pubs—Guinness produces the lion's share of beer consumed in Ireland—occupies a sprawling 59-acre site beside the River Liffey.

"But we *don't* make it with Liffey water," Billy Porter told me the minute I shook his hand. "That's an old heresy. We pump as much as 2¾ million gallons of spring water a day from 25 miles away in County Kildare."

He ticked off the facts: Largest private employer in Ireland, with 4,000 workers. A million pints produced in an average day.

Almost as obvious on the Dublin scene as the pubs and the ubiquitous Guinness billboards are those passports to instant wealth, tickets on the Irish Hospitals' Sweepstakes.

"They cost a pound each, and find buyers in something like 147 countries," Val Joyce told me in the Sweepstakes' sprawling building in suburban Ballsbridge. "There are four races a year, and after each one, winning tickets can be redeemed for as much as £50,000—the equivalent of $120,000."

Celtic vision of Christ, surrounded by saints, angels, and peacocks, illumines a leaf of the Book of Kells. Ninth-century monk-artists painted and inscribed the 340-page Gospel at Kells, in County Meath. The library at Trinity College preserves the masterpiece, lauded by Joyce as "the fountain-head of Irish inspiration."

Torturous pilgrimage to honor St. Patrick: A rock-strewn path on Croagh Patrick tests barefoot penitents. Thousands trek to the summit of the 2,510-foot mountain in County Mayo for Mass on the last Sunday in July. The act commemorates the missionary who, according to a revered tradition, fasted here for 40 days.

Probing the pagan past, Dr. George Eogan, right, of University College, Dublin, excavates a burial complex at Knowth. Here with students he uncovers a small grave, one of more than a dozen surrounding an acre-size artificial mound. Within the main mound he discovered two huge chambers, carved decorations, and cremated remains left 4,500 years ago by settlers probably from the Iberian Peninsula. Excavations also continue at Newgrange in County Meath.

KODACHROMES BY THOMAS J. ABERCROMBIE (TOP) AND JAMES A. SUGAR (C) N.G.S.

That's a lot of money, I hazarded, to fall to people practically out of the sky. "It is," he agreed. "But not what it was in the old days."

In 1931 ticket number F/MH 22370, on a horse named Grakle, netted more than a third of a million pounds. "And a pound then," added Mr. Joyce, "was worth nearly five of your dollars." The real Sweepstakes winners, of course, are Ireland's hospitals. Since 1930 their share—25 percent of the take—has totaled well over $200,000,000.

About this time a line we'd read in a guidebook became an insistent refrain: "Dublin isn't Ireland, isn't Ireland, isn't Ireland." So Audrey, Ken, and I speeded up our plans for a leisurely circuit that would take us across the gentle farmlands of Wicklow and Wexford to the seemingly tropical south, where palms survive at the latitude of Labrador. Cork, the Republic's second city, would lead to Kerry's scenic magic. Then we'd make a long zig-zag up the rocky, island-warted west coast to "Yeats country" and the windy headlands of Donegal (map, page 363).

First, though, we drove north one morning to County Meath for a glimpse into the dim recesses of Ireland's past.

"We have no idea whatsoever who built it," said archeologist Peter Harbison. "They were probably a small, stocky Mediterranean-looking people, but we haven't even a name for them." Dr. Harbison had just led us through a 62-foot passageway into a dark burial chamber at the heart of a 4,000-year-old, 275-foot-wide mound at Newgrange.

"The story of Ireland begins here, you might say," he went on. "Mounds like these—we call them passage graves—are the oldest things we have that reflect the existence in Ireland of a complex social organization."

Boulders the size of office desks formed the walls of the chamber, rising one upon another to a massive capstone 20 feet above the floor. Bits of broken stone, driven into the crevices between the blocks, lay exactly as the hands of Stone Age masons had left them. Only these chips and the engineering skill of a nameless, forgotten people kept the mortarless

structure from crashing down upon our heads.

Now we were ready for our circuit of the Irish countryside, but we were still not fated to escape the thread of Irish history. We drove south through the green hills of Wicklow, peeked at the potteries and fishing fleets of Arklow, and picked up our history lesson again in, of all places, a County Wexford barroom.

Long before dark, Michael Furlong's tiny public house in the village of Foulksmills bulged with farmers still wearing their field clothes and muddy shoes and, to a man, nursing pints of dark stout. Behind the bar a sign announced an appearance of the Ballylannon mummers. This would be a rare treat, for few places in the Republic preserve this archaic entertainment.

Freedom Fighters Recalled in Song

It was nearly 10:30 before the mummers appeared—a dozen men in green military caps and crossed sashes of yellow and green, carrying short wooden swords. To the insistent sounds of a drum, an accordion, and a mouth organ, they hopped and pivoted in a simple step dance, smacking their wooden blades together in an intricate rhythm. And one by one, in words written long ago to keep alive Ireland's burning desire for independence, they took the parts of the freedom fighters of nearly 800 years—from the Christian King Brian Boru, who defeated the Viking invaders in A.D. 1014, to Father John Murphy, a priest-leader in a 1798 revolt against the Crown.

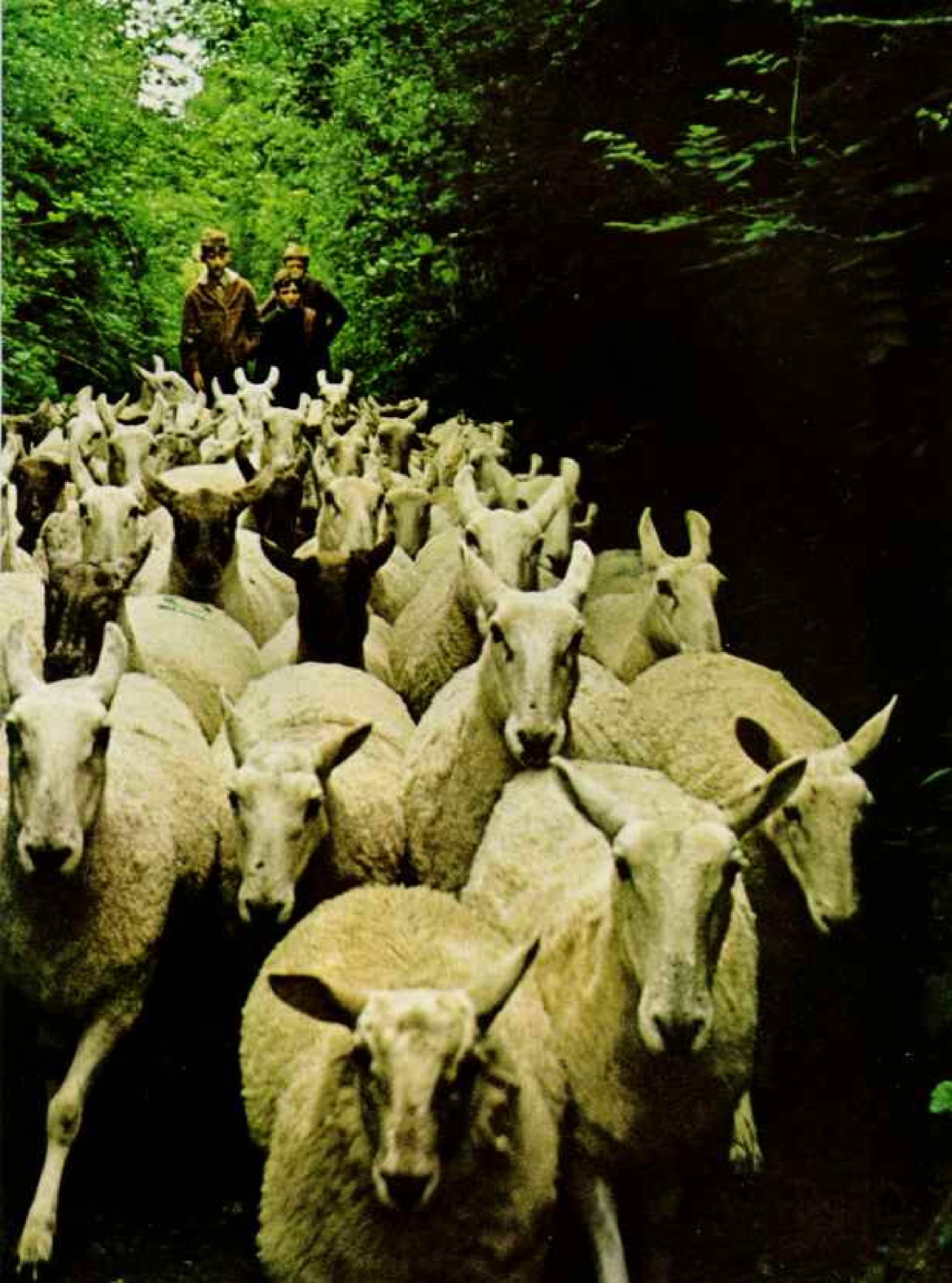
We dropped by next morning about nine—a ghastly hour by Irish standards—to thank Mr. Furlong for his hospitality. One of the mummers, who the night before had sung lustily and often, drooped morosely at the bar. He had brought his bicycle right into the pub with him. One hand steadied it and the other cradled the remnants of a pint.

"The morning after do be the worst!" he managed to say. He downed the last drop and pedaled glumly away.

At New Ross a bridge carried us from County Wexford to County Kilkenny. In one of the town's narrow medieval-looking streets a

Crowding a narrow lane, sheep head for home on the Dennis Crosbie farm at Foulksmills, County Wexford. Photographer Sugar joined the boys at their chores while he stayed at the 200-year-old Crosbie homestead, one of hundreds that introduce paying guests to the delights of rural Ireland.

PHOTOGRAPHS BY JAMES A. SUGAR © N.G.S.



Sculpture on glass: With a power-driven copper wheel, Tommy Wall of Waterford Glass Ltd. engraves a vase presented last fall to Richard Cardinal Cushing in Boston. Mr. Wall spent 50 hours on the design, the cardinal's coat of arms. After a century-long shutdown, Waterford revived lead-crystal manufacture in 1952.

Sure-handed as a juggler, James Kenny transfers kiln-fired cups to a trolley bound for the decorating department of the Arklow Pottery factory in County Wicklow. Such products have more than quadrupled Ireland's industrial exports in the past decade.

KODACHROME (TOP) AND EKTACHROME © N.G.S.

Handcrafting an heirloom, Maureen Conwell repairs a Wilton Royal carpet at Donegal Carpets Ltd. in Killybegs. Most of the company's 75 employees fill orders for new hand-knotted wool carpets, some as wide as 40 feet. To encourage new industries, the Irish Government offers 20-year tax concessions, cash grants, and ready-built factories for rent.

modern ballad blared from a pub's open door:

And when the votes were counted
Every Irish heart was gay.

John F. Kennedy, and now his brother Robert, are as firmly ensconced in Irish hearts as any home-grown heroes. Second cousin Mary Ryan (her maiden name was Kennedy) was away from the homestead at neighboring Dunganstown from which great-grandfather Patrick Kennedy fled to America in the 1840's to escape the Great Famine. But we found Mrs. Ryan's daughter Josie shyly presiding over the little two-room building that embodies all that remains of the original cottage.

Narrow, leaf-walled roads led us back through New Ross, on the River Barrow, where Pat Kennedy probably took ship for the New World, and then on to Waterford. The city sits prettily beside the River Suir, but the ocean-going ships that tie up along its wharves no longer carry away loads of Irish emigrants—and that's another story.

As if the Great Famine had not been burden enough, a depression swept Ireland in the late 1840's. Businesses failed—among them, one that had carried Waterford's name around the world. And so for a century collectors scoured New York City and Newfoundland, Denmark and the West Indies, for the heavy, sparkling decanters and dishes that had made Waterford famous. In Waterford itself, even the location of the old factory was forgotten.

"Thirteen hundred people work here now," said pretty Jennifer Johnson as she showed us through a humming new plant that has risen

Kissing the Blarney Stone demands a helping hand. The visitor must bend back and down to reach the fabled spot under a ledge of Blarney Castle, near Cork. No one remembers the origin of the custom, which is supposed to confer the power to cajole, but the word "blarney" may have entered the English language by way of Queen Elizabeth I. The lord of the castle was so skilled at smooth talk, one story goes, that the Queen once greeted his flowery assurances with the scathing comment, "What? More Blarney!"

Favorite pastime in County Cork, road bowling draws a Sunday crowd of bettors. White-shirted Dennis Scully flings a 28-ounce cast-iron ball along a measured course. Where the road bends, the bowler skillfully lofts the ball straight across the curve. In this match Scully and his rival Johnny O'Donoghue finished within a few feet of each other after 14 throws, with O'Donoghue the winner. The ancient sport sometimes brings fines for obstructing traffic.

phoenixlike to take its place (page 370). "Hand-blown and hand-cut Waterford goes all over the world again. In fact, we have to ration supplies to our dealers. And Waterford men," she concluded with a smile, "are happy to seek their fortunes right here in Ireland."

How had all this come about?

"It wasn't easy," said Miss Johnson. "For nearly a century no one in Waterford had made so much as a drinking glass.

"At first, the craftsmen came from overseas—Italy and Germany," she explained. "The Irishmen who have taken their places started learning at 15; most are still in their mid-20's. On the average, our master blowers and engravers are probably the youngest in the world."

"And your glass must be the heaviest," I suggested after hefting a riding trophy—a massive bowl on which a skillfully engraved horse cleared a hedge jump.

"Thirty-three percent lead," said Miss Johnson. "That's what gives Waterford its weight—and its icy sparkle."

Modern Tourists Take to "Gypsy" Wagons

Good-natured Cork, 65 miles farther along, ranks second only to Dublin in population, though it shelters less than a quarter as many people. But it has its own roster of charms, including the south-of-Ireland's lilting accent and —like Paris—a river encircling its heart. The Lee, wrote poet Edmund Spenser, "encloseth Corke with his devided flood."

We found midtown traffic stalled uncomplainingly behind a gathering of barrel-shaped, horse-drawn wagons. Each carried four berths, a tiny kitchen, and a quartet of fresh-faced Dutch teenagers enjoying one of the world's greatest bargains in leisurely travel. For about $15 each a week, they dozed or read while a patient horse pulled them slowly from town to town through some of Ireland's most beguiling countryside.

Not all the caravans are freshly painted, though, or driven by youths on holiday. You can spot the odd wagon a mile away by the ragtaggle of harness and pots and broken-down wheels and pieces of old iron tied to it and by the number of people with it, some of them like as not walking because there's no room inside. This will be a family of tinkers, Ireland's "gypsies," many of whose ancestors took to the roads during the Great Famine (page 388). The villagers fear and mistrust them, for they live as often by their wits as by honest labor.

Here's a story about some tinkers:

One dark day a band of them came into an ironmonger's and funeral director's shop in the

(Continued on page 377)

Like a spider's tracery, stone walls web the face of County Galway. Despite the green that mantles Ireland, many of her farmers—particularly in the west—struggle to wrest a living from such thin, rocky soil. In centuries past, hardship drove thousands to emigrate. During the past 70 years the Irish Land Commission has purchased most farms and resold them to former tenants. Still, westerners desert their land for opportunities in Ireland's cities. The farmers who remain, most on small holdings, pasture sheep on the sparse grass and furze, and grow potatoes in scant patches.

But the land has recently offered a new source of wealth. Here in Galway mining operations uncover lead, zinc, and silver. In County Tipperary, an area that has been called a "little green Klondike" yields silver, zinc, copper, and lead. Metals, ores, and scrap brought in $26,000,000 last year.

PHOTOGRAPHED BY JAMES A. SUGAR © N.G.S.

Horn makes a handle for a County Cork farmer. Michael Toomey steadies a struggling sheep as he shears five pounds of fleece in three minutes. Coarse wool from these Scottish blackface sheep will be woven into carpets.

west of Ireland. (You'll seldom find an Irish undertaker who hasn't some other business to tide him over periods of good health among his neighbors.) One of the tinkers had died, and his friends wanted to bury him before they moved on. The only trouble, he was a great beef of a man.

The undertaker's clerk showed them the biggest box he had. They shook their heads doubtfully, then brightened. Shouldn't they just borrow it to try it on? Who, thought the clerk, could turn away even a tinker at such a time.

The little band was back next morning, eyes downcast and shaking their heads. They gently set the coffin back where it had stood. A week passed before the undertaker found out how cleverly the tinkers had ensured a free and decent burial for their departed mate.

Just before Sunday noon we dutifully searched out Protestant St. Ann Shandon, whose piebald steeple—built from red stones and white ones salvaged from earlier structures—houses Cork's famed Bells of Shandon,

Whose sounds so wild would,
In the days of childhood,
Fling around my cradle
*Their magic spells.**

I had heard that visitors are permitted to try their hands at playing the famed bells, but the front door was firmly locked. We could see crowds streaming from a neighboring Roman Catholic cathedral.

"There aren't many of the other denomination here," a homeward-bound Catholic paused to tell us in a confidential whisper. "We're 95 percent Roman in the Republic, you know."

I doubt that daytime visitors ever find the gateway to Cork's other major attraction closed, though some of them may dismiss the whole thing as so much blarney. We didn't, and found Blarney Castle entrancing—a super-ruin where, for as long as they like, youngsters can crawl into dungeons, peer from sally ports, and stomp through the bedroom of the Lord of Blarney, whose pleasant but evasive answers, Irish tradition tells us, led Queen Elizabeth I to add his name to the English language.

As for the stone: Visitors who decide to go through with the kissing ritual might remember this. When you've succeeded in bending backward far enough and are hanging upside down eighty-some feet in the air (page 372), don't panic and kiss the wrong stone. The Blarney Stone is the lowermost piece, a block about one foot by four feet. From the looks of the lipstick and hair-oil smears, about half of Blarney's visitors wind up kissing the wrong block, the one just above it.

Vale Best Tasted a Sip at a Time

We moved on from Cork, threading the back roads by preference. One took us to popular pastel-hued Kinsale, which drapes the hills round about the River Bandon like some half-forgotten Mediterranean fishing port. On another, a sign told us we had come to Ballinascarthy, so tiny that most guidebooks omit it altogether. I'm surprised. There ought to be a monument put there by the American Automobile Association. If Henry Ford's father hadn't left Ballinascarthy in the famine years, we might have had to do without the Model T and all its offspring.

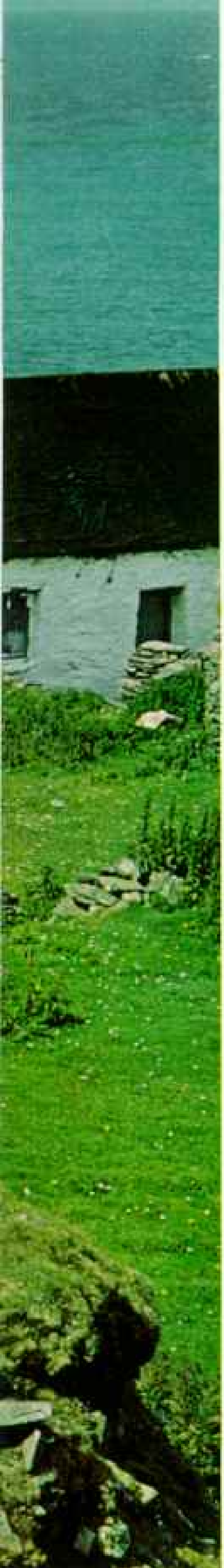
Ahead now lay the fabled and largely unsung vale of Killarney—unsung because, as the irrepressible Brendan Behan once put it, "even an ad-man would be ashamed to attempt to eulogize it."

The Irish insist that Killarney's glories must be tasted a sip at a time, like fine brandy. To drive the point home, they bar automobiles from some of the best trails round the three lakes. Audrey and I made the circuit from crowded Killarney town in a two-wheeled jaunting car; Ken, in a burst of enthusiasm, rented a saddle horse and galloped off ahead.

Gently ruffled water appeared, lying beneath mist-veiled mountains. At Muckross Abbey mossy stones marked the resting places of generations of MacGillicuddys, MacCarthys, and O'Sullivans. A lordly manor house opened its doors to us, and we climbed Ross Castle's crumbling tower for a beguiling view of Inishfallen Island. And linking them all like a green thread were the trails that coil through the valley's exuberant vegetation.

*From "The Bells of Shandon" by Francis Mahony ("Father Prout").

Glowing fire and afternoon sun light the shop of blacksmith Patrick Toomey in the quiet village of Foulksmills. Beside an empty anvil, he leans on the brick frame of his forge and waits for customers who bring horses to shoe, wagons to mend, and tools to straighten. From piles of scrap metal, he will select the proper piece for each job.



PEN-AND-INK DRAWINGS BY JOHN SERRALL © N.G.S.

Abandoned to the surge of the sea, once populous Great Blasket Island rides the stormy North Atlantic off the Dingle Peninsula. A visiting artist (left) matches his paints to the hues of derelict houses and sunny strand. The three-square-mile outcrop teemed with life in the 1800's, when mainlanders took refuge here from harsh laws and landlords. They raised sheep and chickens, cut peat from the hillsides for winter fires, and harvested the sea. One year they drove porpoises on shore to butcher and salt; in bad times, cargoes from wrecked ships helped ward off hunger.

"All of them had the spirit of the sea and great ocean in them," Tomás Ó Crohan wrote of Blasket's children in his autobiography, *The Islandman*. But Ó Crohan saw the end coming 40 years ago. "The like of us," he predicted, "will never be again."

The harsh life turned young people away. In 1955, the last 25 inhabitants accepted a government offer of low-rent cottages on the peninsula. Former residents (above), who rowed four miles from the mainland in canvas-and-wood curraghs, retrieve a window from a dilapidated house.

Killarney's well-touristed glories marked the end of our swing across southern Ireland; ahead now lay the perfect contrast. "Go right out to the tip of the Dingle Peninsula," a friend in Dublin had advised. "It's where city people like me go to hear Irish spoken properly, and to watch men who still know how to grow a field of hay."

There was something else there too—the Great Blasket. Until a few years ago this gale-lashed rock supported Ireland's westernmost settlement, the one about which people said, the next parish is America. I wanted to see if anything was left of the rugged hamlet where a handful of Gaelic-speaking fisherfolk had clung to their cruel life—"ploughing the sea," Blasket-born Tomás Ó Crohan called it—long after men almost everywhere else in northern Europe had turned to kindlier ways of earning a living.

"One day there will be none left in the Blasket," Ó Crohan wrote in *The Islandman*, his book about the agony and nobility of life on a storm-scoured rock in the Atlantic. And, said he, "the like of us will never be again."

Island Life Lives Only in Memory

Ken and I sought out John Larry Cavanagh to ask if he could take us across the four-mile stretch of water. "He's on the field," said Mrs. Cavanagh from the door of her whitewashed stone house in Dunquin. "Up there. Ye'll find a small b'y, a big b'y, and himself."

Strong, sinewy John Larry (page 355) and his two boys were manicuring a freshly mowed field spiked with towering haycocks. "Ye'll have to wait," he said. "We're expecting the bull in the bowler hat. The coat-and-tie bull," he added of the government agent who goes about improving Ireland's livestock through the magic of artificial insemination.

That afternoon Mr. Cavanagh rounded up Tomás and Maurice Daly (Blasket men both, they pronounced it "Dawley"), and the three of them lifted a black 26-foot-long curragh down a concrete ramp and eased it into the sea. It was my first sight of one of these frail boats, built like an old-fashioned canoe of cloth stretched over a wooden framework.

As the curragh rolled in the surf, a stone bruised its bottom. A jet of water began to well up through the single thickness of tarred canvas. Tomás Daly calmly stuffed a bit of burlap sacking between the hole and a wooden rib to slow the leak and beckoned us aboard.

For nearly an hour Ken and I sat low in the boat, watching as the island ahead of us alternately lifted above the heaving sea and then dropped from sight. Each time the men bent to the weight of their long, narrow-bladed oars, I could feel the canvas bottom of the boat give with the suck and pull of the sea.

In speech and song, Irish lasses tell their nation's story at 500-year-old Knappogue Castle in County Clare. The pageant follows a medieval banquet featuring beef and goblets of mead. To provide the entertainment, the Shannon Free Airport Development Company leases part of the castle from its owner, Texan Mark Andrews.

"Twenty years ago I left here," said Tomás Daly after we had landed and climbed up to the village. He kindled a little fire of driftwood in the house he had grown up in, and put on a pot to boil. For an hour the hamlet flickered feebly to life as the Dalys brewed tea while Ken and I explored its ghostly lanes. Then we all sprawled outside in the soft July sunshine. And, inevitably, the Dalys reminisced on the life they had left so long ago and would never know again.

"Cold rain and snow in the winter," said Tomás, "with hardly a bit of daylight and the wind blowing all the time. And ever a trip to the mainland to buy your bread and meat or to hear Mass. And the worst of all," he added, "for the young ones at least, was this: There was no one to marry." Finally, in 1955, the Irish Government persuaded Great Blasket's 25 remaining inhabitants to give up and move to the nearby mainland.

As we climbed back down to the curragh, Tomás carried a weathered windowframe under his arm. Slowly, the houses of Great Blasket are being reduced to ragged piles of stone as men bring back a doorway or a

KODACHROME BY JAMES A. SUGAR © NATIONAL GEOGRAPHIC SOCIETY

plank here, a window there, to use in homes on the mainland (pages 378-9).

The fields grew ever stonier as narrow roads led us into castle-dotted County Clare. "Hundreds of castles," said an Irish friend who met us at Shannon Airport. "More than anywhere else in Ireland."

I pricked up my ears. Before leaving home, I had read an article about shopping in Ireland—shopping for, among other things, castles. O'Brien's Castle, it had said, ringed by a 12-foot moat, for only $4,500—though it did "rather need a roof." Castle Macgarrett: no moat but with roof, central heating, and eight bathrooms, for $56,000.

We settled, as do most of Ireland's visitors, for something less than ownership of one of these drafty piles of stone. Brendan O'Regan, who "invented" Shannon Airport's duty-free shopping center (he saw it as a way of keeping Shannon alive when transatlantic planes no longer needed the airport as an intermediate fueling stop), is also Ireland's most experienced castle expert—on real live castles, at least. He supervises three magnificent examples in which, nearly every night of the year, groups of visitors are whisked back in time to the days of knighthood (preceding pages).

New Life Pulses in Irish Castles

Our favorite was grim, gray Bunratty, where, from the moment they offered us bits of bread dipped in salt—the hallowed Irish gesture that guaranteed the safety of a home's "most noble guests"—the castle's beautiful hostesses cast an irresistible spell. And so did the food: *Braume Brose* or *Sew Lumbarde*—vegetable or fish soup—and *Chekyn's In Browet*—capons simmered in red wine.

"The drink in your goblet," a green-eyed Irish beauty in a low-necked velvet gown intones, "is mead, made from fermented honey." And scorning the dictionary's cynical explanation of how the honeymoon got its name (the sweetness of love, like the moon, is no sooner full than it begins to wane), she substitutes the castle's own romantic version:

"In the 15th century, newly married couples drank mead for one month, or moon, after the wedding—hence, a honeymoon."

"More mead!" shouts a butler clad in doublet and hose as he refills cups with the hot and heady brew. Firelight dances on walls that have seen 500 years of Irish history, and laughter echoes again in rooms that once knew real knights and their ladies.

The imaginative Mr. O'Regan presides not only over castles but over the destiny of something known as the Shannon Free Airport Development Company. Using two kinds of bait—the absence of duty and the availability of the capable hands and minds of County Clare's people—Mr. O'Regan has landed some interesting fish.

Pianos Delivered Still in Tune

In all, 43 firms now contribute to Shannon's latter-day industrial revolution. Irish technicians, for instance, build pianos here for a Dutch firm. One of the bugaboos of manufacturing pianos used to be that of keeping dampness from damaging them during ocean shipment. At Shannon they're popped into big cardboard boxes, put aboard jets, and they're on the Continent or in the United States—and still in tune—only a few hours later. Other companies turn out products as varied as knitted dresses and fireplaces, computers and chemicals, office machines and floor polishers. And the De Beers company produces diamond grit here—some of it from synthetic stones made right in their Shannon plant.

Beyond Shannon lay Galway. Often described as the "most Irish of towns," it cherishes a tradition that Columbus came to its 14th-century Church of St. Nicholas to pray before setting sail for America. I asked the sexton about the story.

"It's just what ye've called it, and no more. There's a tale of a Galway sailor on the *Santa Maria*. But now the book writers have shoved him out and put in Columbus because it makes better reading for you Americans," he said and stumped away. We stumped away too, happy to have met a man with more respect for truth than for drama, and set sail next morning on the *Naomh Eanna*—St. Enda, in English—for the Aran Islands.

"Proudly as the Shannon flows through Limerick to the sea," sings an old ballad. The 1,100-year-old city on the estuary of Ireland's longest river once drew Norse and English overlords. Now a terminal for rail and sea traffic, it berths ocean-going vessels, and exports canned beef, dairy products, and copper concentrates. The County Home and Hospital, foreground, stands amid new houses, cricket fields, and tennis courts overspreading the north side.

HOME TO THE LONELY ARAN ISLANDS

comes a man who died in a Galway hospital. Old friends bear his coffin, brought 25 miles across Galway Bay on the steamer Naomh Eanna, *then by currach through the shallows to Inisheer. Island women still wear red skirts, once traditional throughout western Ireland.*

Three days a week—weather permitting—the steel-hulled vessel calls at Inishmore, and visitors go ashore for a few hours while the ship loads cattle and sheep at a concrete pier.

"Ten years ago there were only carriages here," said an islander, "and no televisions. Now there are cars and a lot of tellys—at least four or five."

Island Farmers Make Their Own Soil

We let the *Naomh Eanna* sail on without us and waited two days for its next call—long enough to explore the farthest corners of the island, where waist-high walls of piled stones enclose tiny fields of potatoes. The soil they grow in is made by the Aran people themselves from seaweed and sand.

"Lobstering's the big thing here," said the friendly islander who took us about in his jaunting car, "though in winter I'm a cockle picker myself. No, I've never tasted a lobster; they go to France. It's the money we'd rather have."

Neither Inishmaan nor Inisheer (*inish* means island) has a pier, so the *Naomh Eanna* anchors half a mile offshore. The men tow cattle and horses out through the heaving surf behind their curraghs, and the animals are hoisted aboard by winch.

Inisheer is the prettier of the two islands, crowned by a ruined castle that rises above a wide sandy beach. Beyond it a basking shark lay like a dark torpedo in the aquamarine water. Ashore, a gaggle of teen-age Dubliners—summer residents here to polish their Gaelic—trooped to the beach to share the excitement of boat day. At one end of the strand, sacks of cement were being brought through the surf three or four at a time by brawny men in curraghs.

"It must still be a hard life," I said to a teacher from Dublin who was there with the students. I was thinking of what winter must be like on this isolated bit of land.

Her comment surprised me. "Ah, it's good to see them doing

Snug in homespun, Inisheerman Coley Conneely laces a piece of raw cowhide with heavy twine to make a pampootie—but wears factory-made shoes himself. Another unfinished pampootie rests on his bench. The Aran footwear must be soaked often in water to keep it from drying into uselessness.

Working on this pair as a gift for the photographer, Coley sang Irish ditties. In return he asked only, "Could you send a book of American folk songs?"

Lashings of hot tea wash down a noon meal of mackerel, potatoes, and bread at the home of Michael Donohue on Inisheer; the cat wins the fish's tail. Like all Aran Islanders, the Donohues speak Gaelic at home but English with their guests. Mainland students board at such homes in the summer while studying the Irish tongue at the local school.

man's work," she said. "They spend most of their time bemoaning their fate and doing very little else."

Now County Galway's harshness gave way to the soft beauty of Sligo. This is Yeats country, where sentimental visitors often detour round Sligo town for a glimpse of a wooded dot in Lough Gill that was transmuted by the poet's magic into the familiar Lake Isle of Innisfree.

Poet's Own Epitaph Marks Yeats's Grave

A few miles farther on, in a churchyard in Drumcliff, a gray stone slab bears the epitaph William Butler Yeats wrote for himself: "Cast a cold Eye On Life, on Death. Horseman, pass by!" On the grave lay a withered rose, perhaps put there by someone who loved the words Yeats left us, and a black crow's feather.

Beyond Donegal town the road narrowed and turned west, alternately skirting the sea and threading the Donegal peninsula's rocky heights. We passed cottages with thatched roofs laced down against the ceaseless plucking of the wind. Sheep, their backs marked with daubs of red or green to denote ownership, huddled in the lee of low stone fences.

At a government factory in Kilcar, where weavers turn out County Donegal's long-wearing tweeds on a battery of clacking hand looms, I asked grizzled Con Furey how the red and green dye was removed before the wool could be spun into yarn.

"We don't try," he said. "Donegal wool's too coarse for the soft tweeds people want these days. It's used for carpets and heavy sweaters. Most of our wool now comes from the south."

"When I was a lad," he went on, "and all the tweed was made at home, a man would shear his own sheep. Then he'd go up on the mountain and pull heather for yellow. Moss from the stones gave him brown. Bracken—whin, we called it—made green. But people got to wanting brighter colors, so all the dyes are chemical now."

Just before Carrick a hand-lettered sign caught our eyes:

HOMESPUN TWEED FOR SALE
VISITORS WELCOME TO SEE LOOM AT WORK

A pathway led steeply down to a whitewashed cottage; inside, Michael Byrne talked as he worked on an 80-yard length of green tweed flecked with purple and orange.

"There are only a handful of independent weavers about now," he said, with the burr of Scotland in his speech. "I've that little sign up there to keep from getting lonely, and I can set my own hours and stop for tea when I've a mind to." He rose from the loom to refill his bobbins on a winder improvised from a bicycle wheel. One of his four children darted onto the loom's plank seat.

Roadside wanderers, tinkers park their horsedrawn caravan for the night. Distinct from gypsies, most tinkers are descendants of poor Irishmen who took to the roads as tinsmiths during the Great Famine. Now about five thousand strong, they follow fairs, do odd jobs, horse trade, and beg.

Livestock walks to market at Tubbercurry, County Sligo, where farmers bargain for cattle face to face. Now as the monthly fair day draws to a close, young men linger to gossip and boys play in a doorway. Boards protect the shop from passing animals.

KODACHROMES BY JAMES A. SUGAR (BELOW) AND NORMAN R. C. McBRIDE © N.G.S.

"**On the hills, the summer-shackled hills,** the sun spanged all day," wrote Irish poet Valentin Iremonger of a scene such as this in Glengesh Pass, County Donegal. Boys in their father's field raise haycocks like sand castles. Their future looks bright as private groups and the government

"Hey, hey," Mr. Byrne said fondly and swept him down again. "It's room there for daddy. Ye'll be at the loom in time enough."

Unfortunately, for every man as resourceful as Michael Byrne, there are dozens who must face the painful fact that here, as in much of western Ireland, there are neither jobs nor opportunities enough to go round. But at least one Donegal village has done something about it.

We drove on to Glencolumbkille, where outside help has come in the form of a government-owned tweed factory, and the people themselves have banded together to start a vegetable-canning plant, a textile factory, and a co-op for marketing the thick white fishermen's sweaters that Donegal housewives knit on winter nights.

Village Growth Slows Emigration

"Upwards of 25 young people used to leave here every year," said Father James McDyer, Glencolumbkille's dynamic priest. "Now we only lose three or four. Motorcars are up from four to 62, and community income has jumped from £40,000 to £120,000 a year."

We left Father McDyer and drove a few miles farther on to Malin More, where the

KODACHROME BY JAMES A. SUGAR (C) N.G.S.

push to diversify Ireland's economy. With his "Save the West" campaign, Donegal priest Father James McDyer promotes village co-operatives, more efficient land use, and new cash crops; the government encourages tourism, offshore fishing, and the establishment of new industry.

Atlantic crashes against Donegal's rocky coast, and then turned back toward Dublin. Only one thing remained: a sentimental pilgrimage to the little town from which my great-great-grandfather and his two sons came to the United States nearly a century and a quarter ago. Never mind that it lies outside the Republic in County Armagh, one of the six counties of Northern Ireland. There was only one Ireland then. Guards on both sides of the border waved us through with such bounteous good cheer that we could easily have thought the same holds true today.

On a street of old row houses, with the Union Jack fluttering above one doorway, I asked an old man if any Scofields lived thereabouts.

"Never heard the name myself," he said.

We tried the same question on the parson and then on the postmistress.

"None at all," she said with finality. "Not these past 59 years, anyway." And that, it turned out, was that.

It didn't matter, really. The whole trip had been a sentimental pilgrimage. It was a fitting thing for us as Americans to have seen this green and warm-hearted land from which so many of our ancestors came. THE END

LONELY CAPE HATTERAS, BESIEGED BY THE SEA

By WILLIAM S. ELLIS

Photographs by EMORY KRISTOF

Both National Geographic Staff

AT FIRST I SAW only the dolphins and the amberjacks, dappling the sea with their green-gold flashes. Then, from up on the flying bridge of our deep-sea fishing boat, Capt. Ernal Foster pointed to starboard and yelled, "See it? Smell the oil? Believe me now?"

The slick showed faint—a scatter rug of dirty rainbow stains—in the Gulf Stream off Cape Hatteras. No mistaking the odor, of course. So I became a believer in the story that the long-time skipper of charter boats insists is true.

The oil, Captain Foster told me, first appeared in 1942 and has been there ever since.

During the early months of that tragic year of maritime history, German submarines claimed a heavy toll of Allied shipping off Cape Hatteras and all of North Carolina's Outer Banks. Tankers and freighters plunged to rest in the already crowded "Graveyard of the Atlantic." And even now, after more than a quarter of a century, the waters remain stained by the lifeblood of war.

We were 15 miles offshore in seas so calm that the wreaths of

Golden calm of an August evening finds surf fishermen casting from Cape Hatteras, the tip of North Carolina's Outer Banks. This chain of Atlantic barrier islands shelters the mainland from ocean tempests. Heaped up by wind and wave, the Banks face constant onslaughts by their creators. Sands wash away from one spot to pile up in another, and inlets open and close at the whim of storms.

Lofty lifesaver, Cape Hatteras Lighthouse towers 208 feet, tallest in the Nation; its beacon can be seen 23 miles at sea. Next year the brick lighthouse will celebrate its hundredth birthday.

sargassum weed all around us lay quietly on the surface. Before we returned to port, however, this fabled piece of the Atlantic reverted to form, like water brought to a sudden boil. And I was glad, for this was the way I wanted to know Cape Hatteras, as mariners have known and feared it for hundreds of years—on an elevator of 10-foot swells, braced against a northeast wind strong enough to drive its chill through thick rubber foul-weather clothing.

The oil slick was gone now, obscured in the wash of the awful stirrings. We came upon treacherous shoal water, which the wind was peeling back to reveal a piece of rusted wreckage. I followed the fluctuations of the depth finder: 13 feet . . . 10 . . . 8. . . . The depth on either side of the boat was even less, for we were crossing the shoal through a narrow cut.

It occurred to me then that, though we were still nearly six miles out to sea, I could stand on bottom and have my head above water. Such are the traps of Hatteras that have snared vessels since the very beginning of American history.

Stage Setting for High American Drama

History is deeply inscribed in the sands of this coastal region. From the village of Kitty Hawk down to lonely Portsmouth Island, I found many a silent setting of dramatic events in the Nation's past. Here the first English-speaking colony in North America—Sir Walter Raleigh's famous Lost Colony—settled. Here, too, Wilbur and Orville Wright gave birth to today's Air Age. Pirates lived and stashed their booty on these shores, the same shores that defied British blockade attempts during the American Revolution.

Long-time summer resort . . . mountainous sand dunes and dense woods . . . refuge for nearly 200 species of birds, including Arctic-nesting snow geese—these also make up the region. More than anything else, though, the Cape Hatteras center slice of the Outer Banks stands as an open window on the violence of the sea.*

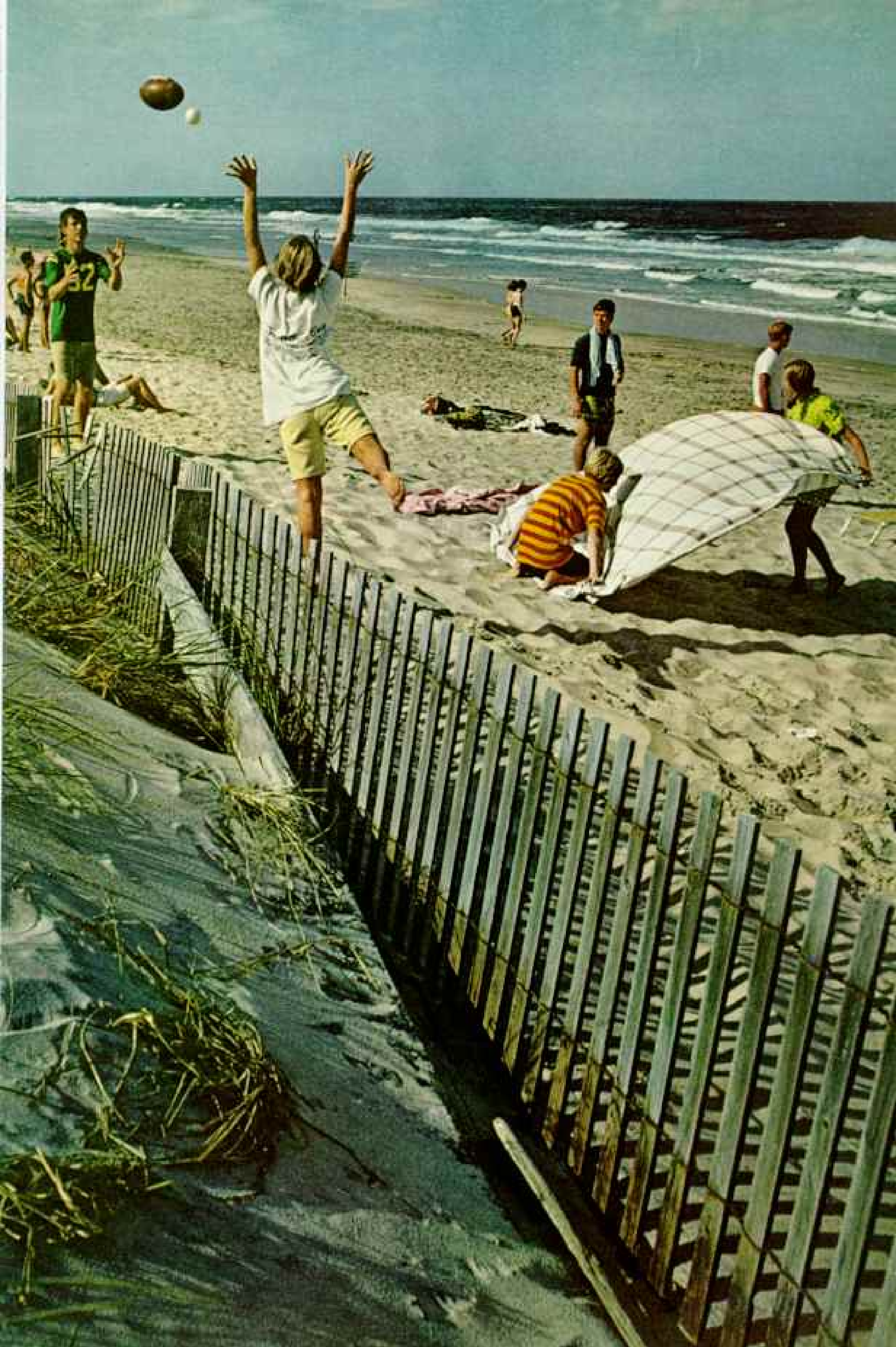
That evening, following our return to port, I walked along the beach with an old man, and we talked about storms and shipwrecks and the sassiness of mosquitoes. When I told him about the enduring oil slick, he replied, "Myself, I don't try to understand the things that go on out there, and I've lived here, man and boy, 74 years come February. I've seen the Atlantic do some things you wouldn't believe, and that's the gospel truth."

Other natives of the Outer Banks told me the same thing. To them, the ones who know it best, the sea at Hatteras is enigmatic and sometimes seemingly sorcerous, a place where winds and currents stir the ghosts of times when the cape exacted a toll of sorrow from passing ships (foldout map, pages 398-400).

At Cape Hatteras the chain of barrier islands making up the Outer Banks bends sharply in a protective embrace of the North

*See "October Holiday on the Outer Banks," by Nike Anderson, NATIONAL GEOGRAPHIC, October 1958.

For all the Nation to enjoy: Cape Hatteras National Seashore, established in 1953 as the first of its kind in the country, extends for 72 miles, beginning near the southern end of Bodie Island and running the length of Hatteras and Ocracoke Islands. Eight villages within the federal domain remain under private ownership (map, pages 398–400). Beside a fence installed to stabilize the sand, youngsters play "double catch" with a football and a softball. Miles of such fences, four and five ranks deep, lie beneath dunes also anchored by beach grass and sea oats.



Carolina coast. To the north lies the great sweep of Hatteras Island beach, now under the care of the National Park Service as the Cape Hatteras National Seashore. Continuing southwestward, it encompasses Ocracoke Island. Beyond Ocracoke Inlet stretches the more recently authorized Cape Lookout National Seashore. In all, the federal preserve strings out for 125 slender miles.

Ghost Island Reclaims a Resident

Southwest of Ocracoke lies Portsmouth Island, now awash in the silence of total abandonment. As recently as last fall, however, when I visited Portsmouth, there were five persons living on it, two of them sisters.

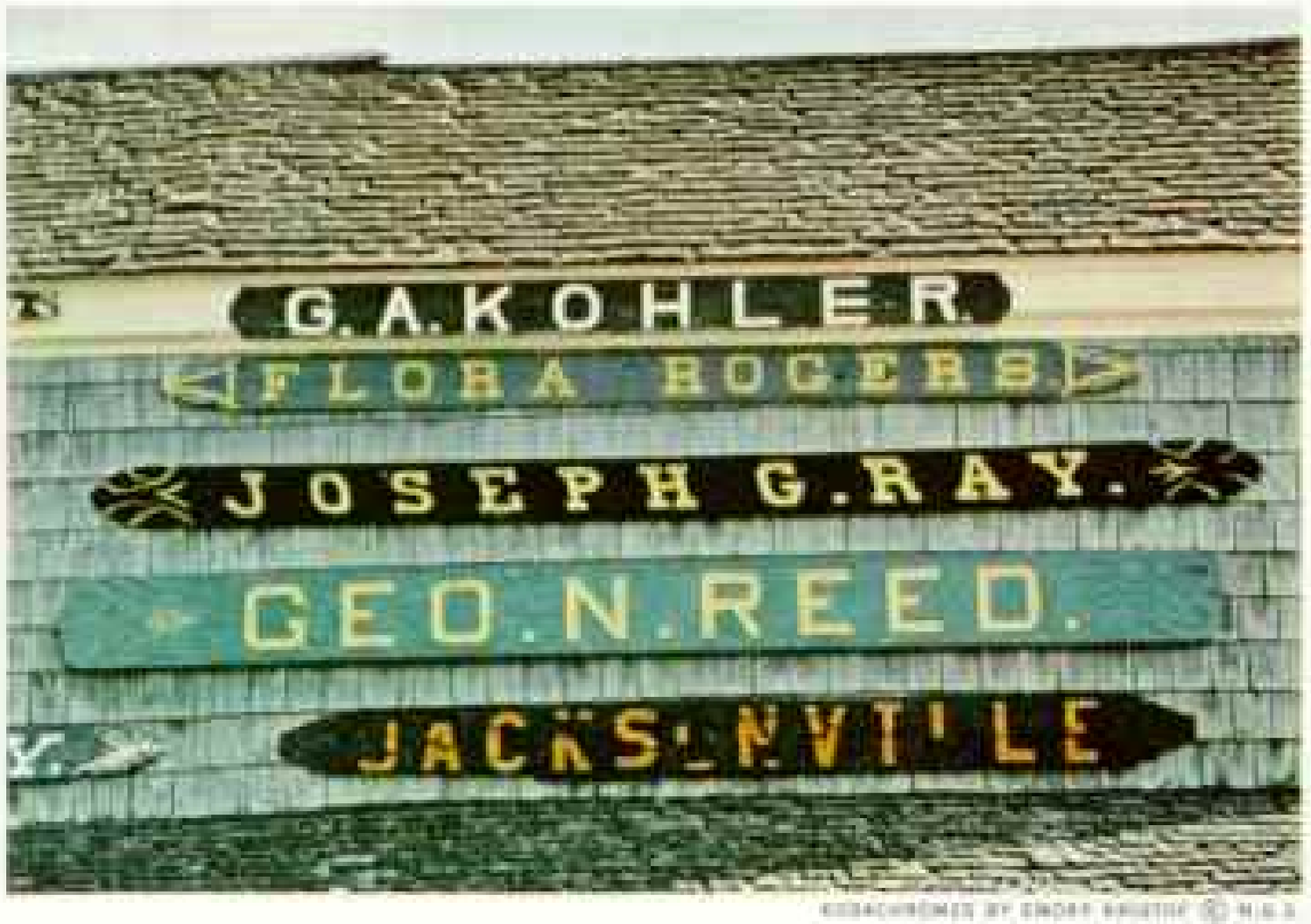
Henry Pigott was born on the island 75 years ago and has lived there off and on for 67 of those years. I found him at work painting the front porch of the house of one of the sisters, a spinster.

"There was a time," Mr. Pigott told me, when "two, maybe three hundred" lived on Portsmouth Island. In 1846 the Government constructed a seamen's hospital there. Inlet pilots built imposing homes, ship traffic was heavy, and the community flourished.

But that's all past now. Heavy growths of wax myrtle and other bushes of trampoline-like resiliency cover the island. The former post office building, not much larger than a tool shed, stands padlocked; inside, a net of

Roster of the wrecked, ships' nameboards decorate a house in Old Nags Head. Collected over the years by the cottage owners, most of the weathered boards were salvaged from vessels driven onto the shoals; others washed in from the sea.

Snug harbor of Ocracoke offers sanctuary to fishing boats and pleasure craft, beckoned home by its 146-year-old lighthouse. Pilots who guided ships through Ocracoke's inlet in the early 1700's founded the village. Today ferries link it with Hatteras Island and the mainland.



KODACHROMES BY ERNEST KRUTTY © N.G.S.

Ghost Fleet of the Outer Banks

Ill-fated ships lie forever anchored in the coastal sea floor. For this map NATIONAL GEOGRAPHIC *staff member Dorothy A. Nicholson plotted more than 500 wrecks, from the British Tiger sunk in 1585 in Ocracoke Inlet, to the fishing trawler* Sarah J., *lost in 1961 in Oregon Inlet. Many vessels went aground in fog or storm. Wars took a further toll. Federal and Confederate gunboats battled to the finish. World War I U-boats sank many vessels, including the Diamond Shoals Lightship, and Nazi submarines in World War II torpedoed freighters and tankers.*

Sloop · Schooner · Brigantine · Brig
Bark · Ship · Steamer · Submarine · Other wrecks
Lighthouse · Campground · Ferry
Coast Guard station · Inactive Coast Guard station

Soundings in feet

Hampton
James River
Chesapeake Bay
Smithfield
Newport News
Hampton Roads
Cape Henry
Norfolk
Virginia Beach
Portsmouth
Chesapeake
Dam Neck Mills
Suffolk
Deep Creek
Oak Grove
Great Bridge
Dismal Swamp
Lake Drummond
VIRGINIA
NORTH CAROLINA
Knotts Island
Sunbury
South Mills
Sligo
Currituck
Morgans Corners
Great Swamp
Barco
Camden
Elizabeth City
Winfall
Hertford
Coinjock
Carolla
Duck
Southern Shores
Currituck Sound
North R.
Pasquotank R.
Perquimans R.
Chowan R.
Back Bay National Wildlife Refuge
Back Bay
False Cape
Currituck Beach Light
Chesapeake Bay Bridge-Tunnel
Intracoastal Waterway
Great Bridge Locks
Coast Guard Air Station

JAMES M. VANCE, 1879
CHLORE, 1942
WELARA, 1889
FRANCISCO BELLAGAMBA, ITALIAN, 1878
THOMAS F. POLLARD, 1920
LENA HUNTER, 1885
SANTORE, 1942
JOANNA M. CANN, CANADIAN, 1881
EMMA F. HART, 1889
H. W. RACE, 1892
PAUGUSSETT, 1886
KINGSTON CEYLONITE, BRITISH, 1942
ALBERT C. PAIGE, 1884
AGNES BARTON, 1889
JENNIE HALL, 1900
BLANCHE, BRITISH, 1869
TIGER, 1942
VOLTA, 1841
ELIZABETH, GERMAN, 1887
NELLIE V. HOWLETT, 1903
FIDOGNA, ITALIAN, 1883
LEWIS A. BOMMELL, 1884
LEONORA, 1847
CITY OF PHILADELPHIA, 1896
HORNET, 1849
C. L. ALLEN, 1855
NETTIE, 1896
GRAY EAGLE, 1888
FLORENCE SHAW, 1908
PACIFIC, 1846
EXPRESS, 1902
EMILIE FRENCH, 1843
TINTO, BRITISH, 1874
ADMIRAL, NORWEGIAN, 1879
STAFFA, BRITISH, 1897
CYTHIA, NORWEGIAN, 1894
WILLIAM H. MACY, 1913
ABIO PARKER, 1884
RALPH, 1832
JOHN S. WOOD, 1888
ELIZA, BRITISH, 1833
WILLIAM MUIR, CANADIAN, 1871
REVENUE, 1818
KILGORE, 1842
R. B. FORBES, FEDERAL, 1862
ORAN SHERWOOD, 1852
VICTORIA, 1843
TAUGH A BALLAGH, CANADIAN, 1873
BALTIC, 1837
A. ERNEST MILLS, 1929
NUOVA OTTAVIA, ITALIAN, 1878
M. A. FORBES, BRITISH, 1870
N. BOYNTON, 1888
GEORGIA, 1818
HENRIETTA PIERCE, 1853
METROPOLIS, 1878
GRACIE D. CHAMBERS, 1918
VIRGIA, CANADIAN, 1891
ORIENTE, PORTUGUESE, 1907
ADA F. WHITNEY, 1885
THOMAS J. MARTIN, 1883
HARKAWAY, BRITISH, 1883
HENRY G. RAE, 1876
MOMIE T., 1920
ED. J. HERAPE, 1877
J. S. HOLDEN, 1903
HUNTER, 1932
MOUNTAINEER, BRITISH, 1852
EMMA J. WARRINGTON, 1892
ST. RITA, 1932
CHARLES S. HIRSCH, 1909
MC DONOUGH, 1884
JOHN MORGAN, 1942
HATTIE DUNN, 1918
LILLIAN LUCKENBACH, 1943
PAN MAINE, 1942
SPRING CHICKEN, 1944
SAMUEL WELSH, 1888
BYRON D. BENSON, 1943
CHANSHELD, 1960
SEA BIRD, CONFEDERATE, 1862
TANNY, CONFEDERATE, 1862
FORREST, CONFEDERATE, 1862
BLAKE WARRIOR, CONFEDERATE, 1862

Edenton

Albemarle Sound

Epochal flight of the Wright brothers lasted for 12 seconds as their flying machine lifted above the sands near Kitty Hawk, December 17, 1903.

Kitty Hawk
WRIGHT BROTHERS NATIONAL MEMORIAL
Kill Devil Hills
Jockey Ridge
Nags Head
FORT RALEIGH NATIONAL HISTORICAL SITE
LOST COLONY
CURLEW CONFEDERATE 1862
Manteo
Whalebone
Roanoke Island
Bodie Island
Wanchese

Columbia
Plymouth
Creswell
Phelps Lake
Pungo Lake
PUNGO NATIONAL WILDLIFE REFUGE
New Lake
ALLIGATOR RIVER CANAL
Alligator River

Fort Raleigh National Historical Site marks the first English settlement in the New World, on Roanoke Island in 1585-86. Other settlers came in 1587. Three years later they had disappeared, leaving only the word "Croatoan" carved on a stockade post.

Sandy Point
Gibbs Point
Rodanthe
Waves
Salvo
Avon
Buxton
Frisco
Hatteras
Cape Hatteras
Hatteras Inlet
Ocracoke Island
Ocracoke
Springer's Point
Ocracoke Inlet
Portsmouth Island

Belhaven
Fairfield
MATTAMUSKEET NATIONAL WILDLIFE REFUGE
Lake Mattamuskeet
Scranton
Engelhard
Swanquarter
SWANQUARTER NATIONAL WILDLIFE REFUGE
Pungo R.
Pamlico River
Long Point
Hog I.
Bluff Point
Oriental
Neuse River
Atlantic
Sealevel
CEDAR ISLAND NATIONAL WILDLIFE REFUGE
Core Sound
Morehead City
Beaufort
Harker's I.
Core Banks

Pamlico Sound

Cape Hatteras National Seashore (shown in green) extends from Bodie Island to Ocracoke Inlet. From there, Cape Lookout National Seashore extends southward nearly to Morehead City.

Gull I.
Hatteras Island
CAPE HATTERAS NATIONAL SEASHORE
CAPE LOOKOUT NATIONAL SEASHORE (Authorized)
Cape Lookout
Shoals

Tales of buried treasure abound along the Banks, a favorite haunt of pirate Edward Teach, known as Blackbeard. The buccaneer's career ended in 1718 when two British warships caught his sloop Adventure inside Ocracoke Inlet.

North Atlantic Ocean

Continental Shelf

Cherished as a raft, and "so can be a shingle," sailors called the Monitor, first Federal ironclad in the Civil War. Towed by a steamer en route to South Carolina in 1862, the Monitor began to swamp in a gale. The steamer reached calm at the eyes, as men went down with the gunboat somewhere off Cape Hatteras.

Brig. Gen. William (Billy) Mitchell proved the vulnerability of ships to aerial bombardment when his airmen sank the Virginia and New Jersey — battleships marked for scrapping — off Diamond Shoals in 1923.

Washington, D.C.
DELAWARE
MARYLAND
VIRGINIA
Richmond
Petersburg
Jamestown
Norfolk
Raleigh
NORTH CAROLINA
New Bern
Cape Hatteras
Wilmington
SOUTH CAROLINA
Georgetown
Charleston
AREA ENLARGED
Gulf Stream

Shipwreck data obtained from material compiled by Outer Banks historian David Stick, Kitty Hawk, North Carolina; The Mariners Museum, Newport News, Virginia; and U. S. Navy records. Nationality of foreign ships given when known.

STATUTE MILES
NAUTICAL MILES

Desperate men once clung in terror to the deck of the *Priscilla* (above), here lined with sightseers. Damaged in the great hurricane of 1899, the barkentine ran aground near Gull Shoal Lifesaving Station. After a mountainous wave swept the captain's wife, two sons, and the cabin boy overboard, the 10 men remaining awaited certain destruction. But Rasmus S. Midgett, on solitary beach patrol, heard their cries. Dashing repeatedly through the towering breakers, he dragged all to safety. Midgett's feat earned him the Gold Lifesaving Medal of Honor.

The *Nomis* (below) was wrecked in August 1935 with all aboard saved. Many a shipwreck survivor owed his life to the Lifesaving Service, which became part of the U. S. Coast Guard in 1915.

ARCOCK BROWN COLLECTION (TOP); THE MARINERS MUSEUM, NEWPORT NEWS, VA.; A. A. HOENSTABLER COLLECTION

spider webs covers the openings in the letter-sorting case.

One of the best preserved structures on the island is the church, which Henry Pigott kept clean and tidy and in good repair. He even rang the church bell each Sunday morning—not so much as a call to worship (services were discontinued long ago), but as a pealing requiem for the island's better days.

Few outsiders visit Portsmouth, and that suited at least one of the five residents just fine. Fred Cannon, who lived alone at one end of the island, told me: "I haven't had a tie on since I came out of the service in 1946. Ain't that wonderful?"

One of the sisters died last January in a hospital on the mainland, and the others moved away. Mr. Pigott insists, however, that he will one day return to his little pink house down by a swash on the island.

For Fred Cannon, only death could take him from the island's solitude which he cherished. In April of this year, his 16-foot skiff was found swamped in Pamlico Sound. His personal belongings washed up on the beach. An investigation by the Coast Guard concluded that he fell overboard and perished.

Only 500 feet wide at some points and isolated from the mainland by broad, shallow sounds, the three major segments of

the Outer Banks—Bodie (pronounced body), Hatteras, and Ocracoke Islands—form a trinity of subservience to the whims of the Atlantic. The landscape undergoes never-ending change. One piece of beach erodes away, and another gains ground; drifting sands plug one inlet, and storm-driven waves pry open another; a section of bridge from which fishermen once dropped lines into 20 feet of water now spans a mud flat.

Arab Ancestor Came Ashore on an Oar

One thing that doesn't change, however, is the character of the Outer Banks and the people who inhabit them. Marinated in some of the richest juices of sea-oriented history, the Banks remain charged with a flavor unique in all the country. Only on these islands is one not overly surprised to find a descendant of a shipwrecked Arab selling homemade fig preserves.

"He was my great-great-great-great-grandfather, a full-blooded Arab," Harvey Wahab told me as we sat on the screened porch of his house, across the street from the Ocracoke Post Office. "He was shipwrecked here in the 1700's. Came ashore on an oar."

Harvey Wahab, 67, pronounces his name WAY-hab. "Away back, though, it was WAH-hab," he said. "Fellow from Arabia once told me it's WAH-hab over there."

Born on Ocracoke Island and retired from

Full fury of Gladys, the hurricane of October 1968, lashes the shore at Nags Head. Surprisingly, the dread floods brought by these storms come not so much from the ocean as from the sounds on the inland side. As the hurricanes move north from the Caribbean, long swells push water through the inlets. Then as the eye passes and the wind shifts, the waters spill out again, sweeping furiously over the low Outer Banks.

Lonely sentinel of the sea, Diamond Shoals Light Station stands guard 14 miles from shore, warning of malevolent shoals in places only three feet below the surface. Four Coast Guardsmen man the station at all times, maintaining radio beacons and the light. Every two weeks a helicopter brings supplies and rotates half the crew. When storms threaten, the men take refuge ashore; dual generators run the automatic navigation devices.

the Coast Guard after 25 years of service, Mr. Wahab has seldom been very far from the Atlantic. I asked him if he didn't sometimes long for a place out of earshot of surf noises, a place where wheat ripens in the sun. He shifted position in the old wooden porch chair and said:

"When I was in the Coast Guard, a friend asked me what I was going to do when I retired. I told him I was going to put an oar on my shoulder and start walking to the northwest. As soon as somebody asked me what I was carrying, I'd stop and settle there. But I'm still here, and reckon I always will be."

Many of the islands' native-born are descendants of English seamen who settled here long before America won its independence. Visitors to the Outer Banks often detect what they think to be a dialect and idiom of old England in the speech of the islanders.

Tide is "toide," and when it's high, it's "hoigh." Water that bubbles over a fire "biles." I once stopped to talk with a life-long resident of the Hatteras Island village of Salvo who was just back from a fishing trip. When I asked him how he made out, he replied, "Oh, I caught a slew, but they were all tee-toncey," meaning he caught many but they were all tiny.

But this is a tongue shaped by years of isolation, a dialect decidedly more Southern than 17th- or 18th-century English.

Unlike those of Harvey Wahab's youth, summers at Ocracoke now draw vacationists, but not so many as to rouse the island from its drowsiness. They come to see the 146-year-old Ocracoke Lighthouse, one of the oldest on the East Coast still in service, and the dozen or so ponies, formerly wild but now penned and fed by the Park Service. Supposedly these ponies descend from Arabian horses shipwrecked more than a century ago.

Another attraction is Springers Point, on the southerly end of the island; there, legend says, Edward Teach had his hideout.

Teach's ferocious appearance—facial hair twisted into pigtails and fashioned with small ribbons, lighted tapers sticking out from under his hat—brought fear to those who encountered him. They called him Blackbeard.

For much of a year Teach terrorized shipping along the coasts of the Carolinas and Virginia. Death came to him in 1718 in Pamlico Sound near Ocracoke when, in a fight with a young British Navy lieutenant, he "received above 20 wounds," a contemporary account relates, "before he fell down dead."

Later that century, in the same vicinity, the British had less success in stopping the flow of supplies to American revolutionary forces. Unfavorable weather and shoal waters stymied attempts by British warships to blockade the inlet between Ocracoke and Portsmouth Islands. Smaller, more maneuverable vessels supplying the colonists continued to slip through the waterway.

"The contemptible port of Ocracock . . . has become a great channel of supply to the rebels," wrote the colonial governor of North Carolina. Indeed, when General Washington's troops were at Valley Forge, one supply plan called for passage through the inlet at Ocracoke.

Following the Revolution, Ocracoke continued to grow in importance as a port. In 1787 nearly 700 vessels reached the North Carolina mainland through the inlet. Changes in currents and failure of dredging to keep pace with sands drifting into the inlet, however, did much to end the trade.

Most of the summer visitors to Ocracoke are campers down from Hatteras Island. They arrive on the free state-operated ferries that push back and forth across Hatteras Inlet. Of the seven campgrounds in the 28,500-acre national seashore, four are on Hatteras. Two of those stand on the ocean, although one wasn't planned that way. It was 1,300 feet from the water when the beach was first opened in 1958, but erosion has chewed off most of that distance.

Cape Hatteras National Seashore was established in 1953, the first of

Worn by sea and sand, a derelict schooner provides a sun screen for a lady on the beach. The *Laura A. Barnes* ended her last voyage on June 1, 1921, on the wave-wracked shore of Bodie Island. Dozens of once-proud ships lie entombed beneath the dunes. Sometimes storms bare the bones of one of these long-forgotten vessels, but the winds soon bury them again.

KODACHROME BY MANUEL L. LOPEZ, NATIONAL GEOGRAPHIC STAFF © N.G.S.

Waiting for the ferry, laughing gulls perch on the mooring at the Ocracoke landing. As the vessel leaves the dock, the flock follows, begging passengers for a handout. In addition to sea and shore birds, the Banks abound in winter-resident waterfowl, particularly greater snow geese, which come by the thousands to Pea Island National Wildlife Refuge.

its kind in the Nation.* From Whalebone on Bodie Island to the southern tip of Ocracoke, the sandy land, except for the village locations, was designated as belonging to all the people. Last year more than a million of them came for a visit.

Men and Sea Battle for the Shore

But the sea still contends for the land too. To combat erosion, the Park Service planted sea oats and American beach grass to catch the ever-moving sands and build them into the ridge of protective dunes now standing near the ocean. Someday groins, or jetties, may have to be built to seaward and an artificial beach created to protect a Navy facility near Buxton and the Cape Hatteras Light.

Many residents of the Outer Banks are wary of man-made defenses, especially dunes. They know that floodwaters come not so much from the sea as from the inland side. In earlier times the high waters escaped simply by washing over the flat islands, but now the newly developed sand dike stands in the way.

"The Park Service may know more than I do, but I still wonder what's going to happen when we have another bad hurricane," said Bernice Ballance, former surfman in the old Lifesaving Service. "I keep remembering the hurricane of 1899, before they put the dunes up, when there wasn't nothing to hold the water back.

"It was the worst storm I ever seen," Mr. Ballance said. "The water in our living room went over the Singer sewing machine. We had to move up to the attic until the storm was over, and when we did get the water out of the house, I'll bet there was a bushel or three pecks of snakes, eels, crabs, fish, and everything else under the staircase. You never seen such a mess."

Bernice Ballance also remembers a day in September 1944, when the wind velocity at Cape Hatteras reached 110 miles an hour, according to records at the cape's weather station. The entry contains this notation:

*There are now six other national seashores: Padre Island, Texas; Point Reyes, California; Cape Cod, Massachusetts; Assateague Island, Maryland-Virginia; Fire Island, New York; and Cape Lookout, North Carolina.

One of a million who visited the national seashore last year, a pretty vacationist delights in the salt breeze and uncrowded sands.

"Estimated. All instruments carried away. . . ."

Other residents told me that the devastating northeast wind of March 7, 1962, was the worst of all. Remembered on the Outer Banks as the Ash Wednesday Storm, the blow stirred the Atlantic until, hurling great heads of water, it severed Hatteras Island, carving out a new 500-foot-wide inlet just north of Buxton village.* Workers succeeded in closing it months later with sand and a wide variety of junk metal, including many old cars.

Mr. Ballance has faced both hurricane and nor'easter in his time, as have most islanders who once were members of the Lifesaving Service. The service began operations on the North Carolina coast in 1874 and functioned until 1915, when it was merged with the old Revenue Cutter Service to form the U. S. Coast Guard. A chain of stations was opened, each staffed by a keeper, or officer in charge, and six surfmen. They patrolled the beach on foot, and sometimes on horseback, always on the alert for a vessel in distress. And when the call came, as it often did, the surfmen pushed their 2,600-pound lifeboats into a wall-like surf, aware that a single wrong move might mean a serious injury.

The logs of duty stations in the Lifesaving Service are filled with accounts of heroism by men with the Outer Banks clan names of Ballance and Meekins and the legendary Midgetts.

On a winter's day, I sat on the abandoned beach where one of the first stations once stood and thought about Rasmus S. Midgett and the barkentine *Priscilla* (page 401). I had heard the story many times during my stay on the Outer Banks—how the vessel was stranded and breaking up as surfman Midgett happened by on his horse. He dismounted and ran through the crashing surf to the ship. He carried one crewman to safety on the beach and went back for another. Ten times he did this, somehow managing to survive a strain on his body that few men have known.

The official report of the incident, as logged by the station keeper, cuts through the drama to produce an epic of understatement: "R. S. Midgett, Surfman No. 1 on South patrol from 3 a.m. to Sunrise. He found a wreck Broken to Pieces 3 miles South of Station and on the Stern was ten men. He managed to save them all without coming to Station to report."

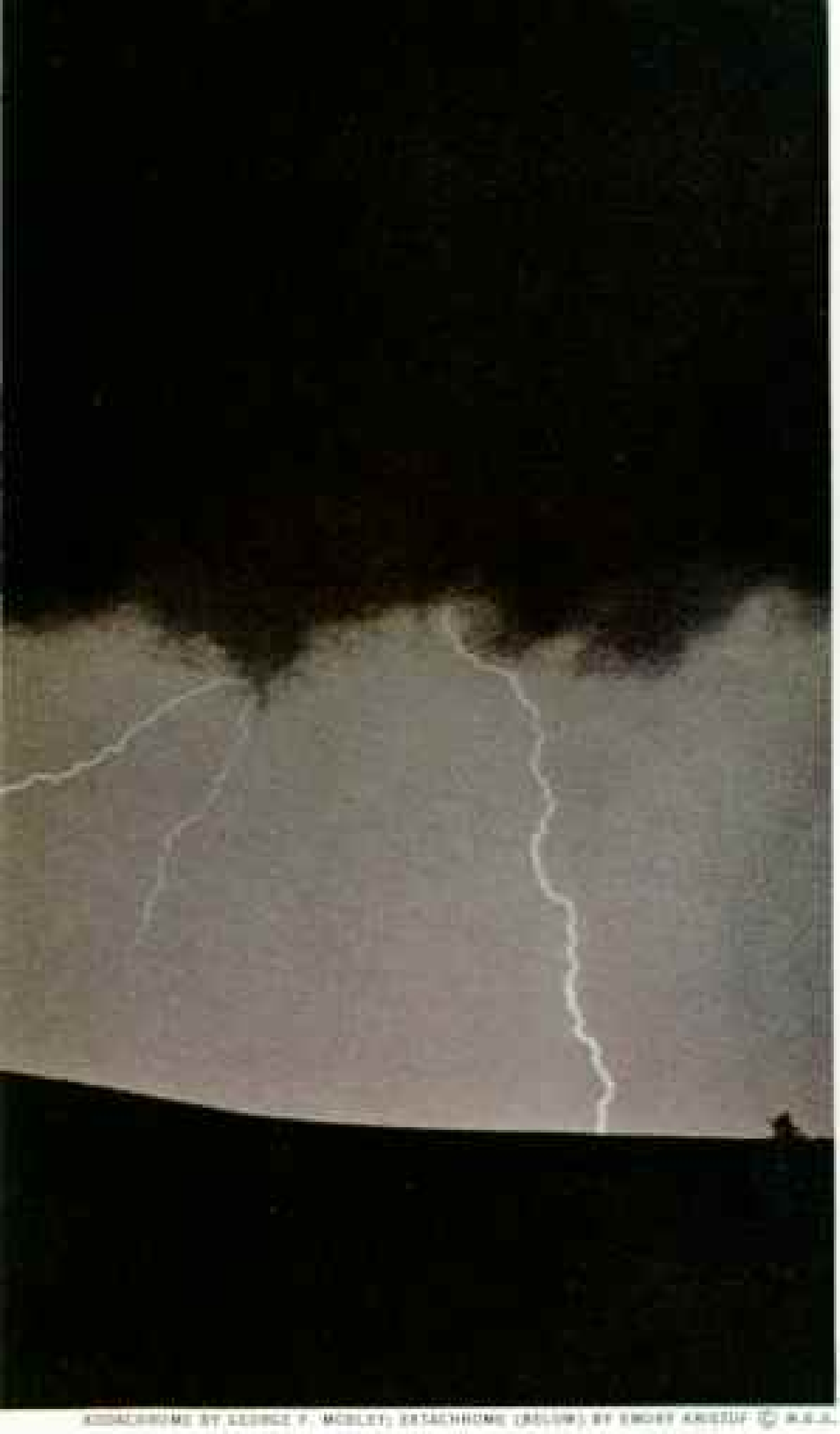
Rasmus Midgett was expected to do what he did, for in putting out to a sea that somersaults to shore, men of the service took guidance in the pithy departing benediction of their superiors: "The rules say you gotta go, not that you gotta come back."

The Lifesaving Service functioned along the coast of the Outer Banks as basically a winter operation. Now, with fleets of pleasure craft moving over the waters, summer is the season for rescue work. Oftentimes the mission involves nothing more than restoring a sense of direction.

"We stopped one pleasure boat that was 15

*See "Our Changing Atlantic Coastline," by Nathaniel T. Kenney, NATIONAL GEOGRAPHIC, December 1962.

Pioneer beach resort of North Carolina, Nags Head sprouted cottages and a hotel in the 1830's, when wealthy planters sought to escape the miasmas of inland swamps and marshes. The first development was on the side away from the ocean; not until the late 1800's did cottages begin to rise here on the Atlantic side. In those days most summer residents came to Nags Head on Memorial Day weekend and stayed until school reopened. Today, with good highways, vacationists come and go in a steady stream.



KODACHROME BY GEORGE F. MOBLEY; EKTACHROME (BELOW) BY EMORY KRISTOF © N.G.S.

miles out to sea," a Coast Guardsman on Hatteras told me, "and the skipper wanted to know if he was still in the inland waterway."

No longer are the old surfboats used in rescue work. Rather, personnel of the five Coast Guard stations along the Outer Banks rely on helicopters and a fleet of high-powered vessels, both large and small.

Hatteras is still the killer it always was, of course, but with swift communications, advances in safety-at-sea techniques, and sophistication of tools for rescue, tragic incidents along the coast occur only rarely now.

Fishermen Cast Into Crashing Surf

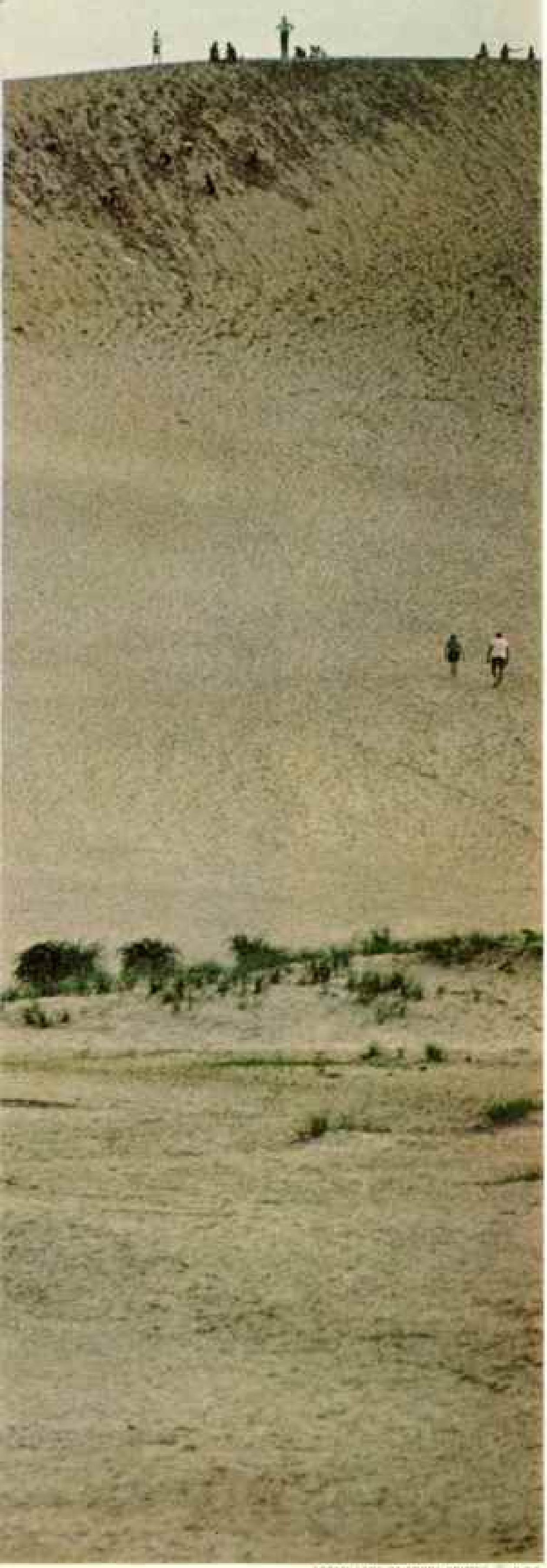
Bernice Ballance went with the Coast Guard when it absorbed the Lifesaving Service in 1915. He retired in 1946, and now, at the age of 85 and with a box full of medals in his dresser drawer, he spends most of his time fishing in the Cape Hatteras surf. He likes to get there at what he calls the "peep of day," especially during the fall months when the channel bass are biting best.

Day had peeped hours earlier when I drove a beach buggy along the Hatteras shoreline. Fishermen were out in great numbers, some stretched out on the sand and dozing in the warm noon sun while their heavy surf-casting rods rested upright in sand spikes.

Hatteras waters drew fishermen long before there were roads on the islands, when it could take 24 hours to drive 50 miles through the sand. They came, and still come, not only for the channel bass but for the blues, black drum, croaker, flounder, whiting, striped bass, king mackerel, spot, bonito, swordfish, and sailfish.

Most of all, though, deep-sea fishermen come for the blue marlin. Stopping my beach buggy on the broad sandy elbow of the cape, I could see at least a dozen charter boats heading out to deep water in search of marlin. On June 11, 1962, a New Jersey fisherman hooked

Where Americans first took to the skies in powered flight, a granite pylon rises in memory. Lightning streaks the sky behind Kill Devil Hill and the monument to Orville and Wilbur Wright. Attracted by level sands and constant winds, the brothers came to the area in 1900, originally to experiment with gliders. On December 17, 1903, they succeeded in launching a mechanically driven heavier-than-air craft on a 12-second flight. The National Park Service Visitor Center, near the site of the first flight, houses a reproduction of the original plane (lower).



ROCKHOUSE BY BRUCE KRISTOF © N.G.S.

a blue marlin off Cape Hatteras; it measured 13 feet 1 inch and weighed 810 pounds, a world's record (since then eclipsed by an 845-pounder caught off St. Thomas in the U. S. Virgin Islands).

Warm-water fish such as the marlin follow the Gulf Stream to Hatteras. The stream comes within 12 miles of shore at the cape—its closest approach to land at any point north of Cape Kennedy, in Florida. Moving with the flow of a thousand Mississippis, it meets the cold currents coming down from the north, and the result is a volcanic rising of the sea until it seems to stand on end. Even now, as I watched the fishing boats, I could see the waters churning and heaving as if in fury.

"If We Could Roll Back the Ocean"

The spectacle is best observed on a stormy day from 208-foot-high Cape Hatteras Lighthouse, the tallest in the Nation. I climbed the spiral staircase to the crown of the tower and looked out on a far-ranging view of the Banks. The Atlantic was gray as mold.

The only other person at the top was a middle-aged man with a pair of binoculars. He watched the water for a long time and then said, more to himself than to me, "Ah, if we could roll back this part of the ocean, you'd see something then."

Diamond Shoals—I'd see that. Extending out to sea for about ten miles, the dreaded reef comes to within three feet of the surface at some points. In the days before depth finders and other modern navigational aids, the sands of Diamond Shoals trapped uncounted vessels and held them until they fell apart under floggings by the Atlantic.

With the ocean rolled back, I'd also see the remains of some of the hundreds of other ships wrecked in Hatteras waters during the past 400 years. One was the famed Federal ironclad *Monitor*.

Following its historic engagement in Hampton Roads with the *Merrimac*, which the

Largest sand dune on the U. S. Atlantic Coast, Jockey Ridge west of Nags Head rises more than 130 feet. Visitors hike to its summit for a broad view of the ocean. As with most of the area's place names, the origin of Jockey Ridge is obscure. One legend relates it to the wild ponies that used to roam the Banks. Supposedly carrying an Arabian strain, they were often caught by the Bankers and raced on the stretch of level sand in front of the mammoth dune. The ridge made an ideal grandstand for the meets.

Confederates had armored and renamed the *Virginia*, the "cheesebox on a raft" was en route to South Carolina. As it rounded Cape Hatteras under tow, the wind shifted to the southwest and freshened to gale force. As *Monitor* helmsman Francis B. Butts later recalled, "The sea rolled high and pitched together in the peculiar manner only seen at Hatteras. . . . The sea rolled over us as if our vessel were a rock in the ocean only a few inches above the water. . . ."

Cut loose from the steamer and shipping water, the 172-foot vessel went to the bottom. The crew aboard the *Monitor* at the time of her loss totaled 65 officers and men. Forty-nine were rescued and taken aboard the side-wheel steamer. Legend has it that the bodies of several of the remaining 16 crewmen later drifted to shore on Hatteras Island and were buried in a woodland-covered expanse of sand dunes and ridges called Buxton Woods.

Divers Still Search for the *Monitor*

Walking through that swampy, green place, where wild rice grows next to leathery-leafed oak trees, I came across the site where the bodies are said to rest. But Buxton Woods is cottonmouth country, so I didn't tarry long enough to observe much more than a slight depression in the ground.

As for the *Monitor* herself, the search goes on. A professional diver claimed to have located the ironclad in 1955, but nothing came of a plan to raise her for exhibition in a museum. Another serious effort to locate and salvage the prize is now under way, but Hatteras has a way of thwarting attempts to plunder its graveyard (map, pages 398-400).

Its long roster of wrecks includes:

• The steamboat *Home*, a packet of rich elegance and record-setting speed. Bound from New York to Charleston, the 550-ton *Home* arrived off Cape Hatteras in October 1837, to meet a hurricane moving up from the Gulf States. Pitching so violently that on the uprise her paddlewheels churned air, the *Home* grounded off Ocracoke and broke up. At least 90 lives were lost.

• The *Carroll A. Deering*. With sails set on her five masts, the Maine-built schooner was sighted on a stormy winter morning in 1921, fast on Diamond Shoals. Surfmen from four Coast Guard stations on the Outer Banks went to the vessel, but except for two cats they found no sign of life. The galley stove held recently prepared food. The fate of the *Deering*'s crew remains a mystery to this day.

• *Diamond Shoals Lightship No. 71*. A German submarine shelled and sank the lightship in World War I. One of those who survived the attack was Guy Quidley of Buxton.

"She was five miles from us when she started shelling," he recalled for me. "I went out a porthole and into a lifeboat wearing nothing but B.V.D.'s and a pair of pants. It took us from 2:30 in the afternoon to 9:30 that night to row and sail 18 miles to shore."

Lightships no longer are positioned off Diamond Shoals; rather, a $2,000,000 Texas Tower, installed in 1966 and rising 120 feet, now helps to guide ships safely around the cape with a light visible for 20 miles (page 403).

Ablaze in a dying sun, surfers head homeward after a day of riding the long Atlantic swells that wash the Outer Banks. With April's first hint of warmth, hearty young people push their boards into the frigid surf. At the end of school, the devotees come in increasing numbers for longer stays. Occasionally a surfer will be caught by the tricky currents and swept out to sea, adding a new responsibility to the Coast Guard's lifesaving duties.

I went to the tower by helicopter, landing on the roof of the ballroom-size enclosure, which is partitioned into working and living spaces for the four Coast Guardsmen there at all times. They pull month-long tours of duty, followed by two weeks of leave.

Unlike the old lightships, the tower cannot raise anchor and run from a storm. Thus the structure, although supported by four steel pilings buried more than 200 feet into the

ocean floor, has taken terrible abuse. In 1967, for example, a waterspout ripped into it, taking away radio and television antennas and shattering nearly all the windows.

"This tower was built to last 75 years," a member of the crew told me, "but to tell you the truth, I wouldn't want to be on it ten years from now."

Cape Becomes "Torpedo Junction"

Of the wide span of time represented by the wrecks at Hatteras, 1942 stands out as the most tragic year. Sinkings totaled more than 40 vessels, many of them tankers, as German subs operating within sight of the Outer Banks turned the area into "Torpedo Junction."

"I've seen five ships burning at one time off the coast here," a resident of the village of Rodanthe told me. "When the toide came in, it painted the beach black with oil."

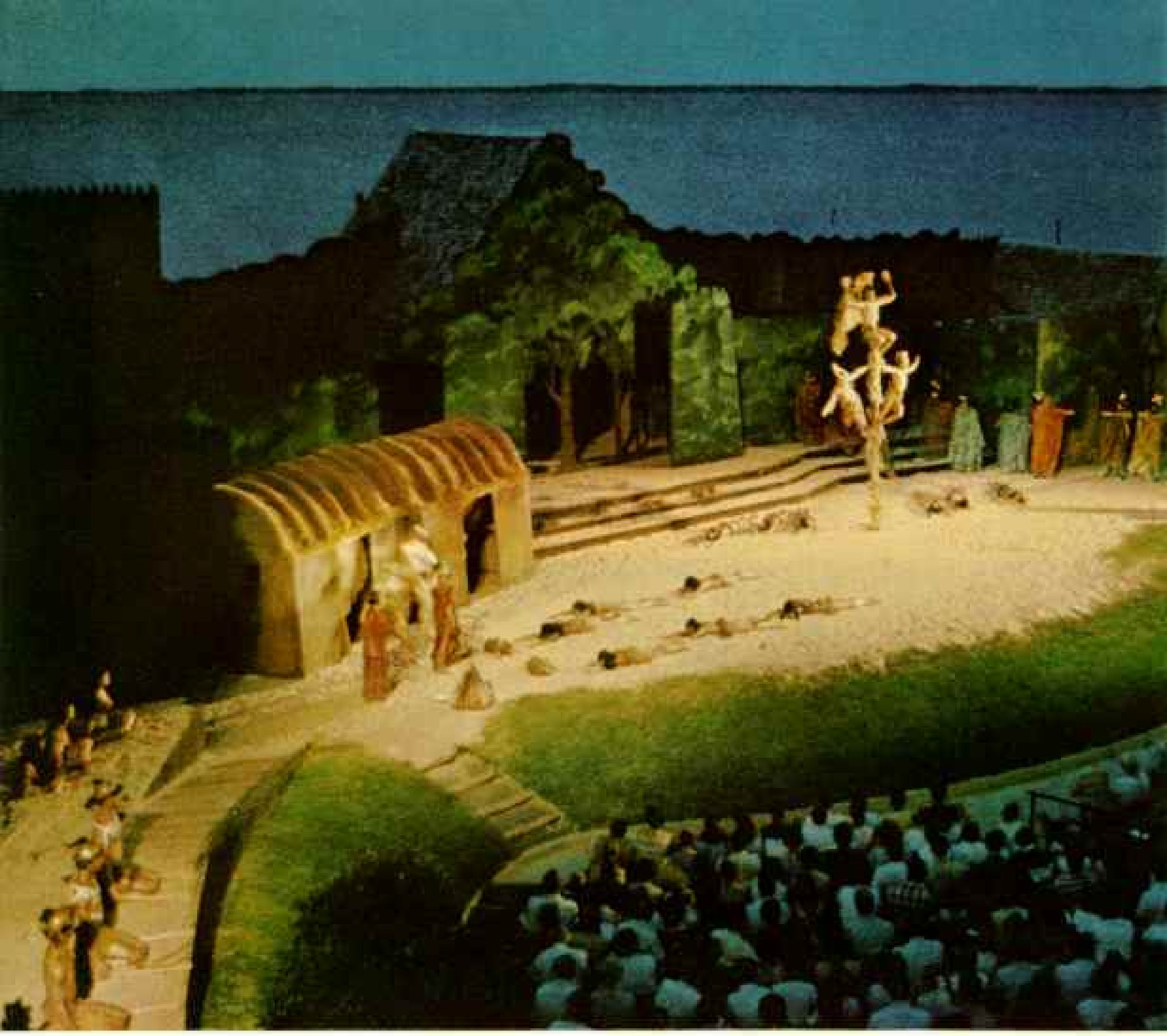
The U-boats attacked at night, always at night. During the day they surfaced, and crewmen sun-bathed off the Banks. This incredible boldness continued well into the year—until, finally, coastal defenses took on some semblance of order. In May, 2,635 mines were placed in the waters; blimps and other aircraft searched out the subs from the air; Coast Guardsmen patrolled the beaches, some on horseback, others leading lean attack dogs.

And subchaser No. 1355 picked up a signal on its sonar.

"We were off the Outer Banks when we got the signal, and thinking it was a German sub, we put down a pattern of depth charges," recalled Bob Frazier of Nags Head, who was a crewman on the subchaser. "A short time later this big whale floated to the surface. That rascal had taken four depth charges and was still alive. It was embarrassing, mistaking a whale for a sub, but we didn't have very good sonar in those days."

Few men were more closely involved with the coastal warfare than Aycock Brown, a genial former newspaperman who now does public relations work on the Outer Banks. As a special agent in Naval Intelligence during the war, he helped identify some of the many bodies that washed ashore from torpedoed ships. Of all his experiences, none so impressed me as the grimly ironical *Bedfordshire* incident.

EXCAVATIONS BY NATIONAL GEOGRAPHIC PHOTOGRAPHER GEORGE F. MOBLEY (C) N.G.S.



Dreams of glory end in an enigma: Weekday evenings during the summer the Waterside Theatre on Roanoke Island plays *The Lost Colony*, an outdoor symphonic drama of the first English settlement in America. Indians offer prayers to their corn god in this opening scene. To Roanoke in 1587 came soldiers, farmers, artisans, women, and children. Waiting desperately for promised supply

Having determined that four bodies on the beach were British seamen from a torpedoed tanker, Mr. Brown set out to find some British flags for use in the burial service.

"A British ship, the *Bedfordshire*, was docked at Morehead City, so I went aboard and asked if they had any extra flags. A crewman pointed to an officer on the bridge and said, 'See him, the one with the beard.' His name was Lt. Thomas Cunningham, and he gave me six Union Jacks."

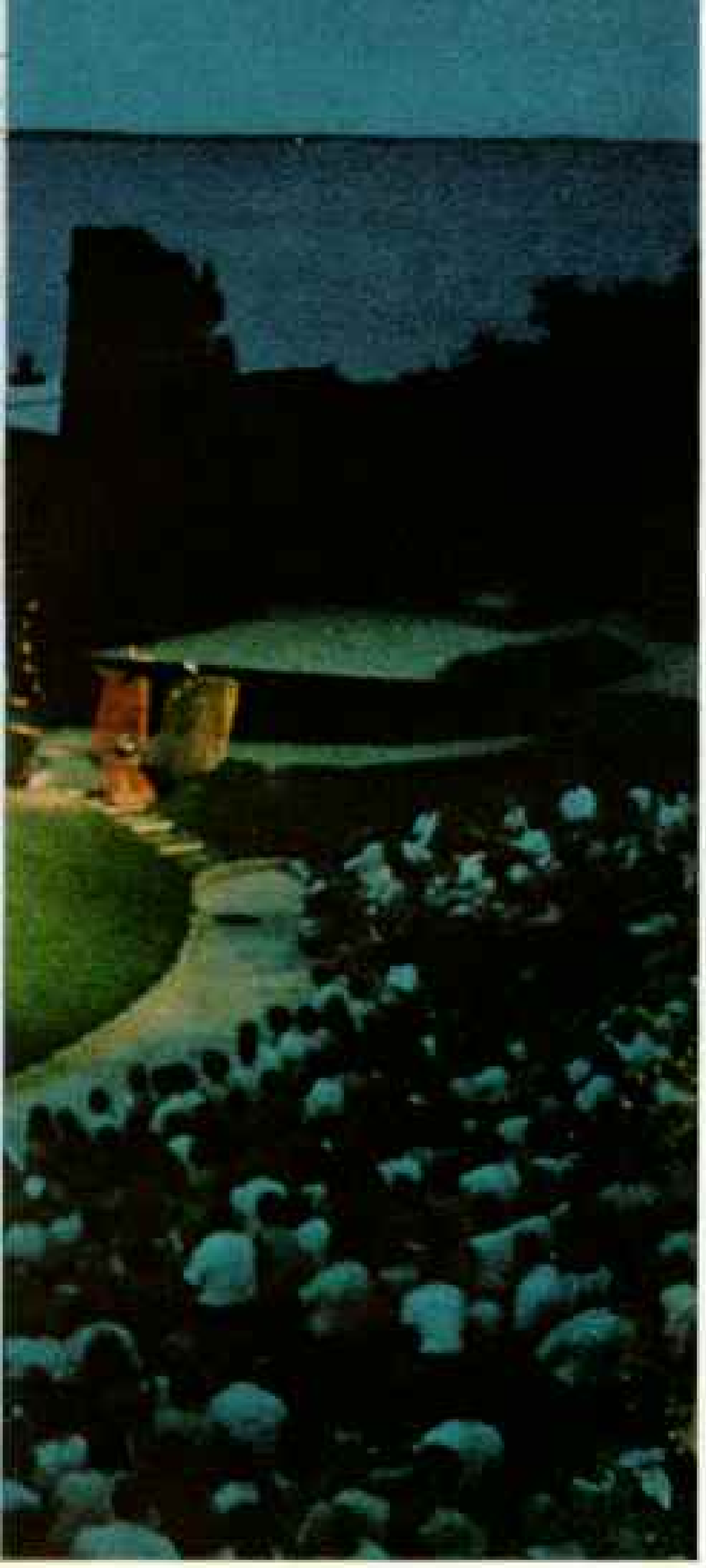
Two weeks later, Aycock Brown was again asked to identify four victims of a submarine sinking. "I looked at the first body," he said, "and knew right away who he was. Lieutenant Cunningham.

"When we buried him, his casket was draped in one of the Union Jacks he'd given me."

Today on the island of Ocracoke there is a small parcel of ground, fenced and half-hidden by yaupon bushes and loblolly pine. It is called the British Cemetery, and there rest the bodies of Lt. Thomas Cunningham and three other crewmen of H.M.S. *Bedfordshire*. No flags fly there, no taps sound at nightfall. But on the cemetery fence are inscribed these lines from Rupert Brooke:

If I should die, think only this of me:
That there's some corner of a foreign field
That is forever England.

English-speaking man came early to these islands—22 years before Jamestown—and it was here that Anglo-American civilization



ENTACHINGS BY ENOCH KRISTOF (ABOVE) AND GEORGE F. MOSLEY © N.G.S.

ships, the colonists fought Indians, disease, and hunger. The ships returned in 1590 to find the settlement deserted, and the mysterious word "Croatoan" carved on a post.

"**I hope it will be a boy,**" says a pioneer woman of the imminent birth of the first English child born in the New World. Eleanor Dare's infant, a girl, was baptized Virginia in honor of the new land. She vanished with the colony.

began. In August 1585, a group of 108 men, organized by Sir Walter Raleigh, reached Roanoke Island, between the mainland and the Outer Banks. There they established the first English colony in North America. Faced by famine and hostile Indians, all returned to England the following year.

The second colony, also dispatched by Raleigh, arrived in July 1587. A few weeks later, the colony increased by one when Eleanor Dare gave birth to a daughter. They named her Virginia, and she was the first child born of English parents in America.

The governor of the colony and the grandfather of Virginia Dare, John White, returned to England for supplies, where he was detained until 1590. Upon returning to Roanoke Island, he found no trace of the colonists other than a single cryptic clue. Carved on a stockade post was the word "Croatoan," a reference apparently to a nearby island. To this day the fate of the Lost Colony stands as one of the great mysteries of American history.

For many years after the disappearance of the colony, the Banks remained in the sole possession of the native Indians. Then, in 1663, the first proprietary charter was issued. Settlers moved in to raise cattle and extract oil from the many dead whales that washed ashore. By the turn of the century, the stockmen and the whalers were sharing the islands with pirates and runaway servants.

Each summer more than 50,000 persons attend performances of *The Lost Colony*, a

pageant on Roanoke Island in which the tragic early attempts to colonize the Outer Banks area are portrayed in an amphitheater set against a backdrop of the waters of the sound (pages 414-15).

I watched the pageant on a warm August evening, when rain threatened and thunder punctuated the exchanges between Queen Elizabeth and Walter Raleigh. Some in the audience looked up in annoyance as a single-engine plane buzzed overhead.

Air Age Launched Near Kill Devil Hill

Another plane buzzed in these same skies 65 years ago, and the entire world now honors its builders. But for some residents of the Outer Banks, the activities of those two brothers from Ohio, Wilbur and Orville Wright, amounted to nothing more than pure folly.

On December 17, 1903, with winds blowing at 22 to 27 miles an hour, Orville piloted a mechanically driven machine 120 feet through the air over a level stretch of sand near Kitty Hawk. Aviation was born with that 12-second flight, the first in which a heavier-than-air craft successfully flew under its own power.*

Today a 60-foot-high pylon of gray granite rises from the top of Kill Devil Hill in honor of the achievements of the brothers. Nearby is a museum housing a reproduction of the plane. Both are parts of the Wright Brothers National Memorial, administered by the National Park Service (pages 408-9).

Mrs. Rennie Williamson, who lives on Roanoke Island on land granted to her family by the British Crown, was 10 years old at the time of the first flight.

"People around here said those Wrights were crazy," she told me. "Even after they got the machine in the air, the kindest thing I heard was a man saying, 'Well, they done it. Dang if they didn't.'"

Mrs. Williamson worked for many years as an accountant for one of the hotels in the resort area of the Outer Banks, the section of Bodie Island centered around Nags Head. There cottages stand on stilts, one

*See "Aviation Looks Ahead on Its 50th Birthday," by Vice Adm. Emory S. Land, "Fifty Years of Flight" (a photographic record), and "Fact Finding for Tomorrow's Planes," by Hugh L. Dryden, all NATIONAL GEOGRAPHIC, December 1953.

Space-eye view of the Outer Banks: This dramatic photograph from 130 miles up was made by the crew of Apollo 9—James A. McDivitt, David R. Scott, and Russell L. Schweickart—while orbiting the earth to test the LM moon-landing craft last March. The bright sands sweep from Virginia's Cape Henry on the north, southeast to Cape Hatteras, then southwest to the V-shaped pendant of Cape Lookout (maps, pages 398-400). Beneath the water, Diamond Shoals off Hatteras and Cape Lookout Shoals to the south extend ominously into the Atlantic. Sand also protrudes from Hatteras and Ocracoke Inlets. Fleece of clouds rides above the warm Gulf Stream. NASA

against the other in a seemingly endless stretch of screened porches and bathing suits hung out to dry (page 407). In winter, however, even this area falls under a heavy, all-enveloping stillness. Pleasure boats leave, cottages are shuttered, and a sign appears in the window of the small restaurant known for the best hush puppies on Hatteras: "Closed. See you next summer."

Birds Rule the Banks in Winter

Some of the loudest winter noises on the Outer Banks come from the 6,700-acre Pea Island National Wildlife Refuge, on the northern part of Hatteras Island. Thousands of snow geese feed on salt-marsh cord grass there, until time to fly north again. On the day I visited the refuge, it was blanketed with snow geese, some clustered in families, others beating through the sky with strong, even strokes. Canada geese were there too, feasting on the rye grass planted in the refuge.

Jerry Holloman, assistant manager of the refuge, pointed out the various species of birds as we drove through the rugged, ridge-backed interior of the preserve. Sighting a common goldeneye on the larger (750 acres) of the two fresh-water ponds in the refuge, he stopped the four-wheel-drive vehicle and said, "The goldeneye is rare here." We watched the duck for nearly 15 minutes, until it rose and moved away on wings revved to a whir.

"We have about 8,000 snow geese this year," Jerry told me. "After they've been here awhile, they get used to cars. But now and then one of them will wait too long to take off from the roadside, and crash into a windshield."

Later, I stood in this great flyway on one of late winter's warming days and watched the departing snow geese split the wideness of the sky with their V-flight wedges. And awed by their inborn elegance in the air, I forgave them their mental lapses on the ground.

Unlike snow geese, sea gulls on the Banks draw little affection from residents because of their vexing habit of dropping clams and scallops on the highway to break the shells.

All-out war on mosquitoes includes marsh drainage and spraying. A drag line dug this network of ditches on Bodie Island (above), following old drainage routes. Sand scooped out by the dredge patterns the marsh. Plans call for diking and creation of fresh-water ponds to attract more waterfowl.

Fog of insecticide envelops campers (lower); a National Park Service truck daily sprays the national seashore's seven campsites.

KODACHROMES BY NATIONAL GEOGRAPHIC PHOTOGRAPHER EMORY KRISTOF © N.G.S.

Convulsive surf pounds the beach as three fishermen try their luck off Cape Hatteras. From boats, beaches, and piers, sportsmen seek channel bass, bluefish, mackerel, sea trout, and flounder. Deep-sea anglers head for "Game Fish Junction," at the edge of the Hatteras shoals, where the warm Gulf Stream holds promise of blue marlin, sailfish, amberjack, and dolphin.

"Beach buggies only!" warn signs on ramps over the dunes. Ordinary cars bog down in the soft sand. Lights blazing in the early dusk, a beach buggy—with four-wheel drive and oversize tires—heads toward Cape Point. In the distance the Cape Hatteras Light begins another night of flashing its warning to passing ships (page 393). The automatic beacon blazes for three seconds out of every eighteen.

HYDACHROMES BY GEORGE F. MOBLEY © NATIONAL GEOGRAPHIC SOCIETY

Expensive motorized sweeping equipment must be used to clear the roads of debris.

In an attempt to combat the bombardment, the likenesses of several gulls were painted on a section of Hatteras Island highway; thereafter, it was hoped, the birds would stop releasing the clams for fear of losing them to their grounded, brush-stroked brethren.

The scheme failed, and today the clams continue to fall. The next move, I was told, may involve putting down a stretch of concrete for exclusive use of the gulls.

Across the road from the refuge, the Atlantic's surf was purling over the Hatteras Island beach with a lazy crest. I walked there for four or five miles that morning, never encountering another person. The offerings of the sea from the night before lay all around: the shells, large and small, perfect and flawed, laid down in patterns for a pearly mosaic; charred wood and pieces of splayed rope; empty applesauce cans and a wrinkled tube of facial cream bearing the label of a pharmacy in Marseilles.

Suddenly a fresh wind came up from the south to stir the sand. Clouds pushed in front of the sun, and the sea lost its color. By late afternoon weathermen were saying what sailors have often heard and always feared: Gale warnings up at Hatteras. THE END

KUSACHIRUMI AND EKTACHROME (UPPER) BY DAVID MOORE, BLACK STAR © N.G.S.

Far East bastion: Rugged Okinawa, largest of the Ryukyu Islands, was captured from Japan after some of the bloodiest fighting of World War II. Since then, the United States has built the island into its principal center of strength in the Pacific. From such bases as Kadena (left), C-141 jet transports take on cargo for Viet Nam.

I THOUGHT I WAS IN TROUBLE. Demonstrators thronged the sidewalk in front of the newspaper office across the street from my hotel in downtown Naha, Okinawa's biggest city. They wore blood-red armbands and headbands, and red banners aflame with Japanese characters waved from dozens of standards. Martial music blared from a loudspeaker. I paused, unsure whether I should try to thread my way through the milling crowd.

"Please to pass," came a voice at my elbow in hesitant English. "Not demonstrate against United States. Strike because newspaper poor pay policy."

I felt relieved, for demonstrations against the U. S. in Okinawa

By JULES B. BILLARD
Senior Editorial Staff

Photographs by
WINFIELD PARKS
National Geographic Staff
and DAVID MOORE
Black Star

Okinawa

THE ISLAND WITHOUT A COUNTRY


B52 即時退
カデナ小学校分

Okinawans air their complaints

DISPLAYING A BANNER that demands "B-52 immediate withdrawal" and wearing headbands and sashes inscribed with similar sentiments, teachers gather in a schoolyard near Kadena Air Force Base. They protest the presence in Okinawa of U. S. bombers. Opposition to the B-52's intensified in November 1968, when a Strategic Air Command bomber crashed and exploded at Kadena.

In Japan, too, the future of Okinawa has become a major political issue, with powerful opposition both to continued United States military rule and to use of the island as a base.

Unrest among Okinawans stems from domestic as well as international problems. At the University of the Ryukyus (right), a demonstrator accuses the school of bureaucracy and demands greater autonomy for fellow students.

KODACHROME (OPPOSITE) BY WINFIELD PARKS; KODACHROME BY DAVID MOORE, BLACK STAR © N.G.S.

make banner headlines these days. Yet the incident signaled an attitude I met repeatedly throughout the land: Okinawans may seek to rid themselves of American control of their affairs, but they go out of their way to befriend the individual American.

Okinawa is the largest of the Ryukyu Islands, an archipelago of mountaintops thrusting out of the sea in a 775-mile crescent between Japan and Taiwan. The 140 islands—about half of them without people—separate the Pacific Ocean from the East China Sea (map, page 430). Okinawa alone accounts for 26 percent of the archipelago's area and 71 percent of the population; often its name is loosely used for the entire Ryukyu chain.

Once before Okinawa burst into the headlines—on April 1, 1945, a day that was both Easter Sunday and April Fools'. An armada of some 1,500 ships, with the greatest concentration of naval gunfire ever to support a Pacific troop landing, set ashore four U. S. divisions for the start of what became the bloodiest battle of the war in the Far East. More than 12,000 Americans lost their lives there; 110,000 Japanese and Okinawan soldiers and at least 75,000 civilians were killed.*

The peace treaty ending the war gave the United States full powers of administration over the Ryukyus. However, John Foster Dulles, a U. S. delegate to the conference, declared that Japan had "residual sovereignty" over the islands, and a succession of U. S. Presidents since then have affirmed the Nation's commitment eventually to give up its war-born control. In 1953 that control was relinquished for the Amami Gunto, the northernmost group of islands in the chain. Today's agitation prods for reversion of the remaining guntos: Okinawa and Sakishima.

Pullout Presents Economic Problems

"You have to understand that our people consider themselves Japanese," Seiho Matsuoka, former Chief Executive of the Ryukyuan government, told me. "Once we were an island kingdom, but for many, many decades we have followed Japanese patterns in our laws and our business and our culture.

"Yet today we have no true nationality. We are not treated as Japanese citizens, we are not U. S. citizens, nor is there such a thing as Ryukyuan citizenship. No one wants to be the man without a country. Most of our people think of themselves as Japanese, and that is why the appeal of reversion is so strong."

Chobyo Yara, the present Chief Executive, explained another facet for me. The stocky, smiling former schoolteacher campaigned on a platform of "immediate and unconditional

*See "Okinawa, Threshold to Japan," by Lt. David D. Duncan, NATIONAL GEOGRAPHIC, October 1945.

reversion" in a November 1968 election—the first time in history Ryukyuans could choose their leader by direct vote.

"We are like a man who lends money and the debtor keeps promising to pay him back," Mr. Yara said. "At last patience wears thin, and the time comes when promises must be kept. We think we have waited for reversion long enough.

"Of course we realize there are problems. Perhaps all cannot be solved overnight. But we must have a start. We must have a plan for the transition and for developing industry, agriculture, fishing, and tourism. We do not want to depend on the U. S. bases as a prop for the economy."

Statistics tell how important the U. S. presence is to Ryukyuan prosperity. Overall United States expenditures in the Ryukyus, direct and indirect, total more than a quarter of a billion dollars a year.

That amounts to almost 40 percent of the gross national product. It gives Ryukyuans an average per capita income of $580—second only to Japan in all the Far East. Total pullout of U. S. forces, immediate or gradual, would find the resources-poor land hard put to create replacement revenue.

"The resources we have," Mr. Matsuoka also told me, "cannot support our present population. Of just under a million people, we estimate 400,000 would have to leave."

I posed questions about reversion to dozens of Ryukyuans on a trip through the island chain. All favored restoration to Japanese rule. But most voiced some concern about what it would mean economically. Perhaps Keisei Shimoji, my guide and interpreter, summed it up most succinctly.

"I think," he said with an infectious grin, "we Okinawans are Japanese at heart and American at pocketbook."

Way-stop to war

Metropolis Rises From Wartime Ruin

The battle for Okinawa left 94 percent of the island's buildings destroyed, its industry ruined, its agriculture devastated. But fly its length today, as I did, and you survey an amazing change.*

Naha, the capital, a small city leveled in the war, now is a sprawling metropolis of 294,000 (pages 428-9), with buildings under construction poking their steel skeletons into the sky. The onetime farming village of Koza now has a population of 67,000; its downtown throbs with the sound and neon of bright spots catering to U. S. servicemen. Trim housing developments stand near Toguchi Beach, where GI's first landed. Dredges work overtime turning sea bottom into new land around the crowded little island, 67 miles long but in places only 2 miles wide.

"See that bunch of buildings over there?" queried Al Liosnoff, my flight companion and an official of the U. S. Civil Administration of the Ryukyus. "That's the University of the Ryukyus. It stands on the site of the old Shuri Castle, which the Japanese used as headquarters in their main line of defense along the Shuri hills.

"That bulldozer gash of a new Okinawan cemetery sits atop Hacksaw Ridge. Those thatched roofs with the TV antennas climb the sides of Conical Hill. And ahead, at the southern tip of the island, you can see Suicide Cliff."

*See "Okinawa, the Island Rebuilt," by Hope A. Diffenderfer, NATIONAL GEOGRAPHIC, February 1955.

PHANTOM II RECONNAISSANCE JETS—two-man planes with cameras but no guns—refuel at Kadena en route from the United States to Viet Nam. In the harbor of Naha, Okinawa's capital (below), a freighter docks beside a vessel loaded with trucks, tractors, and gasoline tankers destined for Southeast Asia. The U. S. has invested more than a billion dollars in Okinawan installations.

Rising from rubble, Naha has erased the scars of World War II. The three-month battle for Okinawa claimed the lives of 12,000 American and 110,000 Japanese and Okinawan servicemen and more than 75,000 civilians. Now Naha bulges with 294,000 people.

The Kumoji River cuts through the city; logs in foreground feed a plywood factory. The Ryukyuan legislature occupies the complex at right center. The islands have achieved some self-government, but a U. S. Army general serves as High Commissioner.

Petitioning the sea gods for good catches, a maiden prays during a fishermen's summer festival at Itoman.

Love of beauty in a city where flowering trees are few leads Naha residents to decorate with plastic blossoms. Island children must attend school through the ninth grade; many go on to one of Okinawa's five colleges and universities.

PHOTOGRAPHS BY WINFIELD PARKS (BELOW) AND DAVID MOORE, BLACK STAR; KODACHROME (ABOVE) BY ROBERT S. DOUGLAS © N.G.S.

Lying athwart "Typhoon Alley," the Ryukyu archipelago stretches 775 miles between Japan and Taiwan. Islanders endure an average of seven tempests a year, when winds sometimes reach velocities of 190 miles an hour. About half of the 140 islands are uninhabited. More than 70 percent of the population lives on Okinawa, which means that the main island must provide living space for an average of 1,700 persons per square mile.

The names ring in histories of the battle; they evoke the indelible heroism that conquers key eminences, and the stark tragedy of heights where—at the struggle's end—two Japanese generals committed hara-kiri and a group of schoolboy-soldiers grenaded themselves to death.

Our helicopter turned north. We whirred over wild expanses that the U. S. Marine Corps uses for jungle warfare training, skittered above stretching runways of giant Kadena Air Force Base (page 422), zipped across row upon row of mammoth Army warehouses at Machinato. For Okinawa bristles as a military citadel and supply base.

Outbreak of the Korean war zoomed the island from a somnolent outpost into a major fortress. Viet Nam intensified the growth; 80,000 American servicemen and civilians now swell the island's population; roads and buildings and installations there represent a U. S. investment of more than a billion dollars.

Island Leader: Three-hatted General

Island auto license plates ballyhoo Okinawa as the "Keystone of the Pacific." And with reason. It lies but a quick jet flight from such pivotal centers as Tokyo, Seoul, Manila, and mainland China.

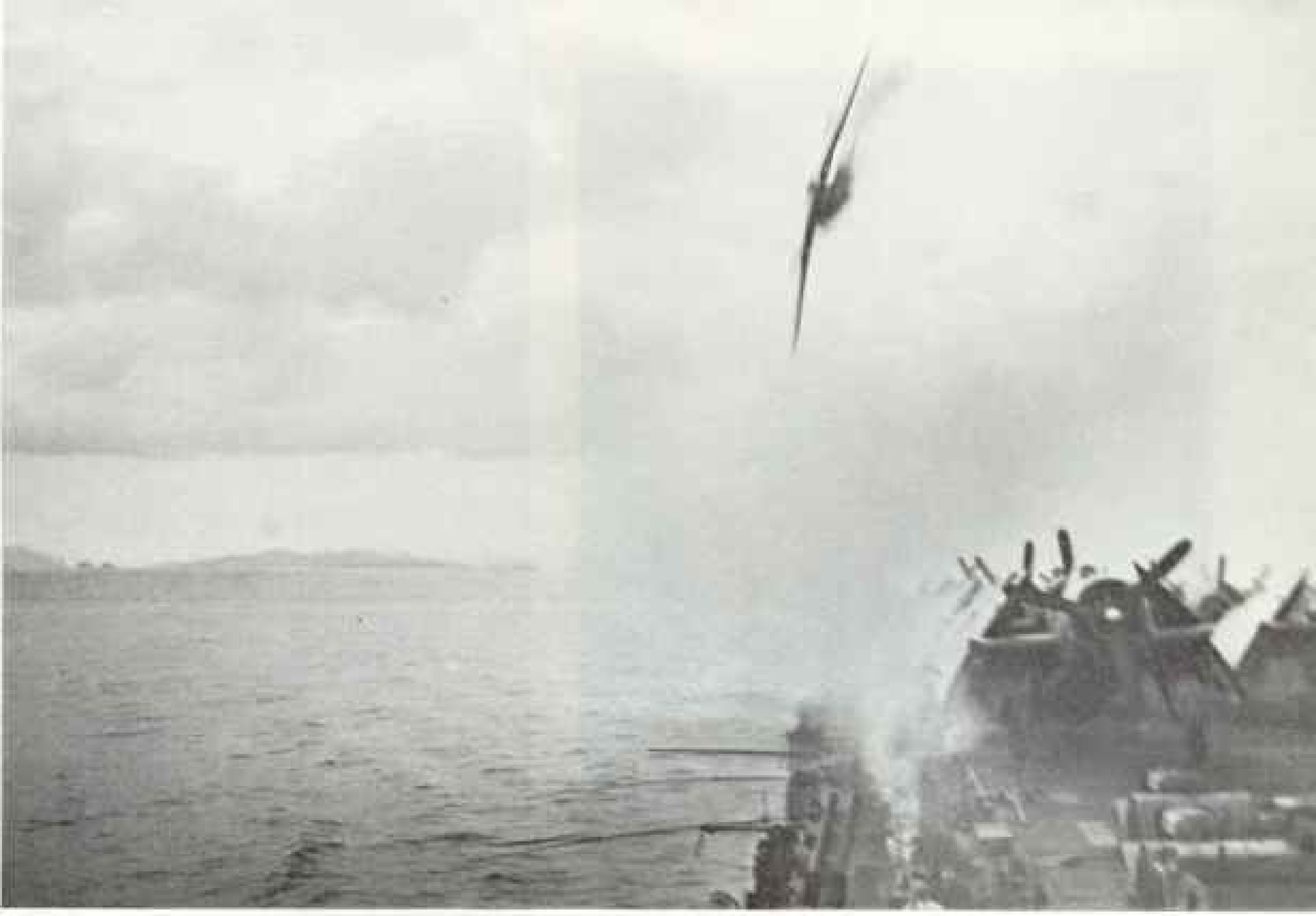
"The United States presence here has a stabilizing effect on the peace and security of this part of the world," Lt. Gen. James B. Lampert explained to me. He wears multihats as High Commissioner of the Ryukyu Islands, commanding general of the U. S. Army units on Okinawa, and representative there of the commander in chief of all U. S. forces in the Pacific.

"A strong U. S. base on Okinawa is vital, but that doesn't mean we can't keep our promise to return the Ryukyus to Japanese administration," the general said.

"Our Government's clear policy is to lay the economic and social groundwork for eventual reversion with a minimum of stress. Where the Okinawan structure has become ready—laws regulating education and the judiciary, for example—authority has been transferred to the local government. Moreover, in the area of self-government, direct election of the Chief Executive began last year.

"Still, many problems remain. Shifting the monetary system from U. S. currency to Japan's so no one loses or profits on the exchange is but one example."

Ryukyuans call the battle that leveled Okinawa "the typhoon of steel." They know about tempests firsthand, for the Ryukyus



Kamikaze pilot zeroes in on the escort carrier U.S.S. *Sangamon* during the Battle of Okinawa in World War II. Riddled by a barrage from the ship's guns, the bomb-laden Japanese plane narrowly misses the deck before crashing into the sea. A later suicide raid damaged the *Sangamon* beyond repair.

The Kamikaze—"divine wind"—was a special attack group of the Japanese Naval Air Forces; its chief membership requirement was a willingness to die for the emperor.

Shell-shattered metal on tiny Ie Shima frames a monument to a famed war correspondent. Here Ernie Pyle, who reported the trials and triumphs of the ordinary GI in World War II, was killed during the fierce six-day battle for control of the island's vital airfield. The plaque reads: "At this spot the 77th Infantry Division lost a buddy, Ernie Pyle, 18 April 1945."

U. S. NAVY (UPPER); KODACHROME BY MICHAEL PATRIS © N.G.S.

With a slash and a toss, a woman harvests a pineapple near the village of Izumi. Farmers spray the plants with hormones to space out blooming and prolong the harvesting season. They find it more difficult to control the wild pigs that raid their fields. One ingenious grower sometimes sets out fermented mash at night; next morning he picks up the inert, inebriated porkers for butchering.

Talons of steel shift freshly cut sugar cane from stockpile to conveyor belt of a refinery at Itoman. Japan buys most of the Ryukyus' sugar and pineapple crop at subsidized prices, and last year contributed $42,000,000 in aid to the islands.

sit in "Typhoon Alley"—a watery track of storms that are spawned in the western Pacific and sweep toward the Asian mainland.

"July through October is the busiest typhoon season," Masatake Itokazu, then section chief of the Ryukyu Weather Bureau, told me. "An average of seven a year race through the Ryukyus. One or two hit Okinawa."

I wondered if Okinawans didn't develop "typhoon nerves." My friend Fuji Sugimoto supplied the answer as he and I drove from Naha to the thriving fishing community of Itoman near Okinawa's southern tip. "See that sugar cane and those rice fields and sweet potato patches? We can use plenty of water in this country. And in the dry season when the government announces that there may have to be water rationing, you'll hear people say: 'Well, we need a typhoon.'

"Of course, we hope only for little ones—'ladies of the Pacific,' we call them."

Fuji and I went to Itoman to see a monster tug of war. The tradition-rich town stages it as part of its harvest festival; in early summer the community holds an equally exciting race between fishing boats bearing colorfully painted prows. Both events stem from rites of old—petitions to the gods for ample crops and catches.

"We have a long history of seafaring here," Mayor Kizo Ishiki told me. Fishermen used to go as far as Taiwan and even the Philippines in huge canoes propelled by oars. The men were at sea for long stretches, always in danger of never coming back. So wives took care of the family finances and ran things at home. Property often was recorded in the wife's name, and passed down through

daughters and not sons. The position of women here was unusual in the Oriental world.

"Itoman women got to be known as hard workers and skilled managers—to say nothing of their beauty," the mayor added. "Even today on Okinawa there is a saying: 'If you want a good wife, marry a girl from Itoman.'"

Down at the town's waterfront I talked to a knot of fishermen. In thonged sandals and cotton pants they had gathered to help Taru Kuniyoshi tinker with the ancient engine in his canoelike *sabani*.

"Before World War II the fishermen turned their catches over to their wives, who peddled them from house to house in the villages," the weather-leathered old seaman told me. "Now we take them to the fishermen's cooperative at the market, and from there they are shipped to Naha or other cities.

"And Itoman women are getting lazy," he grinned from beneath his conical straw hat.

Though trawlers play a growing role, Itoman fishermen still go out in their sabanis—one man to a boat but traveling in groups. They depart before daybreak and by late afternoon are back with their netted catches (page 445). I asked if thoughts about being caught at sea in a typhoon concerned them.

"We can tell by the look of the waves when a storm is coming. But," he added slyly, "we also listen to the weather forecast on the radio the night before."

I couldn't help reflecting how things have changed in a land whose seamen-traders won renown and brought a golden age to the Ryukyus in the 15th and 16th centuries.

The origin of the Ryukyuan people is obscure, though many scholars believe that the

islanders' forebears migrated from southern Japan. For centuries their island kingdom was linked to China by allegiance and cultural heritage. Even after Japanese warlords established sway in 1609 and brought an end to the golden age, Ryukyuan kings sent tribute to China as vassals of that court.

They paid tribute to Japan, too, and their palace at Shuri had separate Chinese and Japanese wings to house emissaries who came on diplomatic and commercial trips. Not until 1879 did Tokyo's emperor depose the last Shuri king and incorporate the archipelago as a prefecture of Japan.

History lists several score spellings of the Ryukyu name. It was "Lew Chew" when Commodore Matthew C. Perry took his black-hulled U. S. ships there in 1853 on the historic voyage that opened Japan to contact with the Western World.* Interpretations of Chinese characters for the archipelago's name include such terms as "sea rope" and "pendant ball." The word Okinawa itself stems from Japanese for "rope in the ocean."

Festival Features Monstrous Tug of War

Drumbeats and the high twang of banjolike samisens dashed such musings from my mind —and brought the fishermen and me to Itoman's main street for the festival parade.

In traditional costumes, marching groups performed folk dances before the reviewing stand. We spectators watched entranced. All over Okinawa the people, though they count themselves Japanese, take tremendous pride today in their Ryukyuan heritage.

Participants ranged from rouged kindergartners to a wrinkled grandmother with tattooed knuckles. The latter sight is rare in Okinawa now, but once nearly all Okinawan girls had their hands tattooed, my interpreter-guide Keisei had told me.

"The marks were put on with needles and indigo dye," he said. "You could tell which district a woman came from by a symbol on her hand. Other designs stood for things like a healthful life, or virtues like being a good cook, or seamstress, or such.

"When Okinawa became a Japanese prefecture, the practice was banned. But in out-of-the-way places it continued awhile. So you still see older women with marked hands."

By the parade's end the late afternoon sun glinted golden from the rice straw of the monstrous rope used in the *tunahiki*—the tug of war highlighting the festivities. Since morning the rope had lain along the curb—in two snaking sections, each nearly a hundred yards long and tapering from four feet thick at the looped head to a few inches at the tail.

"One section represents the male and the other the female principle of harvest fertility," Ushijo Uehara told me. He and Eiji Oshiro were the *fuku iincho*—literally, "vice chairmen"—of the tug of war. "When the loops are joined, the pulling starts, and the team that wins earns better luck in the harvest for the half of the town it represents."

Wisps of straw had been plaited into strands six inches thick and three feet long; these in turn were twined and bound together to form the big rope. Into each section went eight tons of straw.

A great cry from the crowd signaled that sweating team members had at last dragged the looped rope ends together, and joined and locked them with a sturdy pole. Then pandemonium erupted. Spectators became participants. All who could find a handhold on the rope leaped in to tug and grunt. People who couldn't reach the rope pulled on others who could. Leaders' attempts to coordinate the straining backs went unheeded.

But in 5 minutes and 28 seconds it was over. In inching heaves Mr. Oshiro's team-plus-mob dragged the 16 tons of rope and accompanying people the necessary six yards for victory. Then jubilant leaders carried the pole and strands hacked from the rope down to the sea—tossing them into the waves to carry harvest prayers to the gods.

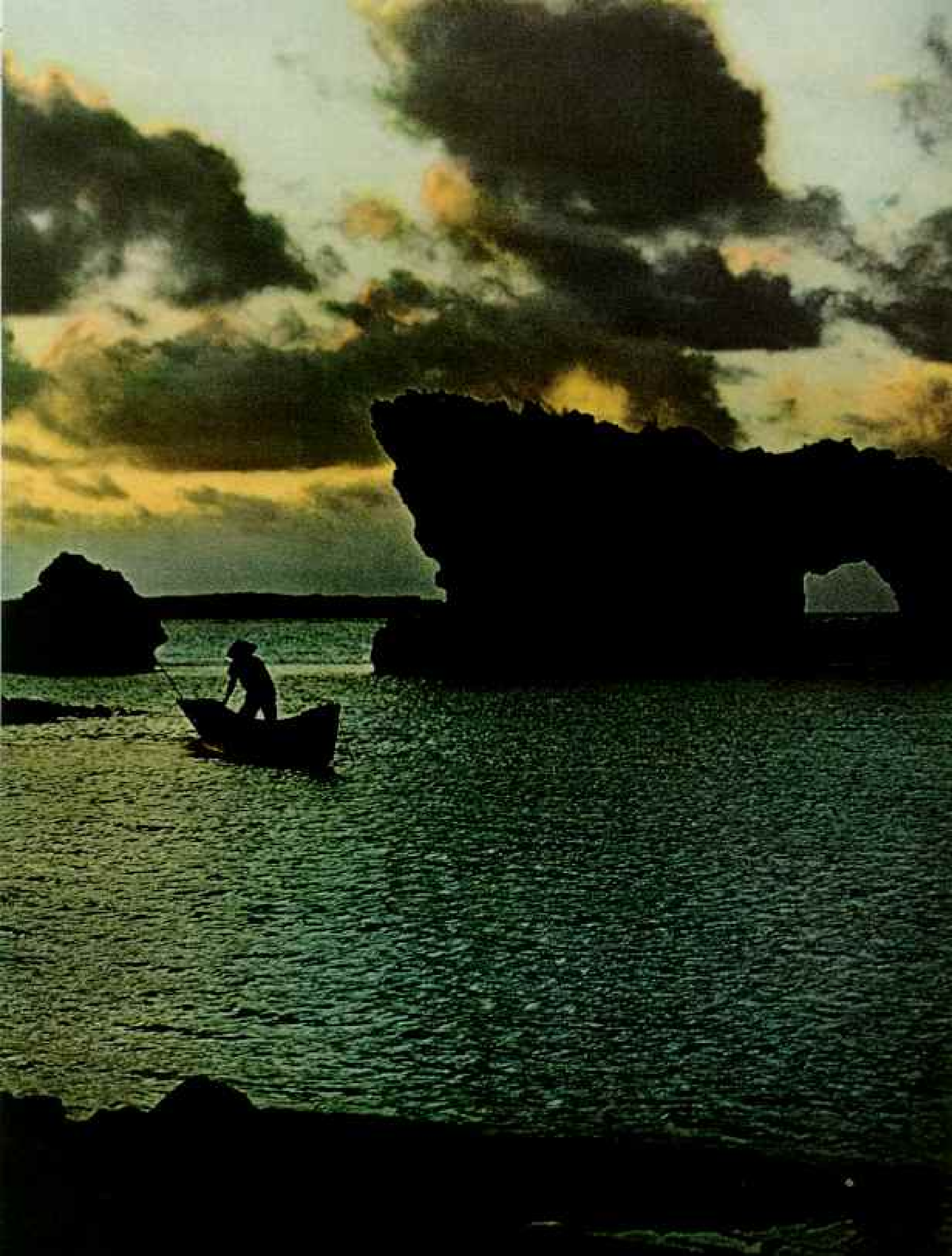
Distinctive Spelling Marks Island Signs

From Naha, set in the rolling hills of the south, to mountain-cradled Nago, where the Motobu Peninsula juts like a thumb from the jungled northern part of Okinawa, Highway 1 offers traffic jams as frustrating as any I've seen. That route, a paved road along the island's west coast, is Okinawa's lifeline. And it spotlights the speed with which Okinawa has been jerked into the 20th century.

*See "The Yankee Sailor Who Opened Japan," by Ferdinand Kuhn, NATIONAL GEOGRAPHIC, July 1953.

Pint-size slugger, a Cub Scout swings a makeshift bat on an improvised ball field in downtown Naha. Okinawans share a love of baseball with the Japanese, to whom they are closely allied culturally and racially.

Anchored amid wave-carved crags, an Okinawan readies his canoelike *sabani* for a night's fishing. On some of the more remote Ryukyu Islands, fishermen claim hereditary ownership



FOUNDATIONS BY DAVID MOORE, BLACK STAR © N.G.S.

of fishing grounds and octopus holes. Conflicts frequently arise, as a local proverb attests: "Trouble about a woman is temporary, but trouble about a fishing ground is permanent."

Before World War II, horse-drawn carts traveled the island's few roads. Today the number of motor vehicles tops 100,000 and climbs by 1,200 a month. Not surprisingly, the fastest-growing business on the island is automobile repairing.

Used-car lots dot Highway 1, along with beauty parlors, tailoring establishments, souvenir stores, dairy bars, restaurants, pawn shops, and businesses where you can rent practically anything from a kitchen spoon to a living room full of furniture.

Japanese signs have translations in English to attract American customers. The results can be delightful. A hardware store near Kadena carries the declaration "Bolt Sell Store." A craftsman in Naha proclaims "Juwely Make & Fix." And a furniture shop at Oyama advertises "For Lent—TV." But my favorites have to be the placard reading "Auto Defilers"—for "dealers"—and the highway sign warning "Plenty Curves At Farwerd."

Brute Strength Decides the Winner

The Oyama TV sign caught my eye when Keisei and I went to a natural amphitheater off Highway 1 to see an Okinawan bullfight. Here it is not man against bull, but one bull against another (pages 442-3). I got a preview explanation from Ryuhan Yamaguchi, whose black-and-white animal was getting a rubdown with wisps of grass in the shade of an old parachute tied to some trees.

I asked what made the animals fight.

"It's just their nature to fight when they see another bull," he said. "They lock horns and push until one gets tired and gives up.

"Training usually begins when they're two years old. Handlers walk them in wet sand to strengthen leg muscles, and make them push against a truck tire tied to a tree, or against a cliff, to make their necks strong."

Just then a handler took the black-and-white's nose rope to lead him to the arena, a circle of leveled earth in a bowl of small hills. Spectators, mostly men, sat on the high grass of the slopes, or perched on the gray stone of tombs built into the hillsides.

"You see family tombs all over the Ryukyus," Keisei said. "Some are just caves with walled-up fronts. Others are like pointed-roof houses, or have a rounded shape that gives them the name 'turtleback' tombs.

"Funeral customs are changing, but it used to be families spent more on their tombs than they did on the homes they lived in. If a boy asked a girl to go to his family tomb with him, it was considered a marriage proposal because of the saying, 'If you want to know what kind of relatives you're getting, visit the family tomb.'"

A shout from the crowd around the bull ring brought my attention to the pit, where the black-and-white bull had tangled with a wiry beast whose cinnamon hide turned ebony from streaks of sweat. Handlers—one to each animal—tugged on nose ropes, stomping the earth with bare feet and shouting "*Hiyasa, hiyasa*" in encouragement.

"The word doesn't mean anything. Wow, look at that!" Keisei exclaimed as the cinnamon bull slipped a horn free and, hooking wickedly, drew blood from the hide of his opponent. Horns engaged again and the pushing match was renewed. "It isn't often a bull gets injured or killed," Keisei reassured me.

To cure a sick car, GI and Okinawan mechanics combine skills at the Naha port facility. The United States military establishment employs some 40,000 islanders.

West learns about East—and vice versa—as off-duty GI's get acquainted with Okinawan girls at Nakagusuku Castle near Naha. The ruined fortress dates from the golden age of the Ryukyus in the 15th century, when its seafaring traders ranged the Far East.


ハーバーライト
ARBOR
KOKUSAI
HOTEL
RESTAURANT
CABARET

Betting is illegal in Okinawa, but I had a feeling money changed hands among the spectators after the cinnamon bull, though pricking his adversary with more hooks, suddenly broke and ran. In triumph, Mr. Yamaguchi's black-and-white was led around the ring, back draped with bunting, horns tied with handkerchiefs tossed from the crowd.

Fishermen Flock to Porpoise Roundup

A few miles northeast of Oyama, Highway 1 reaches the island's narrow waist. Then villages and farms become more scattered, for although two-thirds of Okinawa's land mass lies above this dividing line, only a sixth of its people live there.

The road winds quietly through hills, along placid bays and beaches, and past such scenic spots as Todoroki waterfall and Manza Mo—the "10,000-seat grass," so named because a Shuri king declared its expanse of fine-bladed natural lawn could seat 10,000 people. Finally Highway 1 comes to Nago, gorgeous with cherry blossoms in springtime and scene of a porpoise roundup.

"The porpoises come into Nago Bay in February or March, and even sometimes in April," a town official told me.

"Actually, they're not porpoises. Most are what we call *gondokujira*—blackfish, a kind of small whale. But sometimes a few porpoises get caught, and the event has come to be known as the porpoise roundup.

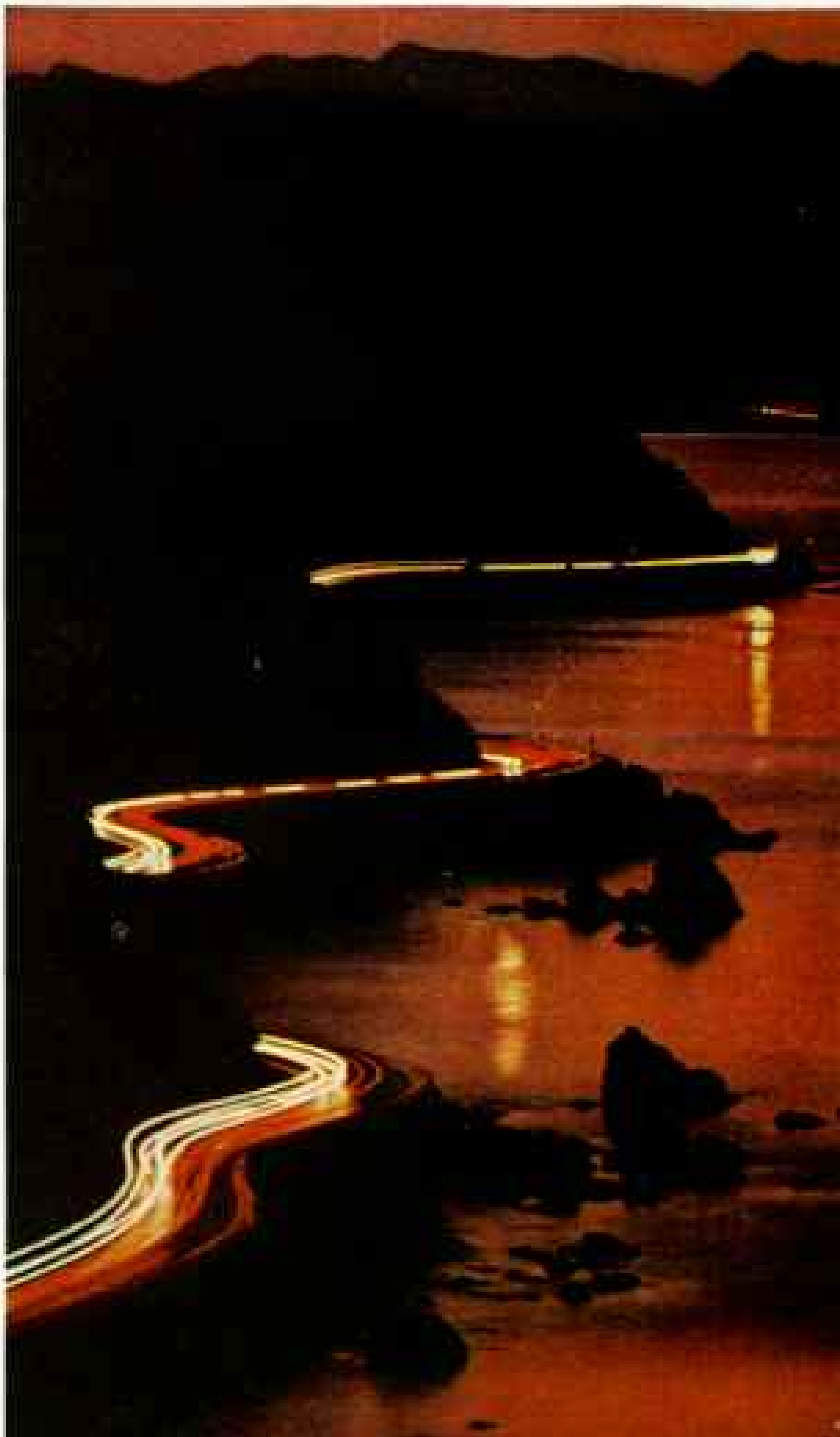
"People who take part in the capture and killing get a share of the meat. It's delicious."

The roundup dates from olden times, but only since 1960 have catches been tallied.

"The record was 189 in a single day, in 1963. Boatmen drop stones in the water to herd a school into the bay. When the animals reach the shallows, people jump in with ropes and harpoons and knives. Things get so exciting I've even seen strangers—tourists in business suits—forget themselves and jump into the water to take part."

Out of Nago I took the winding graveled road that skirts the Motobu Peninsula. Limestone quarries scar its verdant hills; their product, one of the island's few natural resources, feeds rock-crushing and cement plants. Past hanging clouds of dust I went, until I came to the little port of Toguchi. And from there a once-a-day ferry took me to Ie Shima, five miles away.

Commercial canyon of Kokusai Dori throbs with traffic during Naha's rush hour. Stores do a thriving business with the 80,000 U. S. servicemen and civilians living in Okinawa. U. S. spending enriches the island by some $260,000,000 annually. Largely because of the dollar influx, per capita income has risen to $580 a year—high by Asian standards. Most islanders favor reversion to Japan, but many realize U. S. withdrawal could bring economic difficulties.



White snake betwixt red sky and sea: Car lights trace the route of Highway 1, the only paved road running the length of Okinawa. "At day's end," says the author, "I'd swear every one of the island's 100,000 motor vehicles is tangled in the traffic jams."

EKTACHROME (ABOVE) BY DAVID MOORE, BLACK STAR. KODACHROME BY WINFIELD PARKS © N.G.S.

Beast fights beast in an Okinawa-style bullfight. Head-butting, horn-locking matches last from ten to thirty minutes. There is little or no bloodshed; a bull wins when his opponent tires and gives up the fight. Handlers may enter the ring but cannot touch the animals.

Fattened on rice, beans, corn, soycake, powdered milk, and sometimes beer, contestants may weigh 1,600 pounds. Near Nakagusuku Castle, a Sunday crowd (right) rings an arena, one of 10 on Okinawa.

KODACHROMES BY WINFIELD PARKS © N.G.S.

In the battle for Okinawa, plateau-topped Ie Shima was a Japanese airfield, the scene of desperate conflict. There a machine-gun burst snuffed out the life of war correspondent Ernie Pyle, whose dispatches had made his a household name and won the admiration of newsmen like me.

I stood on the island before a monument erected to his memory (page 431). "At this spot the 77th Infantry Division lost a buddy, Ernie Pyle, 18 April 1945," its inscription read. And as I pondered its simple eloquence, an American family with a teen-aged youngster approached. The boy looked a moment, then asked, "Mom, who was Ernie Pyle?"

Mine is a fading generation, I realized with a shock. I suddenly felt uncomfortably old.

The rocky strata that give the Motobu Peninsula its quarries also yield the kind of stone used in centuries-old castles whose ruins grace such heights as Nakijin. And the ruins provide hiding places for *habu*.

The habu *(Trimeresurus flavoviridis)* is the most poisonous of Okinawa's snakes. Its venom causes five or six deaths among the 500 persons bitten each year.

I learned of a habu catcher in a village near Nakijin. So I sought him out, and, sitting Japanese-style on the floor of his farm home, interviewed Tsuneo Uchida.

The 37-year-old father of six had been wounded in the war. "It left my shoulder stiff and I couldn't do farm work, so I became a habu catcher," he said. "The health center that makes an antivenin pays me $2.50 for snakes at least three feet long."

"What happens if the snakes you catch are small?" I asked.

"I turn them loose so they'll grow bigger."

Odor Betrays the Habu's Hideaway

Habu-catcher Ushida, looking in rocky outcroppings and in crevices of stone walls, hunts in midday when the night-feeding snakes hole up. "He can tell by the smell if a snake is in the hole—a horrible smell, like chicken," said my interpreter.

"But chicken doesn't have a bad odor," I protested.

"Excuse me," came the reply. "I misinterpreted. It doesn't smell like chicken. It smells like chicken droppings."

The odoriferous snake, I also learned, goes into a potent drink called habu-saki. To produce it, the snake is pickled in a jar of saki having a high alcoholic content. "Habu-saki very good for love power for older man," explained the wizened proprietor of an herb store on Daido Street in Naha. Intrigued, I bought a four-ounce vial for $3.00. All I can say is that the taste lives up to the smell.

Kin, a town on the eastern side of the island, has three claims to distinction. Centuries ago, a maiden was sacrificed each year to a legendary dragon in a labyrinthine cave hung with stalactites. Later the cave became the locale of a Buddhist temple honoring a 16th-century priest whose meritorious works brought great good to the people. Kin also is important as the site of an annual festival honoring a man who encouraged his countrymen to emigrate from Okinawa.

"That leader was Kyuzo Toyama, a schoolteacher," Seitoku Oshiro told me. Mr. Oshiro,

now art curator of the Ryukyu museum in Shuri, survived the "typhoon of steel" as a 16-year-old among civilians hiding in Kin Cave.

"At the turn of this century, Toyama developed an interest in U. S. democracy. He argued for reforms in the Japanese system of government and in its treatment of Okinawans as inferior citizens. He led a number of emigrants to new freedom in Hawaii, but came back himself to champion the cause he began. Many more Okinawans followed this first group."

Today people still leave Okinawa, helped by government grants that pay transportation costs. Most emigrants go to South America; more than a hundred thousand now live in countries there.

Important efforts are being made to expand the agricultural resources of the islands. You sense that when you drive along coral roads beside the sugar-cane fields on Miyako, or talk to pineapple farmers on Ishigaki in the Yaeyama group. Sugar and pineapples are the Ryukyus' chief exports; Japan buys almost the entire output at heavily subsidized prices.

You travel from Okinawa to Miyako and Ishigaki by leisurely local steamer or by hoppety inter-island airline. You leave behind a place where reconstruction after World War II smeared Westernization onto traditional ways, with results not always pleasing. And you arrive at off-track spots where prewar Okinawan architecture and tranquillity reign.

Ishigaki means "stone wall" in Japanese. The island is aptly named. Boulders amassed from clearing the land march in rows around farmhouses and fence the village streets—evidence of a delight in stone that permeates all the Ryukyus. Okinawan masonry has been called some of the finest in the world.

"Once you could tell the wealth of a man by the kind of wall he had," Keisei explained. "Poor people just piled up any old rocks. Those better off could afford neater walls of selected local stone. The rich had walls with the finest of workmanship and the best of materials brought from far away. Now cinder block is making all fences look alike."

Ishigaki and its slightly larger neighbor Iriomote are two of the main islands of Sakishima Gunto (map, page 430). On forested, rugged Iriomote timbering and cattle-raising projects stimulate development. Ishigaki, 21 miles long, has much of the gunto's population; agriculture thrives on its lowlands.

During World War II those lowlands bore airfields from which Japanese Kamikaze planes took off; their suicide missions wreaked havoc on the U. S. invasion fleet (page 431).

PHOTOGRAPHED BY ROBERT D. DOUGLAS (ABOVE) AND DAVID MOORE, BLACK STAR © N.G.S.

Tillers of the terraced fields on rocky Tonaki Jima trudge home to their village. Thirty-five miles west of Okinawa, the island in recent years has witnessed a great exodus of young adults, lured to Naha's bright lights and plentiful jobs. But even Okinawa sees its share of emigrants; most of them have found new homes in South American countries.

Fishing is a family affair on Ishigaki Island. Wives come to the beach to help clean and fold the nets.

Now runways have been broken to the plow, and former malarial swamps eliminated. New fields thus opened have attracted immigrants from overcrowded Okinawa. I learned one aspect of this with some surprise.

I had stopped beside a pile of pineapples and the farmer in straw hat and rubber-soled work *tabis* who had brought them from the field. We looked at each other. He grinned. And after a moment of embarrassing silence I tried one of the few Japanese phrases I knew.

"*Ikura desu ka*—how much?" I asked, pointing to a small but attractive pineapple.

His reply came in gracious English. "You may have it with my compliments," he said. Then he explained that ten years earlier he had worked at the officers' club at Kadena Air Force Base, but quit to move to Ishigaki for farming under the government's newly opened lands program. So we chatted about the move, and American bases, and reversion, and pineapple raising. And as I prepared to drive away, he said politely:

"Won't you have another pineapple?"

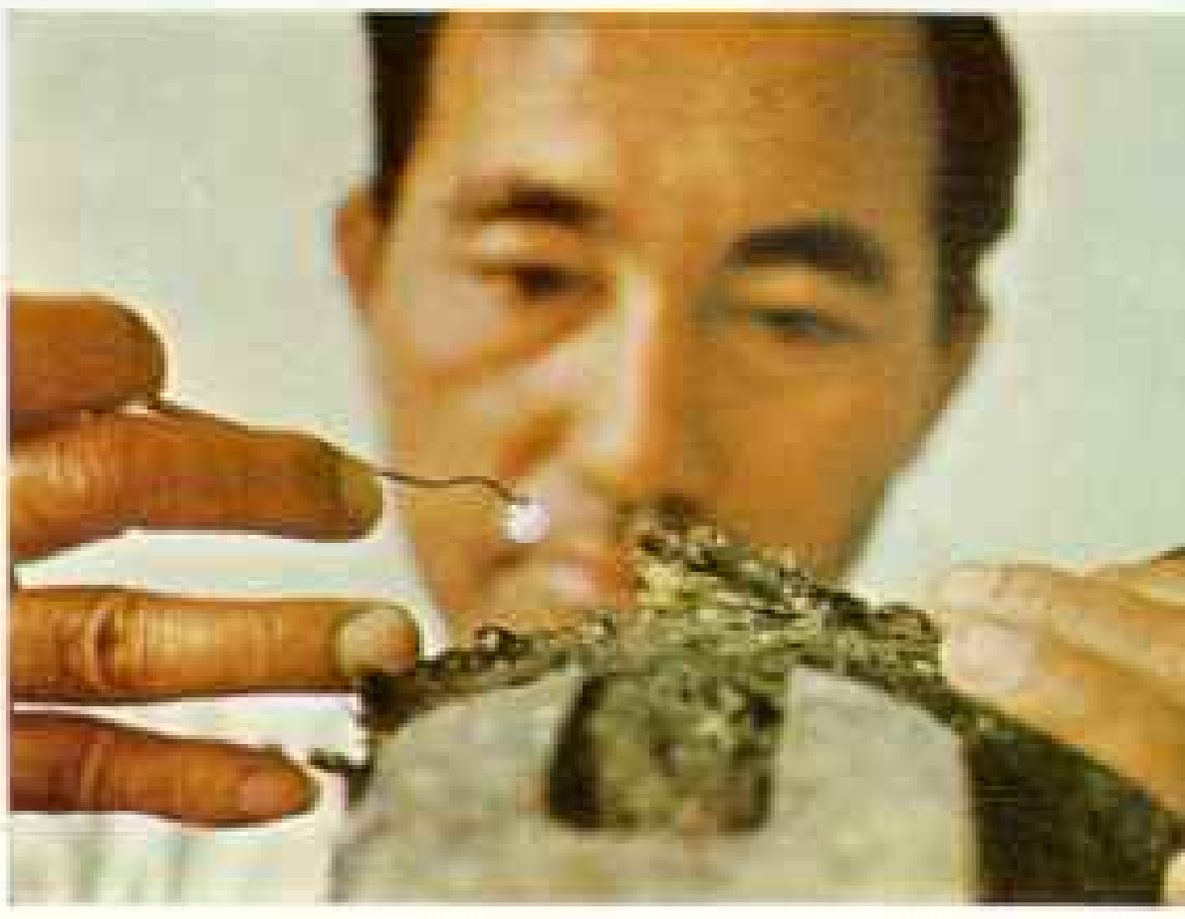
I might have expected such treatment, for Okinawans come by courtesy naturally. It has been a hallmark there for centuries.

As historian George H. Kerr puts it, the chronicle of Okinawa "is essentially the story of a minor kingdom with few resources, and of an unwarlike people, forever seeking balance between powerful neighboring states." As a result, the inhabitants have become "pliable and easygoing . . . eager to please . . . but with quick recourse to stubborn inaction and evasion, the weapons of the weak who wish to resist unwanted change."

By the 1580's Chinese ambassadors were

Birthplace of the black pearl: At Kabira Bay on the north coast of Ishigaki Island, employees of the Ryukyu Pearl Company lower racks filled with black-lipped pearl oysters *(Pinctada margaritifera)*. Plastic floats keep the mollusks suspended four feet beneath the surface for the two to three years they require to produce black pearls. Every three months the men raise the baskets and cleanse the oysters of seaweed and other marine growths.

The Kabira culture ground is the only place in the world where black pearls are grown by implantation (below). In 1965 a single black gem sold for $3,200.



KODACHROME (ABOVE) AND EKTACHROMES BY DAVID MOORE, BLACK STAR © N.G.S.

With the deftness of a surgeon, Susumu Tokashiki inserts a seed into an oyster. Beads of pig-toe clamshell from rivers in the Mississippi Valley provide the best nuclei. The seeder controls the oyster's action-motivating muscle—or foot—with a depressor and cuts a tiny channel into the body. Then he inserts the nucleus, covers it with graft tissue from another oyster, and smooths back the main tissue. Only Mr. Tokashiki, manager of the Ryukyu Pearl Company, and two other men perform the delicate operation.

Rare and lustrous gem emerges from the flesh of its creator. Experts credit successful cultivation to a number of factors, including the mild temperature of Kabira Bay, the wash of its waves, and its northern exposure.

A moment to treasure: Bride, groom, and wedding party pose for the traditional photograph following a Shinto ceremony at a shrine in Naha. She wears a red-lined kimono; her elaborate headdress tops masses of stiffly lacquered hair. He dresses simply in dark silk and sandal-like *zoris*.

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calling the Ryukyuan kingdom Shurei no Kuni—the Nation of Courtesy. And the main gate to its hilltop palace became Shurei Mon, the Gate of Courtesy. An architectural treasure built in the 1500's, the portal was destroyed during World War II. Reconstructed in 1958, it stands now as a landmark and national symbol.

Another graceful gateway, on Ishigaki Island, leads visitors to idyllic Kabira Bay. Its waters provide the island with a rare industry —a black-pearl farm (preceding pages).

"The northward-facing bay, the way the waves wash in, the water temperature—all help make this the only place in the world where black gem pearls are cultivated," Susumu Tokashiki said. He was answering a question I had posed when I interrupted him at work in the plant he directs as manager of the Ryukyu Pearl Company.

"Not only do the oysters have to have perfect conditions to grow, but culturing pearls in them is much more tricky than in regular pearl oysters. That's why black pearls are so rare. And expensive," he added as he displayed a handful of beauties. "One harvested here in 1965 sold for $3,200."

The rich, smoky iridescence comes from substances deposited by the shellfish on irritant beads surgically placed in its tissues. The oyster, suspended beneath the surface in a net-like basket, grows in the bay for two to three years before the pearl is completed. Every three months all of the oysters are raised and their shells cleansed of marine growths.

The sun's glint dulled on the floats from which the baskets hang as I said *sayonara* to Mr. Tokashiki. Storm clouds were gathering —the advent of a typhoon. Another—happily a mild one—had swept the Ryukyus the day I arrived.

I noted the coincidence—and breathed a wish that the Land of Courtesy would ever be touched only by little typhoons—rain-laden "ladies of the Pacific."

SIX-MONTH INDEX AVAILABLE

As one of the benefits of membership in the National Geographic Society, an index for each six-month volume will be sent, upon request, to members who bind their GEOGRAPHICS as works of reference. The index to Volume 135 (January-June 1969) is now ready.

COVER: Fair daughter of Erin, Judith Woodworth typifies the youth of the Irish Republic, where an improving economy offers new opportunities (page 354).

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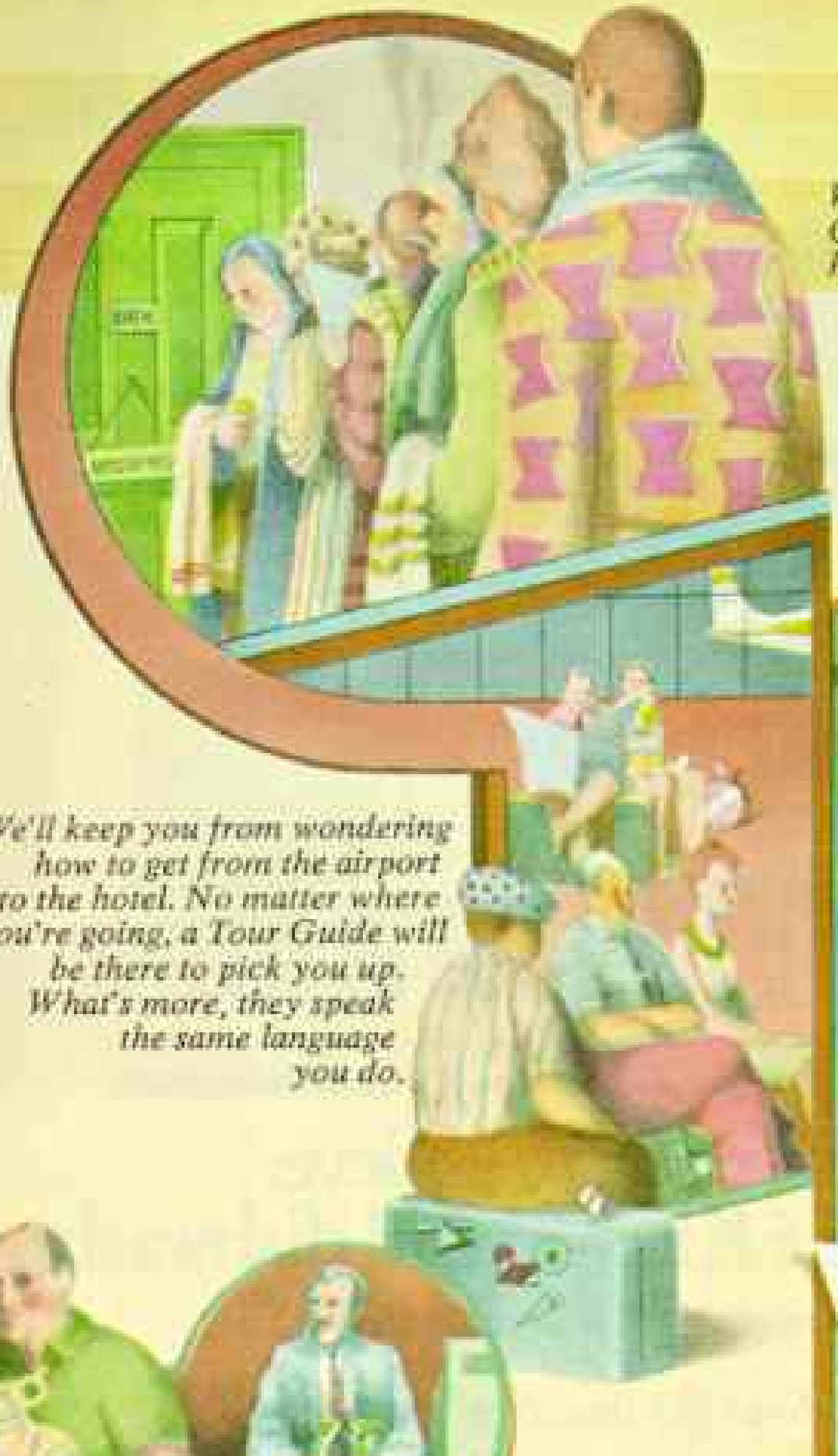

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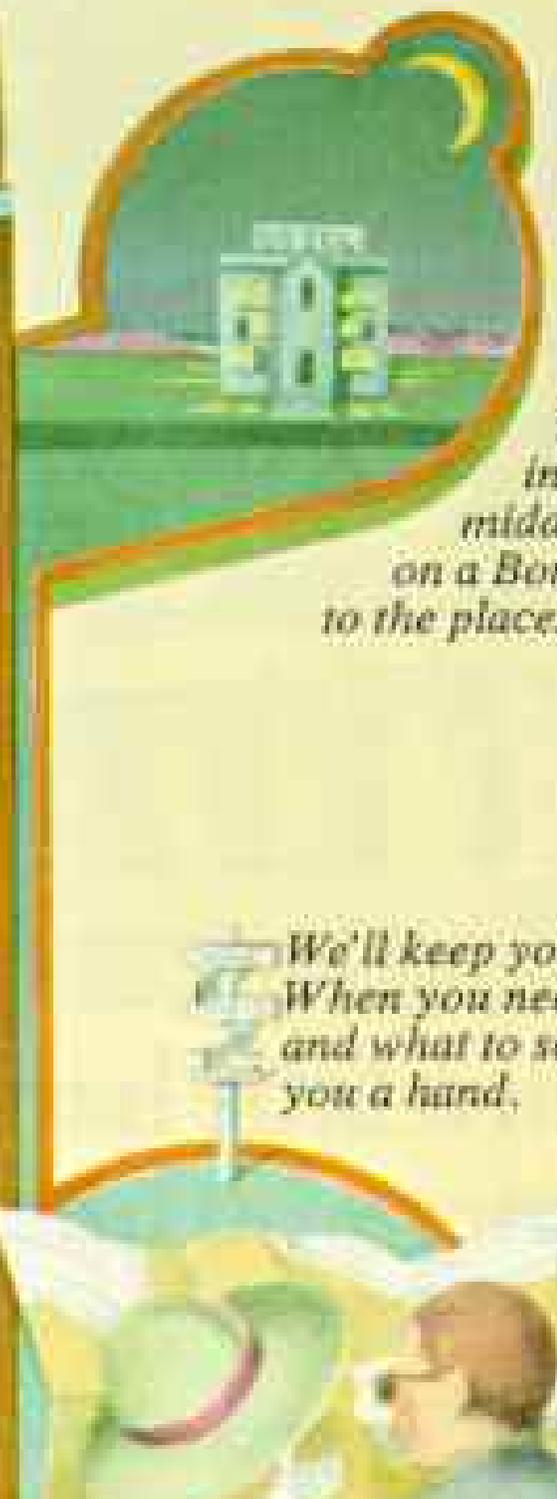

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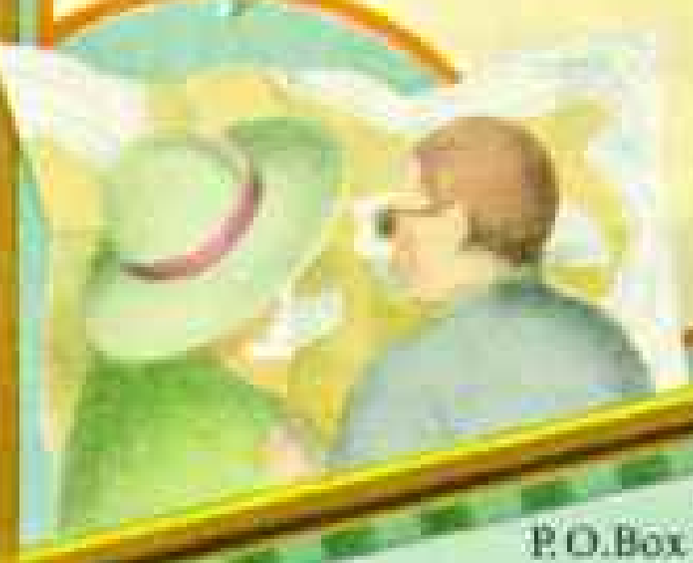

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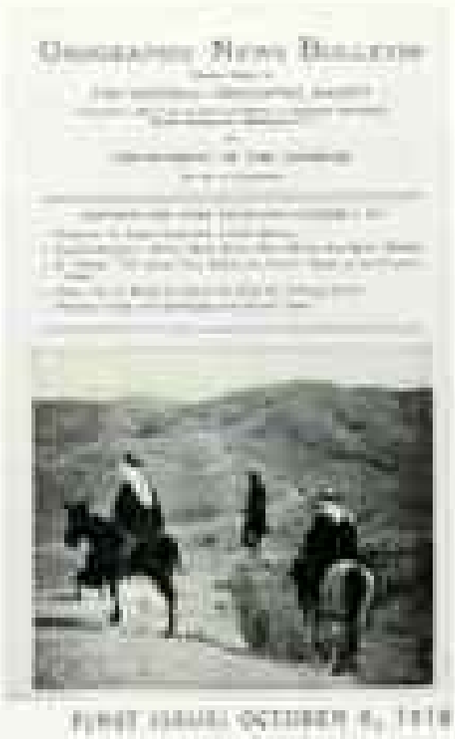

FIRST ISSUE OCTOBER 6, 1919

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Still going to school at fifty!

AS LIVELY as its youngest reader, as welcome as a favorite friend, the National Geographic *School Bulletin* this month begins its 50th year of publication. Here editor Ralph Gray cuts a birthday cake for Dr. Melvin M. Payne, President of the Society, far right, and Dr. Melville Bell Grosvenor, Editor-in-Chief and Chairman of the Board.

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KODACHROME BY ROBERT S. OAKES © N.G.S.

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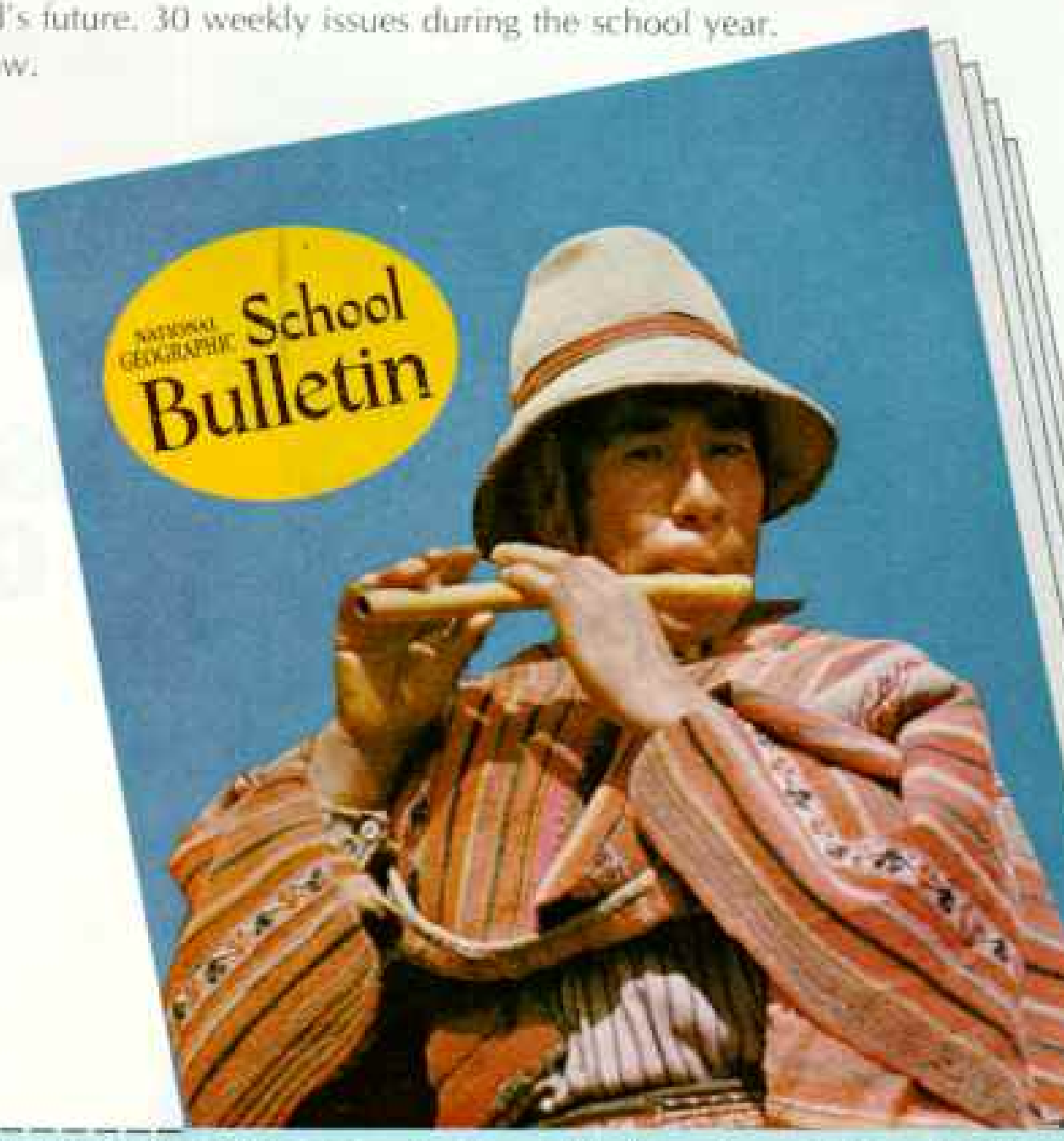

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