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NATIONAL GEOGRAPHIC

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NATIONAL GEOGRAPHIC

Society

16th & M Streets N.W.

Washington 6, D. C.



National Geographic Magazine

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COVER: Neon lights blaze along Hollywood Boulevard in a city within a greater city, Los Angeles (page 460).



Watches shown (from top): Sea Scope II, \$85; Skip Jack 505 Electric, \$79.50; T-404, Self-winding, \$100. All prices plus tax.

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From embattled Viet Nam a woman reporter brings back story, pictures — and a captured flag

“What’s a woman doing here?” The question has followed Dickey Chapelle (right, above) through two decades of covering wars and revolutions. It became the title of her autobiography, recounting her experiences in World War II, the Hungarian revolt (in which the Reds imprisoned her), the Algerian conflict, and the Castro revolution in Cuba.

Last summer the petite (5-foot-4-inch) correspondent flew in U. S. Army and Ma-

rine helicopters hunting Communists in South Viet Nam. Her photographs and eye-witness report will appear in next month’s NATIONAL GEOGRAPHIC. Here she shows assistant illustrations editor W. E. Garrett a Communist flag taken by Vietnamese troops whom she followed into combat.

This kind of meaningful, first-person reporting is exactly what your friends would enjoy as members of the Society. You may nominate them for membership below.

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ABOARD ONE OF THE WORLD'S GREAT TRAINS

by POLLY NOYES
Travel Editor, San Francisco Chronicle

I returned, not long ago, from Chicago to San Francisco on the California Zephyr. And as the wheels clickety-clacked on the last lap of the trip toward the City by the Golden Gate I reflected that right here in our own American West is one of the great train journeys of the world. On one of the world's great trains.

Over many years of travel I recalled as memorable the rail journey through the Alps by way of the Gotthard tunnel; the Japanese-print landscape from the train window between Tokyo and Kyoto; the little train whipping up the valley of the Urubamba. I remembered the famous Blue Train from Paris to Nice on the Cote d'Azur. All were fun trips. But the trip I was just completing was second to none of them.

Three railroads — the Burlington, the Rio Grande, and the Western Pacific — combine their services to make this travel adventure possible. Westbound or eastbound, scheduling is so arranged that you see the best of the West in daytime. Five cars with Vista-Domes give you a view of mountain scenery high as the sky — a camera fan's delight.

Zephyrettes are an institution on this spacious train. These attractive girls are charged with duties ranging from handling dinner reservations to warming baby's bottle.

You step into your roomette, bedroom or compartment; hang up a dress in your own closet; spread out your cosmetics in your own lavatory and prepare to enjoy everything from the music flooding your carpeted private room to coffee in bed in the morning.



The ever-beautiful Colorado Rockies achieve fairyland enchantment during the winter season.

At Denver, coming from Chicago, you are 1000 miles along your way, with San Francisco 1500 miles ahead. The best is yet to come . . . up, up into the Colorado Rockies, country of deep red canyons, sky-high mountains, and tumbling streams. Tunnel after tunnel, including the six-mile Moffat bore, through the Continental Divide.

There are those who think this day of our journey the most fascinating; others for whom the highlight is the more than 100 miles the California Zephyr winds down through the Sierra Nevada, following the turbulent Feather River. Deep green pools and white water rapids. Forests of spruce and pine.



Near the headwaters of famous Feather River, the Vista-Dome streamliner crosses the Sierra Nevada and starts its journey down the entire length of Feather River Canyon.

It's no hardship, incidentally, to economize with a coach seat on this train. I went up front to try them. They recline to any position and have adjustable leg and foot rests.

I felt right at home in the clever "San Francisco Cable Car Room" open to both Pullman and Coach passengers for inexpensive meals and drinks from 6 A. M. to midnight. Food is also reasonably priced in the Dining Car—graciously served at tables decked with colorful Colorado carnations.

Best time of year to make the trip? We asked our Zephyrette her favorite. "Fall," she said without hesitation, "when the aspens are brilliant gold. Though Spring with all the wild flowers is a lovely time, too."

But it's hard to imagine anything more beautiful and exciting than a trip West through the snow-covered mountains in the dead of Winter. You'll arrive completely relaxed, thrilled with the experience of traveling aboard one of the world's great trains . . . the California Zephyr.

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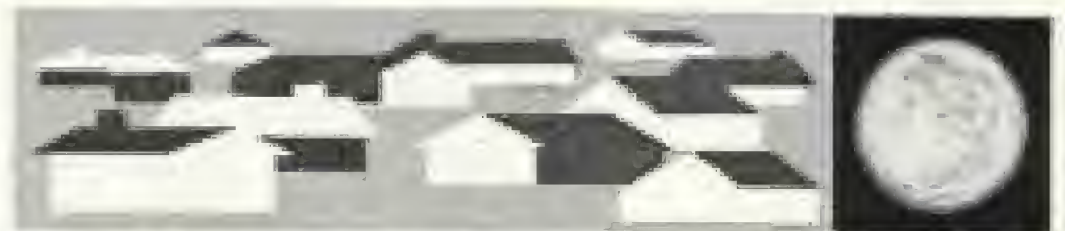
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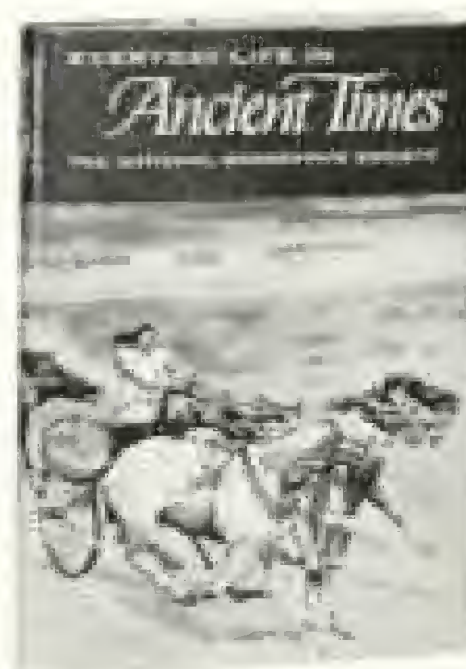
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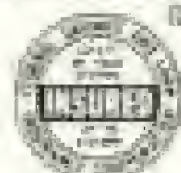
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Now picture this very same underground seepage on a giant scale and you have the problem that has faced many a harassed construction engineer.

Yes, although man may decide to sink a bridge footing here or dig a mine shaft there, Mother Nature quite often has other ideas. And she gets her way through *water*.

How? By the typically feminine maneuver of going underground. Beneath the topsoil lie layers and layers of substances, all of which have different properties. In tunneling through it, man has often, to his dismay, come upon layers of porous, sandy soil or fissured rock through which water flows easily. Trouble!

A problem like this is often solved by a technique called *grouting*. Grouting simply means that materials are pumped in to fill the voids in the sand or rock—like sticking thousands of tiny fingers in thousands of tiny dikes. In the past almost any inexpensive

filler material was used. Cement. Clays. Even oatmeal. You pumped . . . and you hoped.

Then came AM-9* chemical grout.

It all began when a Cyanamid scientist synthesized a new compound named, with typical scientific brevity, *methylenebisacrylamide*. Step number two came when a group of other chemists, while exploring new uses for acrylics, uncovered a weird phenomenon. They found that when they mixed methylenebisacrylamide with another acrylic compound and certain catalysts in a glass of water—the water turned solid! So solid that it had to be cut from the glass with a knife.

At the time these first gels were being formed in the laboratory, an urgent, practical need had already been isolated. Water flowing through soil or rock formations caused costly problems and delays in construction and mining. Could this mysterious gel be the answer? It could—it was.

After refinement in Cyanamid laboratories came the big tests—exhaustive field trials. What emerged was AM-9—a grouting material that could literally work wonders.

It transforms porous soil into impervious matter instantaneously. It halts cave-ins and underground seepages. It permits man to tunnel and excavate to his heart's content.

And AM-9 has still another string to its bow. So thin it flows wherever water can flow, it *waterproofs* just as well as it grouts. AM-9 halts chronic water infiltration in sewers and mines, was used to permanently waterproof the utility tunnels at the Plattsburgh Missile Complex.

With the development of this remarkable product, Cyanamid entered an entirely new field. Chemicals had long been known to improve the *agricultural* properties of the soil, but they had been thought to have little power over the soil's *engineering* properties.

Truly, AM-9 marks a breakthrough for the entire chemical industry.

And that is precisely what is so exciting about being in the *business* of science.

Cyanamid's twelve divisions are staffed with thousands of scientists, virtually all working toward the solution of some pressing problem. Yet the full realization exists that minds must be allowed to "putter." To stare aimlessly into space. To explore with no apparent direction.

Out of this "puttering" comes a variety of things. You get solutions to problems that do not yet exist, weird and seemingly worthless substances—that really work—like AM-9.

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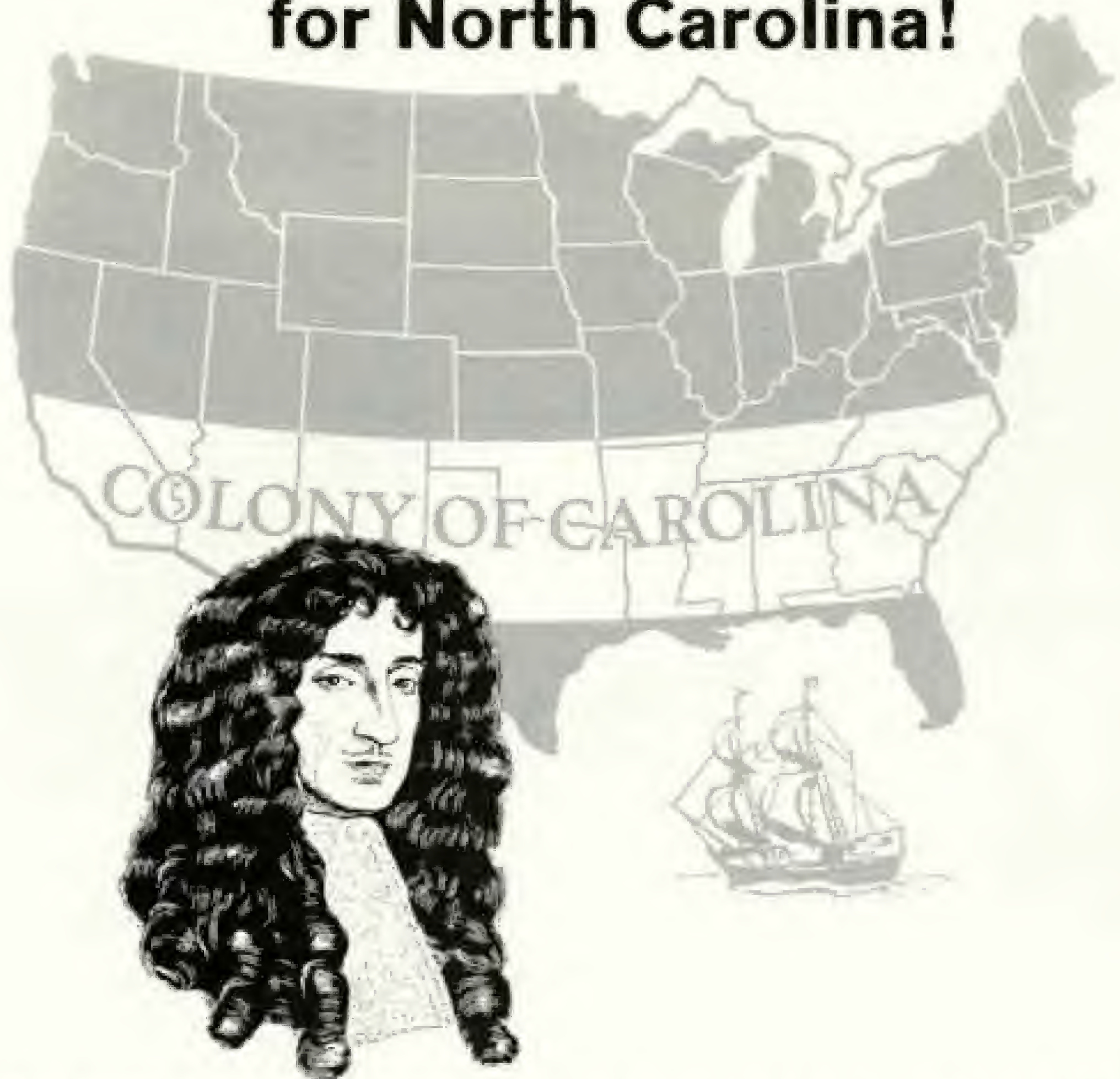
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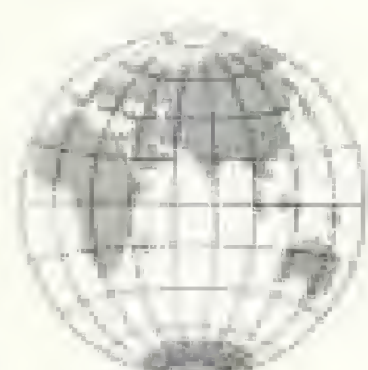
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VOL. 122, No. 4 OCTOBER, 1962

WHEN I WAS a boy, we lived in Ocean Park on what I was sure was the highest hill in the world. Los Angeles to me was a rumbling ride on the big red cars of the Pacific Electric Railway's Venice line, a pimiento-cheese sandwich at the Owl Drug Store, and hours of padding behind my mother at the big May Company store.

We moved away from Los Angeles before I grew up. I do not know how many times I have been back since—perhaps a hundred—but my visits gave me no firm concept of the complex city. I knew the quickest route from airport to hotel, and how to get to the movie studios, aircraft plants, and several good restaurants. Of the friendly, sprawling, gaudy city as a whole, I knew almost nothing.

Palms Beneath an Electric Skyline

Los Angeles is a subtropical metropolis, and the trees and flowers of the world have been borrowed to make it bloom. Long lines of palms, masses of bougainvillea, and other exotic flowers brighten the rows of gleaming white stucco bungalows. Contemporary architecture, some of it very good, gives the growing skyline a taut, electric look.

Cultural life is rich: concerts, chorales, outstanding art exhibits, and the world's leading motion-picture industry. It is a center of intellectual ferment, inspired not only by great universities but also by a tremendous influx of scientists to its space industries.

All this I was to learn. But as my Los Angeles-built jet airliner angled down to the \$70,000,000 airport, it was the wisecracks I had heard about the city that came to mind: Los Angeles is forty suburbs looking for a city. It's an outdoor circus. It's a fine place to live—if you're an orange.

I'd had too much of hearsay and wisecracks; this time I was out to find the facts.

Though my stay was bracketed by disaster, I found the facts tremendously attractive and

Colossus on the western shore . . .

Workshop of the Space Age . . .

Babylon on the freeway . . .

California's City of the Angels

Los Angeles

By ROBERT DE ROOS

*Illustrations by
National Geographic photographer
THOMAS NEBBIA*

The Author: Robert de Roos, a free-lance writer, was born in San José, Costa Rica, in 1912, but has lived in California from early childhood. A former newspaperman, he won a coveted Nieman Fellowship at Harvard University in 1948. Mr. de Roos is the author of many articles and four books, most recently a novel.



Glittering sea of lights, Los Angeles presents one of the world's most spectacular

always exciting. As my plane flew in, I saw below me the raging Bel-Air fire, which destroyed 484 homes in three terrible days and nights in November, 1961 (pages 468-9). As I left in February, 1962, Los Angeles was again declared a disaster area because of flood.

In between, the city demonstrated the range of its weather: sharp, dry Santa Ana winds from the desert; snow; and days of brilliant 87° warmth while most of the country shivered under blizzards. Over-all, the weather, winter and summer, is superb, if a little on

the warm side, and the pervading dancing light makes dark glasses almost mandatory.

But weather was merely a backdrop to my sortie into the city. During my stay, I watched Red Skelton caper for the television camera, poked my hand into a tame whale's mouth, ate smorgasbord, sukiyaki, chiles rellenos, shish kebab, and chow mein, rode a monorail train, watched movie stars grandly entering Grauman's Chinese Theatre, met a mayor, swam in the heart of Hollywood, and nimbly avoided an invitation to ski on Mount Baldy.



night views, Griffith Observatory high above Hollywood (foreground) overlooks the city's sweep

from mountains to ocean

ROBERTSON BY NATIONAL GEOGRAPHIC PHOTOGRAPHER THOMAS WEBER © N.G. 1

I came away with the feeling that Los Angeles has always been running too fast to observe itself. Neither residents nor visitors seem to realize that this biggest city of the Southwest is a new phenomenon in the Nation.

City of Smiling Strangers

As I explored the city's byways, I found a pervading friendliness. The people may be strangers to one another—coming as they have from all parts of the United States—but they are strangers putting their best feet

forward, always quick to help or to smile.

Newcomers find the promise of their new lives at once exhilarating and rewarding. Prophets are honored in Los Angeles; there is a feeling that here all things are possible.

Los Angeles is one of four cities of the United States which merchandisers regard as centers of influence. (The others are New York, Chicago, and Miami.) What happens in Los Angeles affects the buying habits of all of us. It is the industrial center of the West, a strong arm in the defense of the United

States, and a center of the Space Age effort. Los Angeles is a success story, and the success story has always been popular with Americans.

As Dr. Franklin D. Murphy, Chancellor of the University of California at Los Angeles, told me: "This is a great city today—not just a big city, a great city."

Chancellor Murphy, a newcomer to California from Kansas, speaks with the objectivity of a scholar. Los Angeles, addicted to talking about the future, has not realized

City of the Angels Sprawls Across a Mountain-rimmed Coastal Plain

Grown from a village to the Nation's third city in a century, Los Angeles proper (yellow area) has 2,500,000 people, a population exceeded only by New York and Chicago. Close to 7 million swell out the civic mushroom of Greater Los Angeles, which embraces 87 other cities such as Pasadena, Santa Monica, and Long Beach, and scores of smaller communities in Los Angeles and Orange Counties. This artist's-eye view, as if from 40 miles up, sweeps 50 miles from Malibu Beach to Huntington Beach and 40 miles from San Fernando to San Pedro.

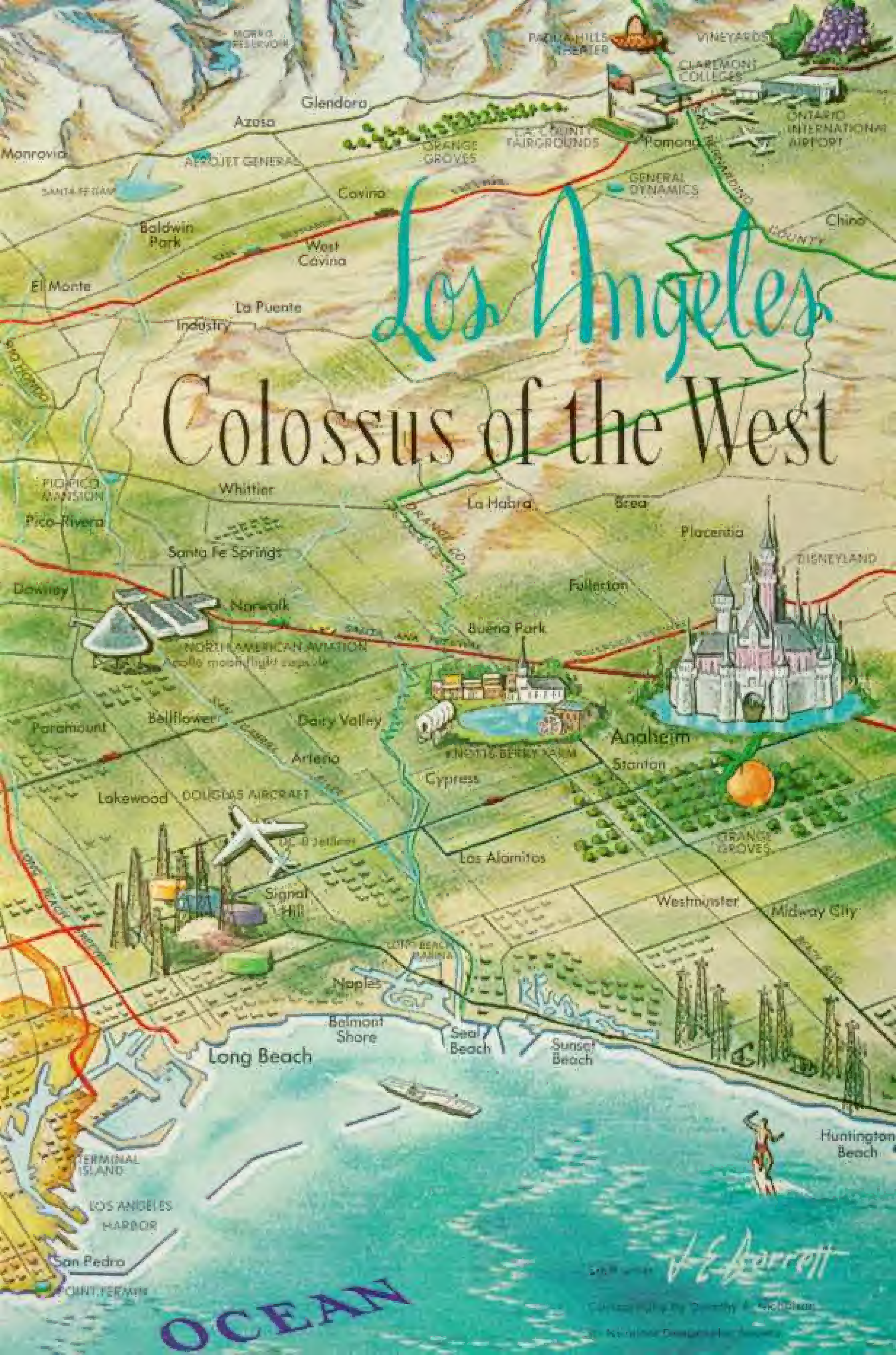
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Los Angeles

Colossus of the West



H. E. Barrett

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Paper-fringed piñatas adorn Mexican shops on old Olvera Street.



Santa Monica bathers frolic in Pacific surf.

Graceful parabolic arches dome a restaurant in the sky at new Los Angeles International Airport.



Hip-swinging twisters gyrate at the Palladium Ballroom in Hollywood.

Sleek thoroughbreds race around the first turn at Santa Anita Park.





Wire weavers shape memory units for computers at a Litton Industries plant in Woodland Hills.

LOS ANGELES has many facets. Sunshine, oranges, and oil sparked the city's early growth; today thousands of factories lure job-seekers. More Americans moved into metropolitan Los Angeles in the past two years than trekked west along the Oregon Trail; yet the enormous blanket of homes, shopping centers, schools, and industrial plants still spreads.

Fun-seekers find mountain, desert, and seashore within an hour's reach.



that its future is already impressively here.

"I think we may be evolving a modification of the American way of living," said John Anson Ford, who had served 24 years on the Los Angeles County Board of Supervisors. "There is an intensity of drive here. Along with creative work, there is an almost frantic attempt to capture leisure. The exodus each weekend is terrific—to Palm Springs, to the beaches, to the mountains. . . ."⁶

But the sharpness of pace is not the whole story. I visited sections of the city where age and good taste had laid a soft patina over the homes, where graceful conifers stood along broad avenues. Fremont Place and Hancock Park, both "old" districts of mellowing homes rising from wide lawns, are quiet retreats.

I visited Ben Marble, an aircraft company executive, at his home in Mandeville Canyon. It is a long, low ranch house set among live oak and eucalyptus trees, with a sheep in the back yard, innumerable cats, a dachshund, and a parrot. The older Marble boys belong to a 4-H club. Ben Marble hunts pheasant 40 minutes from home and plays polo even closer. Yet he lives only 15 minutes from his office in Santa Monica.

On Wilshire Boulevard one day, I asked a stranger why he lived in Los Angeles.

"I live a thousand feet from the sea and five hundred feet above it," he said, "over a beautiful sandy beach. Every morning I get into my 12-cylinder Ferrari and drive to work. It takes me 20 minutes. Every weekend I spend on the beach. If the weather at the beach is not good, I drive to Palm Springs, where the weather is always good. That's why I live in Los Angeles."

Birthplace of a City

At first, the city seemed sheer confusion to me, a "whiteness, flatness and spread," as one guidebook said. "Where will you start?" I was asked. "With the freeways, inertial-guidance systems, space capsules, oil, movies, jet planes, toys, fashions, missiles, or television?"

I started where Los Angeles itself began 181 years ago—on Olvera Street, just off the Plaza which dominated the life of the little village next to the river (foldout map, pages 455-7). I entered the quiet street a block from the Plaza, passing a cluster of palm trees, and paused to inspect an old sandstone watering trough from California's early days.

I walked past wooden *puestos*, little stalls where enchiladas and tacos were cooking.

⁶ See "Californians: Escape to the Desert," by Mason Sutherland, NATIONAL GEOGRAPHIC, November, 1957.



Stars in her eyes, lovely model Darlene Lucht dreams of the day her name may shine from marquee lights. The quest for fame lured her to Hollywood from Wisconsin.

Bumper-to-bumper Traffic Jams Hollywood's Gaudy White Way

In no other U. S. city does life center so much on the automobile as it does in Los Angeles, home of the country's first drive-in restaurants, theaters, banks, and churches. Three-fourths of all Angelenos drive to work. For an evening's entertainment, they frequently motor 10 miles to dinner, 20 miles to a motion picture, or 50 miles to the home of friends. The result: king-size traffic problems despite a vast network of freeways.

Ablaze with lights, Hollywood Boulevard arrows through the heart of the film capital,



where handmade candles, glassware, leather, and candy were for sale. As I climbed the worn steps of the Avila Adobe, the oldest house in Los Angeles, I heard the liquid music of a guitar and the gentle cooing of doves.

Olvera Street Turns Back Time

I was met at the doorway by Mrs. Christine Sterling, one of southern California's remarkable women, who is largely responsible for the preservation of this old Olvera Street area. She led me to a flower-filled patio; although we were in the heart of the city, a hop-skip-and-jump from busy Alameda Street, no

traffic din reached our ears. The only sounds were the soft voices of ring-necked doves nesting in hanging flowerpots and the slap-slap of a potter's wheel.

Mrs. Sterling and I talked of the area now being restored, El Pueblo de Los Angeles State Historical Monument.

"We are going to turn the clock back here," she said. "Everyone seems to want to make everything bigger and better. We will make things a little smaller, a little more peaceful and, maybe, a little better."

The Avila Adobe was built while the city was under Spanish rule, possibly as early as



THE PHOTOGRAPHER BY NATIONAL GEOGRAPHIC PHOTOGRAPHER THOMAS REDDA © 1984

1818. Nearby stand the Church of Our Lady the Queen of the Angels (dedicated in 1822), the Pico House (1869), and the Merced Theater, the city's first, established in 1870. All four are part of the Pueblo restoration.

"This was a plague spot when I came on it in 1928," Mrs. Sterling said. "It was just an alleyway with sewer water running down the middle." But what dismayed Mrs. Sterling most was to see a condemnation sign on the Avila Adobe. Apparently no one cared but Mrs. Sterling.

She roared into action, halted the demolition and, enlisting the support of the late

Harry Chandler of the *Los Angeles Times*, saved the building. By begging and cajolery, she had it restored.

Town of the Queen of the Angels

On September 4, 1781, a small group of settlers from Mexico first arrived at a town site chosen by the Spanish governor of California, Felipe de Neve. The settlement had been officially named El Pueblo de Nuestra Señora La Reina de Los Angeles de Porciúncula (The Town of Our Lady the Queen of the Angels of Porciúncula). Over the years the name was shortened until just Los An-



geles remains. It is variously pronounced "loce ahng-hay-lace," "lawss angless" or "lawss anjelees," or called simply "L. A."

The Americanization of Los Angeles can be said to have begun when the first English-speaking settler, Joseph Chapman, arrived in 1818 on a pirate ship. He was captured as he rowed ashore in a small boat, but the dons didn't quite know what to do with him. His many talents soon won him favor as a respectable and useful citizen. He was a skilled carpenter, and he helped build the church Mrs. Sterling had shown me on the Plaza.

The Mexicans, who had won their independence from Spain, took over Los Angeles in 1822, but in 1848, as a result of the Mexican War, lost not only Los Angeles but all California to the United States.

Six years earlier, in March, 1842, gold was

discovered in Placerita Canyon, about 30 miles northwest of the pueblo of Los Angeles. Francisco Lopez, a ranch foreman hunting stray horses, was digging wild onions during a midday rest when his knife brought up a small gold nugget. The placer deposit thus found was worked for several years, but it proved to be small.

Los Angeles's first real boom grew from the later gold rush to the great strikes in the north, in the Sierra Nevada foothills, after 1848. Many citizens grew rich selling beef to the northern gold camps and cities.

The tide of immigrants from the rest of the country pouring into Los Angeles is nothing new. As a result of a railroad rate war in the mid-1880's, the city was deluged by Midwesterners taking a cheap ride. At one point, the fare from Kansas City to Los Angeles dropped



Stepping in the shoes of the stars delights visitors to Grauman's Chinese Theatre in Hollywood. Here film celebrities have preserved their footprints, handprints, and signatures in the concrete forecourt. John Barrymore etched his profile in concrete, Jimmy Durante his nose, Joe E. Brown his mouth.

Premiere of *West Side Story* attracts spectators straining to see the star, Natalie Wood, and escort Warren Beatty.



BY DETACHMENTS (PREVIOUS AND SUBSEQUENT) © R.G.P.

to an even dollar. By 1892, the population had grown to more than 50,000.

In that year oil was struck within city limits. Fourteen hundred wells sprang up, some of which are still producing. The city entered its modern industrial age.

Metropolis Gains 30 Citizens an Hour

Los Angeles has come a long way since 1781. In area, it is one of the world's largest cities—some 450 square miles, with a periphery of 315 miles. In population, it is the third largest U. S. city (by the 1960 census, New York had 7,781,984; Chicago, 3,550,404; Los Angeles, 2,479,015; Philadelphia, 2,002,512).

And it is by far the fastest growing, numerically. Sixty years ago fewer than 190,000 people lived in the entire Los Angeles area. Today 7,000,000 are here, and the total grows

by nearly 5,000 a week, 30 new citizens every hour. By the year 2000, at the present growth rate, southern California may be one solid city from Santa Barbara to the Mexican border, with a population near 25,000,000.*

The most striking sights in Los Angeles today are its new buildings 20 and more stories high—offices and apartments towering against the sky (page 500). In residential building, Greater Los Angeles led the United States in 1960.

It has other hallmarks: leggy Washingtonia palm trees (page 485) and, almost everywhere, leggy women wearing slacks. Although some of the world's best-dressed women inhabit Los Angeles, the city as a whole is casual rather than chic.

*See "New Rush to Golden California," by George W. Long, NATIONAL GEOGRAPHIC, June, 1954.



Lifting Hymns Herald an Easter Dawn
in the Canyon Setting of Hollywood Bowl

World's largest natural amphitheater, the 120-acre bowl seats 20,000. Steel sound shell and superb acoustics of the sage-covered hills make micro-



STAGEWORK BY JOHN WILKINS © NATIONAL GEOGRAPHIC SOCIETY

phones virtually unnecessary; voices reach the farthest row. In 40 years of concerts, rain has postponed only three performances. A thousand tourists a day visit the sequestered theater.

One bright December morning I pointed my car toward the gigantic white letters high on a hill which spell out HOLLYWOOD (left). I drove up narrow, twisting streets which could have been on Italy's Isle of Capri. Bougainvillea, bird of paradise (the city's official flower), and hibiscus bloomed in profusion in narrow yards. I was moving through a place of decks and tall supporting walls. Homes were cantilevered out from the roadway over steep canyons, shimmering against the hillside.

Mountains Split the City

I turned up a deserted dirt road, running yellow among the hills. A last sharp turn and I stood more than 1,500 feet high in the Santa Monica Mountains, which cut Los Angeles in two. My drive had deposited me on one of the few spots from which I could see almost all the great metropolis (map, pages 455-7).

To the north lay Burbank and Glendale; northwestward spread the floor of the San Fernando Valley. From where I stood, the tremendous sound stages at Warner Bros. Studios looked like toy blocks.

Gazing south, I could see the swimming pools sparkling in the hills. Hollywood Reservoir, held in by Mulholland Dam, a part of the intricate and expensive water system, gleamed in the sun. Below were the buildings of Hollywood and, beyond, the towers of Wilshire Boulevard.

I saw the concrete-lined channel of the Los Angeles River as it crossed the flat plain, and the 454-foot shaft of City Hall rising from the downtown heart of the city.

Farther on, I knew, although the sunlit haze hid them, lay Culver City and Inglewood and, far to the south, where the Pacific was a silver streak, stood San Pedro and the Port of Los Angeles, an artificial harbor carved at a cost of \$155,000,000—a harbor that leads all other Pacific Coast ports in tonnage.

Looking down on this delta of the Los Angeles River, this "island on the land" hemmed in by mountains on two sides and by the Pacific on a third, I wondered just how the



Palatial homes of the film colony rank high among tourist attractions in the Arabian Nights city of Los Angeles. Actress Janet Leigh's 18-room Beverly Hills mansion, complete with outsized swimming pool, epitomizes the luxurious living enjoyed by motion-picture notables.

Studying the script of a new movie, Miss Leigh relaxes in her living room. Moroccan lamps swing above a mosaic table patterned in a musical motif. In the sweeping mural, artist Karl Appel painted his impressions of a New York-to-California trip.

phenomenon of Los Angeles came about. For the plain is semidesert, a place never meant for a metropolis.

The city was founded in the days of sail, yet had no natural harbor and lay on no trade route. It had no navigable river, and only enough water to support perhaps half a million people. Yet there it is today, with its millions of residents jostling in an 85-by-125-mile sweep of coastal plain and mountains.

Lacking a harbor, it built one. Lacking water, it pioneered some of the largest water works conceived by man, reaching out—not without controversy—to the Owens Valley, the Colorado River, and soon to the Feather River, 450 miles north. Through the foresight and daring of its planners, Los Angeles has not had a water shortage in modern times.

Los Angeles, which began long before pueblo days as the Gabrielino Indian village of Yang-na, now surrounds the independent cities of San Fernando, Culver City, and Beverly Hills, and almost pushes Santa Monica



and Long Beach into the Pacific. Those five engorged municipalities have themselves a total population of 506,500. By every measure, Los Angeles is the Colossus of the West. And where the city ends, the metropolitan area begins—with 82 other incorporated cities in Greater Los Angeles, embracing all Los Angeles County and adjacent Orange County.

Boosting Los Angeles in Reverse

Some people feel this growth is destroying the values for which they came to Los Angeles. In a recent letter to the *Los Angeles Times*, Dan Jenkins, a friend of mine who came from New Jersey, wrote somewhat tongue-in-cheek:

"When I get back east, I make a point of talking about nothing but our smog, fires, floods, landslides, earthquakes, freeways, parking problems, impossible traffic condi-

tions, early-morning fog, late-afternoon fog, debilitating lack of seasons, constantly increasing property taxes, Mickey Cohen, and the miserable showing of the 1961 Dodgers and Rams." Jenkins claims he has dissuaded all of 16 persons from moving to Los Angeles.

But his voice is small against the thousands like a St. Louis girl I talked to. She had been in Los Angeles just a year.

"Why, we have an ocean here," she said. "The mountains are right here too, and there is Palm Springs and even Mexico—all so close. I walk down the street and I just laugh, I'm so happy to be here."

A "new" kind of people swells the population: the young men and women who have grown up here, products of one of the most astonishing educational complexes in the Nation. The local youngsters stay on. The University of Southern California (now em-

PHOTOGRAPH BY NATIONAL GEOGRAPHIC PHOTOGRAPHER THOMAS SMITH © 1961





Grimy faces of weary firefighters attest the battle they waged against wind-whipped flames.



Leapfrogging Canyons, Brush Fires Roar Through Rich Residential Districts

Twin fires swept across 14,000 acres of the Santa Mónica Mountains in November, 1961. Hundreds of show-place houses in the Bel-Air and Brentwood areas burned to the ground; property damage exceeded 25 million dollars. Aerial bombing with chemicals helped keep the conflagrations from joining. Dense smoke blanketed Los Angeles; Fresno, 200 miles to the north, saw the haze.

Chimneys stand like tombstones atop the ashes of mansions in exclusive Bel-Air. A few estates on this ridge miraculously survived. Here, three months after the blaze, bulldozers have carved new homesites on the far slopes. Such terraced lots cost upward of \$40,000.

barked on a 30-year, \$106,675,000 expansion program) alone has 50,000 graduates in Los Angeles County—and their average age is 35.

"Most people who came to Los Angeles and southern California in the early years were essentially seeking escape," said Chancellor Murphy of UCLA. "They were escaping the cold winters of Iowa and the droughts and dust of Oklahoma and eastern Colorado. People who are escaping live in an unreal world. A whole range of off-beat things was bound to bubble up here.

"With World War II came a tremendous growth of industry. After the war, overnight, a science-based industry grew up. It needed

highly intelligent young people who were not escaping but wanted to become involved."

These dynamic young people form the "critical mass" that caused explosions in Los Angeles's commerce, industry, and culture.

I called on Norman Chandler, the handsome, distinguished Chairman of the Board and President of the Times-Mirror Company and one of the most influential men in California. We sat in his office in the blocky *Times* building, across from City Hall, and I asked him to describe Los Angeles.

He laughed. "I've heard a lot of people try," he said. "I think it is a city that has grown so fast and is growing so fast it hasn't





had a chance to meld into a solid, basic city. Every large community has to have a hard core, a downtown city. Los Angeles had it once, but the suburban areas grew so fast that downtown was neglected. It will come back. We will have a central city."

Norman Chandler's evidence was just outside his window: the towering and beautiful new buildings of the Civic Center. Also part of the reinvigoration of downtown Los Angeles are the new structures of Union Oil, Occidental Life, the United California Bank, Signal Oil, and Tishman; a 35-story building is to go up at Sixth and Hill; a \$25,000,000 Music Center is planned on Bunker Hill, which rises sharply at Third and Hill Streets.

Redevelopment on Bunker Hill

Later, I boarded an orange-colored car of the Angels' Flight Railway to reach the top of Bunker Hill. This railroad, purporting to be the world's shortest, consists of two cable cars and travels a route of one block, up a 33-percent grade, in about a minute.

Bunker Hill—named for its resemblance to its Boston counterpart—was once a proud section of stately homes with intricate fretwork, gables, and bays; now it is a moldering ruin, ripe for the bulldozer. Its redevelopment as a modern apartment house, business, and cultural center awaits court action.

"Los Angeles has known since 1930 that Bunker Hill should be redeveloped," comely 31-year-old Mrs. Rosalind Wiener Wyman, the only woman member of the City Council, told me. "It's a slum. But it took ten years before the City Council could get the Bunker Hill redevelopment project approved, and now we are in the courts fighting for our right to clear the area."

Marineland of the Pacific, a three-ring sea circus, perches on a rocky spur of the Palms Verdes Hills. Sea lions and bottle-nosed dolphins frolic in the arena in foreground, trained whales and striped dolphins in the circular stadium beyond. Circling the center tank on different levels, visitors can watch a diver feeding myriad species of fish.

Bimbo, 4,000 pounds of pilot whale, explodes for a handout of squid. Doing five shows daily, he "sings," jabs a punching bag, and "shakes hands" with his trainer. He takes pictures of spectators by pulling a string attached to a camera shutter.

"We have lawsuits here against everything," she said. "You can get groups to protest here more easily than any other place I know."

When I talked with tall, white-haired Harold Wright, veteran manager of the Chamber of Commerce, I asked about the contention Mrs. Wyman had mentioned.

"It's a good thing, in a way," Wright said. "People come out here to put in a new plant





or start a new business, and they frequently say, 'Who do we see here?'

"You don't 'see' anybody. There is no recognized center of power. That leads to wrangling, but it's better than having a few powerful figures in control."

Los Angeles has a decentralized municipal

government. Its department heads are not individuals; the mayor appoints commissions for each branch or department: a harbor commission, a police commission, a traffic commission, and so on. Mayor Samuel W. Yorty, who hails from Nebraska, explained it to me as he sat behind his broad desk in City Hall,



PHOTOGRAPHS BY JORGE ARDITA © NATIONAL GEOGRAPHIC SOCIETY

"I'm the first Democrat in 40 years to be mayor in this city," he told me. "I have tried to make the government really nonpartisan, and I have brought in men from our great universities to serve as commissioners. I've given the brains of the community a chance to come downtown."

Soaring like rockets at their trainer's command, six-foot, 200-pound striped dolphins leap in formation 18 feet above water. Marineland's sportive acrobats also jump through fiery hoops and play basketball.

When I had been in Los Angeles a few weeks, I found myself stuffed with statistics. Everyone fed me figures. Schools: more than 3 billion dollars spent since 1952 to provide for 683,000 current students from elementary through junior college; the second largest school district in the country (only New York's is larger). Telephones: 3,542,000 phones in service in the county—one for every 1.7 persons. Tourists: nearly 5,000,000, who spent \$694,789,360 last year. The harbor: more than 4,500 ships entered port last year.

These were big, juicy, supersaturated figures. I decided I'd get a better understanding of the city if I saw what tourists come to see.

Stars and Studios on Show

Los Angeles is the home of people who are admired throughout the world—Doris Day, Robert Young, Jimmy Durante, and scores of others—and visitors want to see their homes. It is not surprising that the most popular tour offered by the Tanner Gray Line wends its way through Beverly Hills and the Pacific Palisades, passing many of the stars' homes en route.

Visitors' affection for the stars extends into the past too. It is a moving experience to visit the home of the late Will Rogers in Pacific Palisades. The spacious ranch house and grounds, including the cowboy-humorist's polo field, are now the Will Rogers State Park (pages 476-7). With original furnishings and many mementos, the house looks as though the immortal Will had just walked out the door.

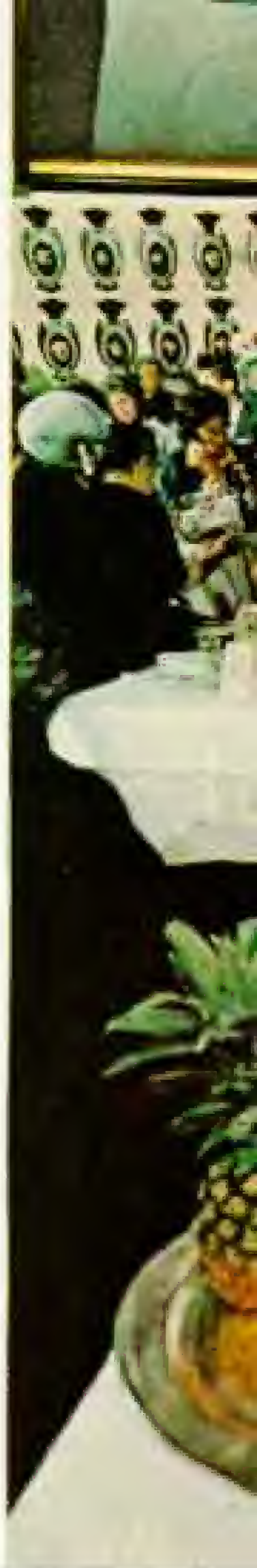
When I visited the concrete "front yard" of Grauman's Chinese Theatre (page 462), I discovered by placing my shoes in the concrete prints that my feet are the same size as Bob Hope's. Here, too, I met Charles E. Toberman, also known as "Mr. Hollywood," the man who built the Chinese Theatre for Sid Grauman.

"One day, Sid and I were inspecting the theater," Toberman said, "and he stepped through a door and put his feet right into some fresh concrete. You should have heard that cement man."

"Grauman drew himself up. 'I'm Sid Grauman,' he said. 'If you're such a big shot,' answered the workman, 'I'll write your name

Food to feast the eye fills a stall in Farmers Market, whose 164 booths sell everything from homemade peanut butter to Spanish-speaking mynah birds. Some twenty thousand shoppers visit the emporium daily.

Food to tempt the palate—smoked capon, cracked crab, salmon in dill, Princess Margrate cake, and “smorgashricka” appetizer—decorates a table in Scandia Restaurant on Sunset Boulevard, one of Los Angeles’s many elegant eating places.



in the cement.’ That’s when Sid got the idea of putting stars’ footprints in the courtyard. Now hundreds of people a day drop around to look at the prints.”

Toberman recalled the early days of Hollywood. “There was a streetcar line running out from Los Angeles,” he said, “but it swayed so much, people got seasick riding it. There were pepper trees along Vine Street in those days. I remember, when they started cutting them down, Mary Pickford started a battle to preserve them.” He paused. “It was a more colorful town then. They made their movies in the streets.”

Disney’s Land of Past and Future

One morning I drove out the crowded Santa Ana Freeway through a heavy haze that hid most of the industrial area rimming Los Angeles on the south and east. Later, as the sun became brighter, I glimpsed the

saw-tooth roofs of factories and the glaring signs offering new homes for \$89 down. The spindly palm trees, each with a mop of unruly tresses, bent before the sharp wind. A tumbleweed skittered along the highway, outdistancing the traffic.

I was on my way to Disneyland. The wind was still blowing when I reached there, but a brass band in brilliant red-and-gold coats blew even harder and more cheerfully.

Immediately I was plunged into that ecstatic world Walt Disney has created for America, and I realized once again that in Disneyland the present does not exist—only tomorrow and many a bright yesterday, but no today (pages 478-9).

In Frontierland, I saw the false fronts of Mother Murphy’s Chop House, El Dorado Hotel, and the Opera House of the little town of Rainbow Ridge. This town is located near a most improbable wilderness area of beaver



RODACHEN (ARROW) AND HIS ENTICERS © NATIONAL GEOGRAPHIC SOCIETY

dams, bear ranges, elk, and bobcat; and a desert teeming with "life," including a huge diamondback rattler, marmots, peccaries, and Gila monsters, all made to look like the real thing—and animated.

I visited the Grand Canyon, flew over London in a Peter Pan pirate galleon, and took a rocket to the moon. Best of all I liked the submarine ride. (Walt Disney has a fleet of eight submersibles—the only submarines on the globe dedicated to fun.)

With Edward Meck of the Disney staff, I rode the monorail that currently carries nearly four million passengers a year.

"I didn't see many children in the park," I remarked.

"Well, of course, they are in school today," Eddie explained. "Even so, we get many more adults than children. The ratio is 3.5 to one. Sometimes people ask us when Walt is going to build a Disneyland for kids."

When Disneyland opened in 1955, Walt Disney said it would never be completed. "It will grow as long as there is imagination left in the world," he said. I saw what he meant when I visited the Disney Studio in Burbank.

Land of Oz Comes to Life

Some of the things planned for Disneyland's future were coming off the drawing boards. I stood in a haunted house and watched a skeleton materialize from a fireplace, float across the room, and disappear in mid-air. Another pesky skeleton threw a dagger which narrowly missed my head and quivered in the wall behind me. I saw Emerald City in the Land of Oz, a metropolis inside a magic mountain, guarded by animated soldiers. This is in model form now; it will reach Disneyland in two or three years.

After the mechanical marvels of Disneyland, the natural wonders of Marineland of



the Pacific, on a level shelf above the sea near Palos Verdes Estates, were a delight of a different kind. Here, in three gigantic tanks, sea lions, sharks, giant sea bass, 300-pound sea turtles, and hundreds of fish sport in man's largest fish bowls. But the stars of Marineland are the trained whales and the high-jumping dolphins, which perform several times a day (pages 470-72).

I ducked into the restricted area behind the big tanks and found British-born David H. Brown, Curator of Mammals, in his small office. In a British accent, he told me of his marine charges: six pilot whales, 14 bottle-nosed dolphins, five striped dolphins, a dozen sea lions, six harbor seals, four walruses.

Of pilot whales, David Brown said, "They are remarkable beasts. I don't say they are any more intelligent than the bottle-nosed dolphin, but they adapt more readily to captivity, possibly because they are less emotional."

We walked to a small holding tank where Squirt, Brown's pet, was blowing gently with two other pilot whales.

"Squirt verges on domesticity," Brown said, reaching down to scratch her back. The small whale, shiny black like good-quality rubber, rolled over and opened her mouth, showing little cone-shaped black teeth that resembled football cleats. Brown tickled the roof of her mouth and urged me to do the same.

"Pilot whales have a very hard palate," he said. I can vouch for this.

Market Stays Open All Night

As I drove home in the dusk, the radio blared: "Do you ever need a head of lettuce at three in the morning?" It went on to say that the Hollywood Ranch Market never closed. I remembered seeing the market crowded with customers when I drove by the night before—at 1:30 a.m.

The radio announcement reminded me I had not visited the Farmers Market, one of the most famous in this country. It started as a vegetable stand in 1934, but has become considerably more.

"It was a depression idea, a scramble to

Will Rogers Would Find His Ranch Home Just As He Left It 27 Years Ago

Flying to Alaska in 1935, Rogers died with Wiley Post when their plane crashed. Now a state park, the humorist's estate preserves his boots and saddle in the living room where he entertained friends by roping the mounted calf. Weapons and trappings from his collection hang from the balcony rail. Polo was Rogers's favorite sport. "I'll take up golf," he once said, "whenever it can be played on horseback." On the field he laid out 40 years ago, hoofs pound the turf in a Sunday game (below).





Grand Master of Fantasy Leads the Christmas Parade at Disneyland

For creator Walt Disney, Disneyland is a 20-year dream come true. Five million visitors a year pour into his magic kingdom. Spread across 160 acres in Anaheim, 25 miles southeast of downtown Los Angeles, Disneyland combines story-book adventures, the wonders of nature, a look into the future, and pages out of history. During the peak summer season the park employs nearly 4,000 people to man the 45 major attractions and countless exhibits and shops.

Driving with two of his granddaughters in an antique electric car, Mr. Disney heads the Parade of All Nations that opens the holiday season. More than 2,500 marchers decked in costumes of some 30 lands take part in the annual parade down Main Street.

Fairy-tale enemies, Big Bad Wolf and Little Pig consort peacefully at Disneyland. Employees costumed as Snow White and the Seven Dwarfs, Mickey and Minnie Mouse, and many other Disney characters stroll the grounds.

Stately stern-wheeler *Mark Twain* passes an Indian village in Frontierland, where life-sized "braves" stretch skins over a travois frame.







BRONKHORST © NATIONAL GEOGRAPHIC SOCIETY



Four Traffic Layers Merge at the Stack, World's Busiest Intersection

With the highest ratio of automobiles to population in the country, metropolitan Los Angeles has 315 miles of freeways and plans to add another 1,500 miles by 1980.

A 30-minute drive by freeway puts Angelinos 22 to 25 miles from the center of the city. Yet nightmarish jams clog exit ramps in rush hours. Police in helicopters help ground officers to direct the rivers of traffic. More than 300,000 cars a day use this interchange.

Veil of smog, bane of Los Angeles, hovers over the heart of the city, but hilltop homes in Palms Verdes Estates escape the haze. Occurring about 70 days a year, smog irritates eyes and nasal tissues, hampers air traffic, and damages crops. Authorities attribute the condition to the action of sunlight on exhaust gases in air lying virtually motionless in the mountain-ringed basin.



make a living," Murray Bennett, assistant general manager, told me.

Since then, banking on highest quality goods and a friendly approach, the market has grown to a phenomenon. About 20,000 people a day visit it—6,250,000 a year.

Normally, I am not an admirer of fruits and vegetables, but never have I seen such bounty as in the Farmers Market. There were bright red watermelons (in January), papayas, oranges, salad greens, and beans, all of almost unbelievable perfection. There were cheeses and pastries, buttons, baskets, and bows, clothing, gifts, pets, choice meats, and any number of other good things (page 474). A sign on a bright red tower of tomatoes read, in a casually flippant style: "Keep Your Cute Little Fingers Off."

The place was jammed, many visitors eating at outdoor tables. Their fare included Mexican enchiladas, Italian pizzas, barbecued ribs, Chinese egg rolls, and a wide and wonderful variety of pies and sandwiches.

I went next day to Forest Lawn, the astonishing cemetery in Glendale. The man at the gate told me, "We were the biggest thing on the coast, until Disneyland. This is the most beautiful memorial park in the world."

Swans were preening in a small pond, and the grass, rising toward the Wee Kirk o' the Heather, was a dazzling green. A steady procession of cars slowly wound up Cathedral Drive, past the Whispering Pines and the Temple of Santa Sabina, past Sunrise Slope and Graceland to the Court of David, where a replica of Michelangelo's huge statue stood white in the afternoon. A million and a half people visit Forest Lawn each year to see the Last Supper Window, the Mystery of Life Garden, and Jan Styka's gigantic painting of the Crucifixion.

In Thrall to the Automobile

I drove to Forest Lawn on a hot Sunday afternoon, when the roads were clogged with traffic. Most of it was headed for Griffith Park, the spacious mountain area that includes a small zoo, picnic grounds, tennis courts, and an observatory (page 453). I knew there were 3,400,000 motor vehicles in Los Angeles County—enough to stretch more than 10,000 miles bumper-to-bumper—and they all seemed to be on the road that day.

Los Angeles is one of the few big cities to have made its main growth after the advent of the automobile. Today it is in thrall to the horseless carriage, and its people both love and hate the machine. More Thunderbirds,



PHOTOGRAPH BY NATIONAL GEOGRAPHIC SOCIETY

Miracle Mile's developer, A. W. Ross has seen Wilshire Boulevard grow from a 20-foot-wide dirt road to a 100-foot-broad thoroughfare in the past 40 years; property skyrocketed from \$100 a front foot to as high as \$6,000. New 22-story Lee Tower rises at left amid offices, shops, and department stores.

Continentials, and Mercedes-Benzes are sold in Los Angeles than in any other metropolitan area in the country. One restaurant has a parking area reserved for Rolls-Royces.

Although they love their cars, the people of Los Angeles resent their terrible dependence on them. They hate the traffic, and the automobile is a major cause of smog. The cars and trucks of Los Angeles County burn 6,800,000 gallons of gasoline a day and vent the waste products of this into the air.

I stood with Chief of Police William H. Parker at the broad picture window in his office. Far away to the east was a yellowish curtain of smog. We watched the swift movement of cars on the Santa Ana Freeway. Chief Parker looked down on a dozen or more parking lots, vast acres of them, where commuters had left their pastel shells.

"Those automobiles," he said, "are pieces of machinery that cost more than three thousand dollars each, on the average; they weigh more than three thousand pounds—and they move one-and-a-half persons to and from work. Then they sit there and deteriorate nine hours a day."

Parking is a major industry. A map of downtown Los Angeles shows nearly a third of the land devoted to parking lots. Businessmen keep rubber stamps on their desks to validate the parking tickets of visitors. On almost every new store front is the sign: "Free Parking in Rear."

To the monstrous number of private cars is added the fleet of buses and streetcars of the Metropolitan Transit Authority, carrying 750,000 passengers a day—a drop in the bucket against the need for a mass rapid-transit system. Test borings are finished and design is well along for a proposed subway, but there is widespread doubt that a rapid-transit system will solve the problem.

Miracle Mile Revolutionized Shopping

A. W. Ross, developer of Los Angeles's Miracle Mile shopping district, did not invent the automobile, but he was one of the first men in the United States to recognize its enormous potential. What he did about it set a pattern for the city's growth (left).

In 1921, reasoning that the automobile would change America's shopping habits, he purchased 18 acres on Wilshire Boulevard, then a 20-foot-wide dirt road well outside city limits. Ross chose his location strategically; it could be reached easily from Beverly Hills, Hollywood, and the wealthy Wilshire and Westlake districts. Within ten years the

boulevard was a wide, well-lighted, modern shopping thoroughfare.

When Ross started his district, there were ten department stores downtown. Today there are six on Wilshire Boulevard and only four downtown. Newest and most spectacular in the Mile is Seibu, the country's first Japanese department store. The Lee Tower in the Mile was the first 22-story skyscraper to be built in Los Angeles after the city's 150-foot height limit was removed in 1957.



APRIL 1961 © NATIONAL GEOGRAPHIC SOCIETY

"Gigantic flower of folk art," critics have labeled Simon Rodia's towers, which the immigrant tile setter erected outside his home in Watts to show his gratitude to the U. S. Bits of shell, glass, and china inlay the steel-and-concrete spires.

After traveling the 15½-mile length of Wilshire Boulevard, I realized that this street is the unifying element in the diversity of Los Angeles. It ties together the city of today with the city's past; virtually everything that has happened to Los Angeles has happened or is represented on Wilshire.

The boulevard began as an animal trail, then became an Indian trace and a path for the Spaniards' ox-drawn *carretas*. It traverses old millionaires' row in the no-longer-fashionable Westlake district, and borders Fremont Place, a present enclave of the rich.

Its lands are the acres of the old Spanish ranchos—La Brea, Rodeo de las Aguas (Gathering of the Waters), Las Cienegas, and San José de Buenos Aires. In the spring its vacant lots blaze with yellow mustard bloom, only a short taxi ride from today's skyscrapers. It has some of the most exclusive stores in the city, laid out so that customers can enter from parking lots in the rear.

Wilshire runs past Westwood Village, seat of UCLA, which has grown from a provincial normal school to a university of high degree in less than fifty years. I drove onto the hilly 465-acre campus where the buildings, modeled after those of Italy's Lombardy, shone golden in the sunshine (pages 486-7).

A bright yellow crane formed a Y against the blue of the sky, a symbol of the rush to complete new buildings for the urgent needs of the growing student body (almost 20,000 at present). UCLA is physically raw-looking, but that will change: the Regents appropriated \$50,000 for tree planting in 1958.

Ships Steer by a Golden Angel

From Wilshire Boulevard the jutting spire of the world's largest Mormon temple can be seen. Atop it, 273 feet in the air, stands the golden figure of the angel Moroni, a triumphant trumpet at his lips. Ships 25 miles at sea use the floodlighted tower as a guide mark on clear nights.

Beyond Westwood, Wilshire curves through a sprawling Veterans Administration facility and then straightens for its final drive to the sea through Santa Monica.

On this last stretch of the boulevard is Douglas Park, named for Donald Douglas, who did experimental work on his early planes on the site. I used to hang around that plant when I was a boy, intrigued by the idea of aviation so close to my home. None of those early plane men looked very great then, with their khaki coveralls and greasy hands, but they shrank the world.



Enormous Tusks Spike the Skull of a Mammoth

La Brea Tar Pits, sticky quagmires in Hancock Park where oil and tar still bubble from subterranean pools, trapped thousands of now-extinct mammals and birds.

La Brea skeletons in the Los Angeles County Museum in Exposition Park make up the world's largest Pleistocene collection.

This imperial mammoth, a close relative of the elephant, towered 12 feet.

Washingtonia palms, native to canyons of northwestern Mexico, soar 75 feet above a street in Pasadena. Their skirts of dead leaves have been trimmed to the top.





Even faculty secretaries study at UCLA. April sun bathes the university's handsome new Medical Building.

Wilshire ends softly at palm-fringed Palisades Park above the Pacific.

The boulevard cuts through Los Angeles's recent past and the days of the dons, but its most fantastic chapters are revealed in La Brea Tar Pits, still gurgling sluggishly in Hancock Park on the Miracle Mile—ugly sumps surrounded by heavy wire fences to keep people from falling in. A small observation house has been erected; now a campaign is under way for funds to build a science exhibit museum in the park.

The Indians were familiar with these treacherous black pits, and the Spanish used the *brea* (tar) to waterproof their roofs—including that of the Avila Adobe.

In 1875 a geologist wrote the first scientific paper describing the pits as a repository of thousands of fossil bones. No one paid any attention. Not till 1905 did scientists become actively interested. In 1913 the Los Angeles County Museum took over management of the pits, and since then half a million bones have been recovered for study and reconstruction by experts.



Class-bound Students Crisscross the Sun-drenched UCLA Green

The University of California at Los Angeles spreads across 465 acres of rolling country in Westwood Village.

UCLA currently enrolls nearly 20,000 full-time students. In addition, thousands take extension courses ranging from modern Armenian to thermal management of spacecraft.

Situated just off Wilshire Boulevard, UCLA offers courses dealing with motion pictures, television, and the theater. Many graduates hold top jobs in the film industry.

Twin towers flank the entrance to Josiah Royce Hall, named for an eminent American philosopher. Brick staircase at the end of the esplanade leads to gymnasiums.

Dancers sway to a Javanese gamelan orchestra in a UCLA music class.



BY ENTERTAINMENT WEEKLY AND ILLUSTRATED BY NATIONAL GEOGRAPHIC SOCIETY





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OWL

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WATER

DOLSON & SON

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Tournament of Roses

Tournament of Roses

Tournament of Roses

LEFT

The bones reveal that short-faced bears, saber-toothed cats, imperial mammoths (which stood up to 13 feet high), and prehistoric condorlike vultures with 12-foot wing spreads once roamed the steamy plain and lost their lives in the pits. Their bones, preserved by the tar, proved a major scientific find. Many skeletons have been pieced together and are on display at the Los Angeles County Museum (page 484).

Even more astonishing than the bones of the saber-toothed cats are the tiny bones of lizards, hares, birds, and mice, as well as the minute parts of insects and seeds and other plant remains. The brea pits have yielded a cross section of life on the Los Angeles delta 14,000 to 15,000 years ago.

Concerts, Chorales, and Rodia's Towers

Wherever I went in Los Angeles, I saw a lively cultural life. There are concerts in the Hollywood Bowl, nestled at the foot of the Santa Monica Mountains (page 464). The Los Angeles Philharmonic Orchestra plays

36 concerts a year on a subscription basis and is always a sellout; in addition, it gives some 65 concerts a year in neighboring cities. The Community Concert Association is the largest in the country, with 10,000 members. The Roger Wagner Chorale is internationally famous through its recordings.

Los Angeles, with its recurrent building booms, has been a bonanza for architects, and some notable work has been done. William Pereira and Welton Becket, among others, have designed beautiful contemporary buildings. But for me, the most striking structures in Los Angeles are the Watts Towers. They were created by Simon Rodia, an unlettered Italian-born tile setter, and they enliven Watts, an outlying section of the city.

I first saw the towers from a block away—eight narrow, conical, filigreed spires. They reminded me of some mythical storybook castle. I find it hard to say just what the towers in Simon Rodia's "garden" are—architecture, sculpture, or simply happy doodlings in concrete and multicolored rubbish.



ALL PHOTOGRAPHS BY JOHN AND ROSAMUND WILSON FOR NATIONAL GEOGRAPHIC SOCIETY

Spectacle in Pasadena: the Tournament of Roses on New Year's Day

Cheering thousands line Colorado Boulevard (opposite), canopied with banners for the 73d annual Rose Parade on January 1, 1962. Television cameras relayed the pageant to millions more across the Nation. Only an all-night vigil on the sidewalk (above) guaranteed a front-row spot for watching the procession of 60 floats, 20 marching bands, and scores of equestrian units. Fresh orchids from Hawaii, carnations from Denver, and millions of roses from the gardens of southern California mantled the floats. Rose Bowl game, pioneer of post-season football contests, climaxes the day-long event.



Fireball sun inflames smog-tinged sky and silhouettes a forest of derricks in Long Beach.

Rodia's towers are a delight of lattice-like slender arches and airy interlaced forms which climb into the sky in an irregular pattern. Every inch of the arches, walls, and towers is covered with patterns of sea shells, old tile, bits of broken pottery and mirror, green and blue bottles, and rocks (page 483).

It took 33 years for their creator, working alone in his spare time with only simple tools and a window-washer's belt, to complete his castles. Then he deeded them to neighbors and moved away, north of San Francisco.

He is a silent man, not given to explanations. But he once told an interviewer: "I wanted to do something for the United States because there are nice people in this country." That is the fullest statement he has ever made about his labor of love.

Bottles, broken plates, rocks, and shells—so described, the towers sound ugly and weird. They are not. I realized as I looked at them in a cold sunset that Simon Rodia, working only from the blueprint he read in his heart, has sent us all a colossal valentine.



PHOTOGRAPHS BY NATIONAL GEOGRAPHIC PHOTOGRAPHER THOMAS REDDIN © 1961

Tapping phenomenally rich fields, the port city's wells pump millions of barrels of oil a year

Los Angeles produces long-legged, tanned athletes in prodigious numbers. They have shown their prowess in tennis, football, and track for many years. More recently, Los Angeles, which calls itself "the sports capital of the world," has seen a tremendous upsurge in all competitive sports.

Biggest shot in the arm came when Walter O'Malley tore the heart out of Brooklyn and led his Dodgers baseball team to Los Angeles. The city is now really in the big leagues, with the Dodgers in the National League and the

new Los Angeles Angels in the American.

Even though the Dodgers played on an improvised field in the Memorial Coliseum, built for football, the fans turned out in such numbers that a new National League attendance record was set in 1960. This year the Dodgers opened "the finest stadium in baseball," at Chavez Ravine near the fantastic confluence of freeways in downtown Los Angeles known as the Stack (page 480); the Angels, too, play here. Excitement ran high last July 4 when, for the first time, both teams led their leagues.

Naples, a Labyrinth of Islands, Channels, and Lagoons, Enjoys the Nautical Life

Greater Los Angeles has a Pacific shoreline of nearly 105 miles, stretching southeast from Malibu at the foot of the Santa Monica Mountains to San Clemente. Each weekend a mass exodus from the city crowds the beaches, and the seas swarm with sails and surfboards.

Handsome homes set among green lawns and tropical vegetation edge the canals of Naples, a section of Long Beach. Arched bridges link the islands. Yachts fill the Long Beach Marina on the far shore of Alamitos Bay, whose seven miles of waterways provide excellent havens.

Catapulted from a springboard, an amateur acrobat soars above the sands of Santa Monica's "Muscle Beach," mecca of the body worshipers. The beach gained its nickname from exhibitions performed by physical culturists.

Tempered by the cool California Current, Los Angeles enjoys a mild climate. From winter to summer, the average temperature rises only 15 degrees, from January's 55° to July's 68° Fahrenheit.





Rounding out the sports calendar are two great race tracks, Santa Anita (page 458) and Hollywood Parks; the Lakers, professional basketballers; the Rams, football pros; the Blades, a new hockey team; professional golf, and hundreds of amateur events. The hockey team surprised everyone by drawing more than 10,000 spectators a game in the latter part of its season. Hockey, basketball, and other events are presented in the new Sports Arena (near the Memorial Coliseum) with a seating capacity of more than 15,000.

Industry Proves Its Vitality

For many years, Los Angeles has suffered the disbelief of many eastern businessmen.

"I don't believe anything they tell me out there," a Bostonian said to me. "It's all a bubble."

This attitude is due to a distrust of the glamor industries, principally motion pictures and aircraft. It ignores the oil of the region, the rich agricultural pattern, and the diversity of secondary industries. When the bottom dropped out of the aviation industry right after the war, when oil yields declined, when the movies took their nose dive and agricultural revenues fell off, the Los Angeles economy did not collapse. It was then that many realized the strength of the city's other industries—tires, fashions, electronics, chemicals, toys, machinery, and the assembly of automobiles.

The motion-picture business, which has died so often in print, is a robust corpse—much too young to die. Movies came to Los Angeles in 1907 when director Francis Boggs and cameraman Thomas Persons shot scenes there for a one-reel version of *The Count of Monte Cristo*. In 1913 Cecil B. DeMille, Jesse Lasky, and Samuel Goldwyn rented a barn in Hollywood to make *The Squaw Man*; one year later David W. Griffith produced *The Birth of a Nation*. These were the early years, too, of such old-time movie giants as Mary Pickford, Charlie Chaplin, Buster Keaton, and Harold Lloyd.

The first centers of movie making were Edendale, Santa Monica, Long Beach, Glendale, and Culver City. Hollywood did not welcome the motion-picture makers, and it is ironical that it became the most famous of all for the glamorous life. The town had been founded by Mr. and Mrs. Horace H. Wilcox, Kansas prohibitionists who had envisioned an entirely different sort of community.

I wandered around Warner Bros. Studios in Burbank one day, amazed by the bustle.



Laughter rocks a studio in CBS Television City, Hollywood, as three cameras record last year's *Tell It to Groucho* show.

Monitor screens in the glassed-in control room capture Groucho Marx and his guests from three angles and enable the technical crew to judge the quality and vary the scenes. Small screens in bottom row reveal what the three cameras are shooting. Large screens in top panel show the picture being used, made by camera at far right.

Jack Benny and His Troupe Parody *The Mikado* for Fall Showing on TV

A Sunday evening tradition on radio and television for 30 years, the Benny show has been shifted to Tuesday nights. Here Dennis Day (center) and Don Wilson rehearse a song with the star (left) in the Revue Studios.

Camera at left rolls in and out on a pedestal dolly; the other shoots from a height of eight to ten feet.

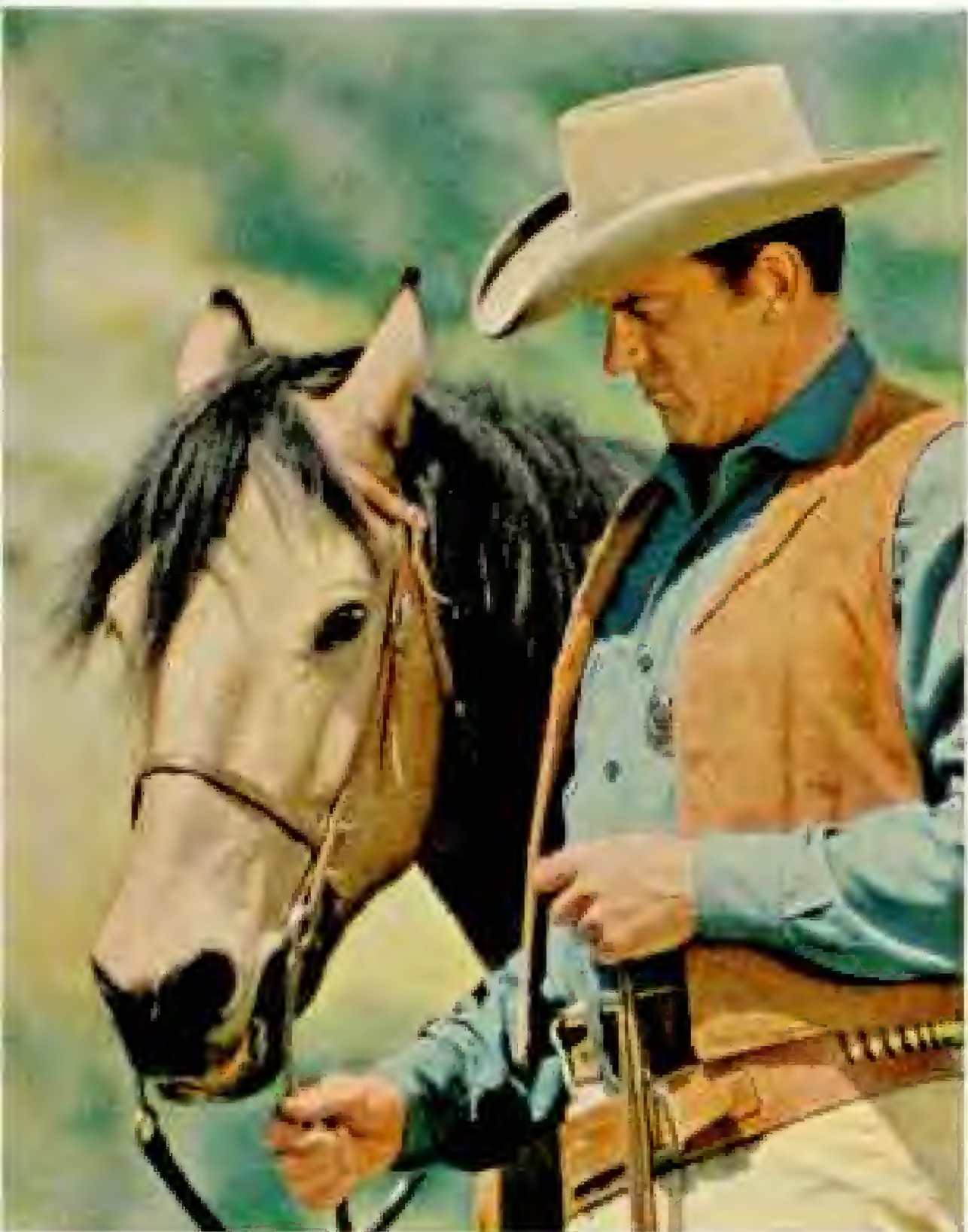


BU ENTERTAINMENT © NATIONAL GEOGRAPHIC SOCIETY



Technicians outnumber actors as the *Gunslinger* television crew films an episode on a San Fernando Valley ranch. Reflectors of aluminum foil soften shadows on the performers' faces. Cloth shrouding the microphone at right muffles the whine of the wind. Cameramen, who have just filmed a close-up, prepare for a long shot.

Marshal Matt Dillon, played by James Arness, stars in *Gunslinger*, a long-running CBS adventure series that re-creates frontier days in Dodge City, Kansas.



Clint Walker was going through his paces for *The Cheyenne Show* on the Western set on the back lot. Another company was at work on the New Orleans set, and the men of *77 Sunset Strip* were rushing the latest episode into the can, one of 39 they make in a year.

All around Los Angeles, both on movie lots and on location, other companies were working feverishly to keep up with their rush schedules (above). Warner Bros. alone is geared to produce more than ten hours of motion pictures a week for television—the equivalent of more than five feature pictures. Probably more motion-picture footage is being shot today than in the movies' pre-television peak years of 1937 and 1938.

Motion pictures and television together, however, are small in scale compared to today's space effort. This is the largest single endeavor ever embarked on by the United States, and Los Angeles is at its center.

Companies which once were content to produce airliners, bombers, and fighters now hire astronomers, biologists, physicists and geophysicists, botanists, and mathematicians as a matter of course. One of the nimblest leaps in American industrial history was made when aircraft companies reached out and made space their domain.

"Missiles are composed of the same basic ingredients as aircraft," explained F.A.W. Stieller of the Aerospace Industries Associ-



KODACHROME © NATIONAL GEOGRAPHIC SOCIETY

ation. "They both have an airframe, a propulsion system, and a guidance system. There all resemblance ends. But the people who were able to design and build airplanes adapted readily to the new materials and techniques involved in missiles."

Classrooms for the Space Age

Originally, the aircraft industry went to California because of the benign climate. Today the climate is still important, but industry also values a different kind of climate—the academic. Because of the many institutions of higher education here, scientists and technicians can more readily keep abreast of rapid technological developments.

Certainly, neither the aircraft industry nor its giant offspring, the aerospace industry, could have prospered without such institutions as Pasadena's California Institute of Technology and its daring pioneer work. Caltech has furnished battalions of Ph.D.'s to southern California's space industry.

The aerospace industry here has a weekly payroll of \$26,000,000 and provides employment for 180,000 men and women. More than a fourth of all manufacturing employment in the Los Angeles area depends on aerospace activities, and 85 percent of the work depends on the Defense Department or the National Aeronautics and Space Administration.

Recently, at ground-breaking for the new



Ladder-riding welder in the Douglas Aircraft plant at Santa Monica works on a massive weld fixture. The opening frames a dome-shaped bulkhead for the S-IV, second stage of a Saturn rocket designed to pace exploration of the solar system.

Aviation plants freckle the face of Los Angeles, the Nation's foremost city in aircraft production. Each month commercial and military jets roll off assembly lines by the hundreds.

Hound Dog missiles receive a final check-out at the North American Aviation factory in Downey. The stubby-winged, 43-foot-long air-to-ground rocket can be launched from a B-52 more than 600 miles from target.

spacecraft can be tested and observed on earth before they are rocketed from the planet.

Visually, this industry is hard to encompass. I flew with Mel Nowack, chief helicopter pilot for North American Aviation, in one of three helicopters which fly 36 trips a day shuttling executives from plant to plant.

We flew from the Los Angeles airport to Downey, site of NAA's Autometrics Division, which makes inertial-guidance

systems. NAA's Space and Information Systems Division, which makes the air-to-surface Hound Dog missile and the Apollo mooncraft, is also at Downey (opposite).

Along the way, we passed over the busy factories of Northrop, Hughes Aircraft, Aerospace, and half a dozen other companies—gigantic buildings surrounded by neat herringbone patterns of parked cars.

We flew over a river of brown earth, the carved-out path of a new highway, and over

Douglas Astropower plant in Costa Mesa. Dr. Theodore von Kármán of Caltech, an early rocket experimenter, recalled a visit from an Air Force general in 1938.

"We have every confidence in you, doctor," the general said, "but do you *really* think \$10,000 for a study of rockets is justified?"

Last June another firm, Space Technology Laboratories, dedicated a single new facility in Redondo Beach that cost \$30,000,000. The center includes a giant chamber in which

PHOTOGRAPHS BY NATIONAL GEOGRAPHIC SOCIETY



PHOTOGRAPH BY NATIONAL GEOGRAPHIC SOCIETY

modest homes whose back yards were set with blue swimming pools. We saw no human figures, and it was easy to imagine that the automobiles which silently streamed down the freeways, nosed into parking lots, and backed and filled like intelligent beetles were the only sentient beings below. The illusion lasted until we hovered over an array of Hound Dog missiles and returned to the world of men.

Supergun Fires Glass Bullets

Inside a prosaic factory building, I found the walls adorned with photographs of comets, nebulae, galactic clusters, and great flames of the sun's corona. Pretty Jonelle Smith typed nonchalantly in a room containing a model of the moon six feet in diameter. The whole atmosphere is designed to remind workers that the space race is on.

In one aerospace laboratory, Ed A. Escallier, an associate engineer, fired a supergun loaded with minute spheres of glass against metal shields. His gun is powered by a bank of electrical equipment which for a fraction of a second can equal the output of Hoover Dam's generators. The speeding glass pellets simulate the impact micrometeorites may have on future spacecraft.

In another laboratory, Dr. Jack Green, a geologist, seeks means to use materials which may be found on the moon—assuming the moon has been the scene of volcanic action. He has boiled water out of volcanic rocks with a solar still, and has made building blocks of powdered basalt and sulphur.

At the Autonetics Division I saw electrical circuits reduced to microscopic size by engineers engaged in microminiaturization. I saw one circuit 50/1000 of an inch square containing six resistors and six transistors.

The idea is not simply to save weight and space: these miniatures have a built-in high-reliability factor. The same principle is followed at Litton Industries (page 459), where I watched skilled technicians assemble tiny gyroscopes, vital elements of an inertial-navigation system for fighter planes.

Rocket Stage Towers Four Stories

From this world of miniatures, I traveled to Santa Monica. At the Missile and Space Systems Division of Douglas Aircraft Company, I stood beside the huge shaft of an S-IV rocket, second stage of the massive Saturn booster. It was an enormous barrel four stories high and 18 feet in diameter—and this merely one stage of a rocket, forerunner of



A jetliner soars above Santa Monica Freeway and heads toward downtown Los Angeles on a

an even larger version of the Saturn which some day will launch men to the moon.

Inside the welding room, several of these towering cylinders, painted a silvery blue, stood like silos. Two gigantic cog wheels slowly turned as sections of the fuel tanks passed under a welding torch. The workmen were pygmies among the giant cylinders.

I moved on to Lockheed in Burbank, and the first thing I said there was, "Now that you are out of the airframe business . . ."

"Out of the business!" said William Statler, chief engineer for aircraft. "Why, we've got the world's largest aircraft program under way in seven countries—seven assembly lines for F-404 fighters alone." Then he went on to describe the company's P3V, a new, superior plane used for antisubmarine warfare, a subject close to Lockheed's heart.

Lockheed also has 700 people working on spacecraft. "Our primary objective is to take the next big step," said Jack B. Wassall, Di-



PHOTOGRAPH BY NATIONAL GEOGRAPHIC PHOTOGRAPHER THOMAS HARRIS © N.G.P.

sunny winter morning. Snowy San Gabriel Mountains wall off the city from the Mojave Desert

rector of Engineering. "Our work has to do with man in space, vehicles which might orbit the moon, or land on the moon, or travel on beyond—anywhere in space."

"Anywhere in space . . ."

That is the challenge that is attracting young, vigorous Americans to Los Angeles—unexcelled opportunity in science-based industry, an industry without traditional boundaries—and a chance to live and prosper on a new frontier under the sun.

One late afternoon, I found myself at Clover Field, where Douglas planes in 1924 started the first airborne trip around the world. And I realized I was within a few blocks of the "highest hill in the world," where I had lived as a boy. I drove on.

But when I got to the hill, it was not tall at all. It was scarcely a bump. It seemed a curious thing. The hill is the only thing in southern California that has shrunk in the past twenty years.

THE END





Wintering on the Roof of the World

*A scientific expedition
survives eight months
in the shadow of
Mount Everest*

By BARRY C. BISHOP

National Geographic Staff

Photographs by the author

“THIS WON’T take a minute, old chap.” Dr. John B. West humored me as he led me from the tent to a yellow contraption set up in a yak pasture—a bicycle with one wheel that would take me nowhere.

Clad only in pajama bottoms and a light sweater, even though the December chill hovered around freezing, I mounted the bicycle and meekly submitted while gleaming metal electrodes were taped to my wrists.

“Just breathe into this mouthpiece,” John murmured as he shoved a rubber hose into my mouth and clamped a spring over my nose.

A metronome sounded its remorseless cadence, and my feet pumped the pedals in rhythmic response. A friction drag on the wheel forced me to put out a great deal of effort (page 526).

Tick, tock, tick, tock. . .

The tempo remained constant, nearly

Last light of day, burst into starred rays by the camera lens, strikes sparks from snow atop a Himalayan glacier. A New Zealand visitor to Nepal gazes up the dark slope of Ama Dablam through an unworldly pink glow.



two beats a second. But the counts seemed to come faster and faster as I struggled to keep up. I tried to time my breathing, but soon each breath was a labored gasp. My face bloated, and I had to shut my mind against the clamp on my nose and the ache in my lungs. Through perspiration-blinded eyes I could dimly see the faces of our Sherpa helpers, grinning broadly at my discomfort.



PHOTOGRAPHS BY VERA B. BRONFMAN
AND DAVID L. BROWN © 1965

Conqueror of Everest, Antarctic explorer, New Zealand beekeeper—Sir Edmund Hillary headed the World Book Encyclopedia Scientific Expedition to the Himalayas. An old hand in Nepal, he himself led a search for the “Abominable Snowman” and an assault on Makalu. His umbrella, bought in Katmandu for 75 cents, wards off rain and sun.

Monsoon mists veil the track that leads porters out of Katmandu to the foothills of the Everest country. Large red B's help the author, Barry Bishop, spot his equipment for study of glaciers and weather. Other expedition members carried out research into man's adjustment to high altitudes.

Porters rest as a basket-bearing traveler joins the procession.

My five furious minutes were nearly at an end. “Get ready!” shouted Dr. West. “Exhale and hold it.” He clamped off the hose through which I had been breathing. Dr. James S. Milledge, our electrocardiogram specialist, untaped the electrodes and helped me to the ground. I slumped, panting desperately in the thin mountain air.

I had just been a guinea pig for an experiment to see how well man can perform when oxygen-starved at an extreme altitude, nearly three miles above sea level. My exhaled breath had been captured in a rubberized canvas bag, so that its oxygen and carbon dioxide content could be measured. The pattern of my heartbeat, detected by the electrodes on chest and wrists, was now registered on the tape of an electrocardiogram.

Scientists Camp in the Abode of Snow

We were camped near the mouth of Nepal's Mingbo Valley, almost 15,000 feet up in the very heart of the world's highest mountains, the Himalayas (map, next page). Their name, from the ancient Sanskrit, means “abode of snow.” Low stone walls surrounded our tents and a scattering of stone huts used by Sherpa highlanders in summer (page 514).

Behind us, to the west, the Mingbo Valley dropped to another valley, the Inja Khola, with its Shangri-La monastery of Thyangboche. Gigantic peaks hemmed us in at every turn, dominated by the icy spire of Ama Dablam, soaring a mile and a half above our heads (page 537). Hidden just behind Ama Dablam, and less than 12 miles to the northeast as the Tibetan raven flies, stood Everest itself, culmination of earth.

This majestic setting was our home for the winter of 1960-61, as we delved into many an unanswered question about man's ability to survive in an abnormal environment.

The story of our expedition really began three years earlier, during the International Geophysical Year. And oddly enough it began in the cold, desolate wastes of Antarctica. There two old friends huddled in a polar tent: New Zealander Sir Edmund Hillary (left), who had conquered Mount Everest in 1953, and Dr. Griffith Pugh of the Medical Research Council of Great Britain, the physiologist on that same Everest expedition.*

These veteran mountaineers talked of the rhododendron trees, the pine forests, the laughing Sherpas of Nepal, and the months

*The epic story of the conquest of Everest was related by Sir John Hunt and Sir Edmund Hillary in the NATIONAL GEOGRAPHIC for July, 1954.



MAP BY W. L. BURGOLF AND J. J. KELLY (COMPILED BY E. W. SCHREIBER)

they had spent on its lofty mountains. They mused on the fact that in spite of the numerous climbing expeditions of recent years to the high Himalayas, much scientific work remained to be done.

So they planned a new assault, one that would combine mountaineering with investigations of a host of significant questions:

How high can man live for long periods without physical deterioration?

What changes take place in the body as a man acclimatizes to very high altitudes?

Could a man acclimatize himself so well that he could climb the highest peaks without oxygen equipment?

Aside from such fundamental physiological riddles, the expedition would try to fathom many mysteries of Himalayan weather, plant and animal life, and glaciers.

Within a few months Sir Edmund had found an enthusiastic sponsor in the publishers of World Book Encyclopedia. The United States Air Force and the British Medical Research Council gave support. The

Monsoon Rains Fall on Flooded Fields Through a Swirling Pillar of Mist

Stepped fields in Nepal's lowlands await the harvesting of rice. After the harvest, terraces will grow wheat. In the heights where the Sherpas live, potatoes form the main crop.



National Geographic Society, through its Committee for Research and Exploration, generously made it possible for me to join the expedition and carry out field programs of glaciology, meteorology, solar radiation studies, and mapping.

500 Porters Carry Equipment

And so, in September, 1960, Sir Edmund assembled his forces in Katmandu, Nepal's capital. Scientists and mountaineers (eventually we numbered 22, although no more than 15 were together at one time) trickled in

from five nations—Australia, New Zealand, Great Britain, India, and the United States.

When we marched out of Katmandu, we were an imposing caravan. Nearly 500 porters, each shouldering some 60 pounds, carried our gear—stationary bicycles, glacier drills, theodolites, and other scientific equipment; ice axes, ropes, and spikes for climbing; food, fuel, and generators; tents, clothing, and a prefabricated hut; and a bag of rupees to pay off our porters at the rate of 75 cents a day.

Sir Edmund, with 10 of the party, set out ahead to spend six weeks in the Rolwaling





Long, shining hair of a Sherpa mountain man gets a critical inspection; next step, braids. Sleeping lugs air during a ten o'clock breakfast halt.

Porter's aching tooth receives attention from Dr. James S. Milledge, a British physiologist. Although he had scant dental training, he extracted the tooth with forceps. Other Nepalese countryfolk, who rarely see a physician except when expeditions pass, flocked in for treatment of their ills.

PHOTOGRAPHS BY H. WAULIN (PAGES 48-50) AND ZEPHYR C. BROWN © NATIONAL GEOGRAPHIC SOCIETY



Sniffing the air, water buffaloes catch the scent of foreigners. Girls carry bamboo rain mats on their backs. Countless terraced fields turn the slope into a broad green staircase.

Playful Sherpani shows her tongue in a typical gesture of high spirits.

MICHAEL R. TULL







**Balanced Boulders Appear to Menace
a Bridge Crossed by Laden Sherpas**

Shrunk below its monsoon level, the brawling Bhote Kosi boils through a gorge near Namche Barwa. These mountaineers, who support the Hillary party, march toward the Mingbo Valley.

Halloweenlike figure dances in a monastery yard. Sherpas by the hundreds converged on Thyangboche for the three-day festival of Mani Rimdu. Prayer and meditation filled the first day; thereafter pantomimes by masked monks drew tears of merriment. Sherpas celebrated with barley beer and rice spirits.

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PHOTOGRAPHS BY THOMAS B. MATHIAS. ILLUSTRATIONS BY ROBERT J. BARNES. © 1953



Valley, some 12 days' march from Katmandu and 40 miles west of Everest. His mission: to seek out the mysterious yeti, the "Abominable Snowman" of the high Himalayas, and to determine whether this elusive creature is myth or monster, or perhaps a compound of both.

The rest of us—four Westerners (or sahibs, as the Sherpas called us) and the bulk of the porters—trekked directly to the Everest region to set up camp. The party was led by Norman D. Hardie, a structural engineer from New Zealand and an old hand in Nepal.

Later, Hillary's party would join us in the Mingbo Valley, where we would winter over in the high Himalayas. When spring came, we would try to climb Makalu, the world's fifth highest peak, without supplementary oxygen.

During our 18-day march in to Thyangboche, the tail end of the monsoon season lashed us with downpours as we headed east along slippery trails (page 504). Between rains the sun beat on us, and we found constant use for our umbrellas (they could also be a defense if we met a cobra on the trail). Inch-long black leeches fastened themselves to our bodies and grew fat on our blood.

Caravan Toils Over Ridges and Rivers

Hardly a foot of the trail was level. Cross a raging river, swollen with the mountain snows (pages 510 and 517); toil, sweating, 5,000 feet up a hillside of terraced rice fields; top a cool, misty ridge; slip and slide 4,000 feet down to another rushing torrent; up, down, hot, cold, wet, dry, exhausted, exhilarated—this was our daily lot as we cut across the pattern of rivers that drain the Himalayas into the Ganges.

But each day we gained a little in elevation, and each day we toughened up a little more for the rigors of life in the highlands.

Dawa Tenzing, our venerable Sherpa sirdar, or top sergeant, kept the army of porters moving and saw that no loads were lost. I kept an eye on 20 cases, each marked with big red B's, that held my scientific gear.

Mornings we rose at dawn, just as alpenglow hit the peaks in the background, to have a quick cup of tea. Then there would be

three or four hours of hard hiking before a breakfast of oatmeal, eggs, tea, and chapatties—pancakes of unleavened bread. The porters preferred tea and a porridge of tsamba, or ground barley, with chili peppers so hot that they blistered the lips of Westerners.

Midafternoons we always made camp after covering 10 or 12 miles. In nearby streams we washed away the grime of the day's march, a luxury we could seldom enjoy once we reached the cold uplands.

Nepalese Seek Medical Care

As word spread that an expedition was in the neighborhood, scores of Nepalese trooped into camp, many seeking medical care. Dr. James S. Milledge, from the British Medical Research Council, ministered as best he could with pill, ointment, and bandage (page 509). Since then, Jim and his doctor-wife, Betty, have become medical missionaries in India.

Finally we turned north along the Dudh Kosi, whose tributaries drain the Everest country itself. Now we were in the Solu Khumbu region, the home of our Sherpas, whose sturdy endurance, courage, and happy disposition make them invaluable as porters and assistants on Himalayan expeditions.

On October 2, during a snowstorm, we reached the Buddhist monastery of Thyangboche, 13,100 feet high and only four miles from the Mingbo Valley. We paid off our lowland porters, who hastened, shivering, back down the 180-mile trail to Katmandu.

Thyangboche perches on a beautiful wooded promontory above the confluence of the Dudh Kosi and the Imja Khola valleys. When the mists lifted, we gasped in awe at the overpowering nearness of the giants to the north—Everest, Nuptse, Lhoise—and at Ama Dablam, dominating the sky, under whose icy thumb we were to spend our winter.

Around the monastery hovered an air of calm and meditation. Prayer flags fluttered in every yard. A long stone *mani* wall repeated in chiseled letters the ancient words, *Om mani padme hum*, "O the jewel in the lotus" invoking the patron deity of Lamaism, who is envisaged as in a lotus blossom.

Occasionally the calm was broken by the

Forty Years of Snowfall Leave 10-inch Layers in a Glacial Cake

Carving steps in an icefall. New Zealander Norman D. Hardie and the Sherpa Furkepa cut a trail for porters to carry supplies to the Silver Hut (page 518). Pemba Tenzing bears flags to mark the trail and warn of crevasses. Each seam of ice, like a tree's annual growth ring, reflects a year's accumulation. New snow mantles the glacier's surface.



cheerful music of brass bells as a herd of shaggy yaks, their horned heads slowly swinging back and forth, grazed in the meadows. And now and again we heard the chanting of the monks, the clanging of their cymbals, and the ringing of the gong that calls them to prayer. The gong, we discovered, was an oxygen cylinder abandoned by a prewar Everest expedition.

After paying our respects to the head lama,

who gave us his blessing, we began our reconnaissance of the Mingbo Valley. We floundered through recent monsoon snows, scaled granite buttresses, and clambered over the debris of avalanche and glacier to heights of nearly 20,000 feet.

Now we began to feel strongly the effects of high altitude. Our heads ached. We suffered from exhaustion and lethargy. We vomited from nausea, and appetite dimin-

**Fresh Snow Dusts the Base Camp
in a Stone-walled Yak Pasture**

Herders' summer village of Mingbo, almost three miles high, accommodates the main base, lowest of three camps. Sherpas normally do not winter this



ished. We had insomnia; sleep came only with the aid of sleeping pills. Then, while we slept, our breathing often would stop completely for many seconds; we would wake suddenly, gasping and fighting for breath.

Heavy breathing in an atmosphere of low humidity left our throats dry and sore. Resulting spells of high-altitude coughing tore at our chests.

Sunburn became a special problem. Thin

mountain air does not adequately screen out ultraviolet rays. Even the roofs of our mouths were burned as the sun's rays bounced off the snow into our open, panting jaws.

All in all, this was a miserable time for us. It would take four to six weeks before our bodies adjusted to the thin air and lack of oxygen. And if we had not already partially acclimatized during the march in, the adjustment would have been even more severe.

high. Tents supplement stone huts huddled under a bleak, jagged mountain flank.

Aluminum foil insulates the Green Hut's frame of wire and wood. Canvas outer skin gave the hut its name. Sherpas marveled at the skill of New Zealand builder Walter Romanes (on the roof).

ILLUSTRATIONS BY BERRY T. WOOD, NATIONAL GEOGRAPHIC STAFF © N.G.S.



Many changes occur in a man who comes from sea level to the high mountains. The number of oxygen-carrying red cells in his blood increases. He breathes faster to compensate for the thinness of the air. The respiratory center of the brain, which normally responds to the amount of carbon dioxide in the blood, learns to accept instead signals of oxygen shortage (pages 530-31).

Climbers Borrow From Polar Explorers

Was 17,500 feet the limit at which complete adjustment is possible? That is the altitude of the highest settlement on earth—the mining camp of Aucanquilcha in the Chilean Andes. The Indian miners of the area climb daily to work in a sulphur mine at 18,800 feet, but at night they insist on returning to sleep at 17,500 feet.

Our plan was to set up a winter camp at a height of roughly 19,000 feet, and to live there for a number of months. We were to make use of polar exploration aids, such as prefabricated huts, electricity, and the helicopter. We would see if our acclimatization was lasting, and whether it would do damage to our systems.

And so, with occasional excursions back to the low end of the valley to recuperate, we explored the Mingbo's seven-mile sweep around the base of Ama Dablam. We pushed eastward up a narrow, steep-sided gorge that broadened as it rose, ending in a glacial amphitheater. Into this bowl, known to mountaineers as a cirque, converged half a dozen smaller glaciers like spokes in a wheel. On the large glacier we would build our highest camp.

Several times our hearts beat faster as a rumbling echoed across the valley. It sounded for all the world like a timpanist rolling his kettledrums. This was the thunder of an avalanche.

Sometimes we could not see what caused the ominous roar; at other times a billowing froth rose in slow motion to mark the path of destruction. After endless seconds, cascading snow and ice would flow like white tuff from beneath the froth. Abruptly the surging mass would reach the lower levels and stop; the mist of pulverized snow would settle, and tranquility would return to our valley.

Having chosen suitable locations, we collected our equipment and supplies at the mouth of the valley, hired additional Sherpa porters, and began building and stocking our

bases. We took along as mascot a Tibetan terrier puppy named Rakpa.

Base camp was to be at the yak herders' village of Mingbo, deserted at this season, near the lower end of the valley. Altitude here is 14,860 feet.

Below the snout of the main glacier, at 17,390 feet near the other end of the valley, we established our intermediate camp. Walter Romanes, our master builder from New Zealand, put together a structure of timbers that had been carried in from the Dudh Kosi. Over this frame he and his helpers stretched wire netting and aluminum-coated building paper, covered on the outside by heavy green canvas (preceding page). We called it the Green Hut. Sherpas and sahibs alike were impressed with the finished shelter.

Some weeks later, after the rest of the party joined us, we were to erect our most ambitious camp, the Silver Hut. At 18,765 feet it became, as far as we know, the highest dwelling in the world (opposite and page 518).

This cylindrical prefabricated structure weighed a ton and measured 22 feet long by 10 feet in diameter. It had been manufactured in more than a hundred curved pieces for easy carrying, no piece being more than four and a half feet long. Despite rugged treatment during the march in from Katmandu, the pieces fitted neatly together like a jigsaw puzzle, and the whole job took only a day.

The skin consisted of two layers of aluminum-painted marine plywood, separated by three inches of foam plastic for insulation. Even when outside temperatures dropped to 18° below zero F., we were able to work in shirt-sleeve comfort at 70° inside.

London Subway Far From Home

From afar, the Silver Hut looked like a section of drainpipe on the smooth glacier ice. Inside it resembled an airplane fuselage.

Desmond Doig,* who took leave from his post as Assistant Editor of *The Statesman of Calcutta* and New Delhi to serve as the expedition's official reporter, saw the hut as part of a London subway:

*I saw a London tube today
That evidently lost its way.
Perhaps like me you think it silly
To stray so far from Piccadilly.*

Isolated though we were in the Mingbo, we were not cut off from the world. Runners

*See "Bhutan, the Mountain Kingdom," by Desmond Doig, NATIONAL GEOGRAPHIC, September, 1961.



EXPLORATIONS BY JAMES W. HILL AND ROBERT AND GEORGE LANE © NATIONAL GEOGRAPHIC SOCIETY

Porters bend beneath sections of the prefabricated Silver Hut, sandwiches of plywood and plastic foam. Crossing a swollen stream with 60-pound loads, the men tread cautiously, for rapids run swift and boulders roll.

Room with a view stands more than three and a half miles high. Hillary's poles brace panels of the Silver Hut. Lessons learned in Antarctica gave mountaineers this snug hut, in which the party spent five wintry months.





Highest house in the world at 18,765 feet, the Silver Hut overlooks Mingbo Valley. The first Westerners to winter this high in the Himalayas jammed eight bunks into one end of their 22-foot home, scientific equipment into the other. Sherpas slept in the cook tent. Party at right bores a ten-foot hole in which the author, kneeling, will plant a pole to measure the glacier's movement and accumulation of snow.

Cramped quarters. Dr. Milledge takes a bath in Dr. Griffith Pugh's instrument tank.



brought mail from Katmandu, where my wife Lila and Betty Milledge maintained a liaison office for the expedition. And our short-wave radio kept us in contact with Sir Edmund and the yeti party (and later with Katmandu), except when Red Chinese broadcasts of propaganda, music, or drama drowned out our conversations.

Word came, finally, that the yeti party was leaving the Rolwaling Valley and would arrive in the village of Khumjung, near Thyangboche, at the end of October. Down we went to meet our friends.



ASCENDING BY BERT L. FISHER (RACEY AND A. JAMES) © NATIONAL GEOGRAPHIC SOCIETY

After a month in a sterile environment of snow, ice, and rock high above timberline, we reveled in the smells and sights of living things. Below brown grazing pastures, we found the lower stretches of the Imja Kholu aflame with autumn colors.

Sherpas Celebrate a Home-coming

In Thyangboche we picked up Dr. Pugh, the expedition's scientific leader, who had just brought up additional physiological equipment from Katmandu. Together we hiked the three miles to Khumjung, nestled

in a lovely valley beneath the sacred mountain of Khumbila.

Home of most of the expedition Sherpas, Khumjung was alive with excitement as women and children welcomed their long-absent men. We shared their elation as we greeted our comrades. How different we all were—sunburned, wild-haired, bearded. We roared with laughter at one another.

That night hospitality knew no limits in the Sherpas' homes. Rakshi, a local rice gin, and chang, a native beer, flowed freely. During the revelry, those of us in the Mingbo



ILLUSTRATION BY R. H. BIRCHMAN © R. C. G.

Yeti-tracking party buys the hide of an "Abominable Snowman," actually that of a rare Tibetan blue bear. R. Marlin Perkins, Director of Chicago's Lincoln Park Zoo, examines the pelt. New Zealander Peter D. Mulgrew (rear) later collapsed on Makalu (page 544).



ILLUSTRATION BY ROBERT D. BRADY

"Yeti" scalp, modeled by Mr. Perkins, was flown from Khumjung for examination by Western scientists.

Foxlike tracks, melted out by the sun, form the giant spoor of the yeti. Three-foot ice ax gives scale.

work party learned of the search for the Abominable Snowman from Sir Edmund, Desmond Doig, and R. Marlin Perkins, then Director of Chicago's Lincoln Park Zoo, the expedition's zoologist.*

For more than half a century the Western World has been tantalized by controversy over the Abominable Snowman, the yeti of the Sherpas. The stories vary in details, but many of them suggest a shaggy creature, half human, half ape. It prowls the high Himalayas by night, leaving monstrous tracks in the snow. It is a fearsome, savage beast with a high-pitched, whistling scream; a vile, pungent odor; feet that point backward; and supernatural powers.

Cameras Snap No Abominable Snowmen

Above all the yeti is elusive, and few claim to have seen it. Indeed, some say it is invisible, and others believe that bad luck, perhaps death, results from casting eyes on the monster. Even to hear its mournful cry is to risk serious illness. Mothers warn their wayward children that "the yeti will get you!"

In 1951, British explorers Eric Shipton and Dr. Michael Ward (a member of our expedi-

tion) made remarkable photographs of a set of supposed yeti tracks on the Menlung Glacier, east of the Rolwaling Valley. These pictures seemed to support the rumors that an unknown primate existed in the mountain wilds of northeastern Nepal.

Sir Edmund and his colleagues hoped to use scientific methods to search for the yeti and evaluate the evidence for its existence. They carried guns that fire a knock-out hypodermic, and cameras that could be triggered by a thread across a trail.

Marlin Perkins described setting up observation camps and scanning the ledges and caves of the valleysides through spotting scopes. But no one saw a yeti, and the camera registered no mysterious creatures.

One day two Sherpas ran breathlessly into camp. "Yeti, sahib! Yeti, sahib!" They had found fresh tracks.

Perkins and the others quickly followed the Sherpas up a snowfield, carrying cameras, tape measures, sketch pads, and plaster of Paris to make casts. But the sun had melted the tracks until they were almost indistinguishable.

*Mr. Perkins has since accepted an appointment as Director of the St. Louis Zoo.

White Scarf of Greeting Loops Hillary's Neck as the Scalp Returns

Lamas in Khumjung released their relic for scientific appraisal only after three Sherpas pledged their entire fortunes for its return in six weeks. On the day the forfeits fell due, a helicopter flew Sir Edmund in with the precious scalp. Western experts found that it had been molded from hide of the serow goat-antelope.





Pilgrim Sleeps in Snow and Munches Glass

Man Bahadur, from the Nepalese lowlands, roamed the Himalayas in winter, commanded by a vision and protected by his faith. He chews glass tubing with hard-to-believe impunity (above) and walks shoeless in the snow (right). His soles (behind a centimeter ruler) show cuts and fissures but none of the frostbite that would have cost Westerners their feet. At the author's request, he led the way to the spot (below) where he spent two nights stretched on the snow in zero temperatures. He slept in thin clothes, hands and feet bare.



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Then Dr. Lawrence Swan, our biologist from San Francisco State College, discovered a magnificent set of tracks on the Ripimu Glacier. They were almost identical to those photographed in 1951.

Inspection of these tracks revealed a most interesting fact: On the snow slope that remained in shade most of the day, the tracks were obviously foxlike. But as they moved around the slope into an area that received more sun, they became yeti tracks, elongated in the direction of the afternoon sun's rays (page 520). Farther along, in the shade again, the tracks reverted to fox.

"There was the answer," remarked Desmond. "The fox tracks—they could as easily have been from a snow leopard, a bear, or a wolf—were melted out into the larger, man-like tracks of the yeti."

Hill Woman Drives a Bargain

But if the party did not find the yeti or its tracks, they did uncover a yeti fur. The story is best told by Desmond Doig, whose knowledge of the language and customs of Nepal made him invaluable in the search:

"The friendly head lama of Beding Monastery, in a sudden impetuous show of affection, drew me aside and whispered, 'There is a yeti skin in the village.'

"The fur was owned by a Buddhist nun who lived close by the monastery, he said. She might let us see it for a price.

"Would she sell it?"

"The old man was immediately a sphinx in magenta robes: aloof, smiling a Mona Lisa smile, and apparently struck dumb with shock.

"That afternoon I visited the monastery with one of our Sherpas, Ang Temba, whom I had come to appreciate as a Houdini-cum-Mandrake in Sherpa clothing. The lama pointed out the nun, a gentle, middle-aged woman wearing turquoise and coral in her ears.

"Ang Temba went into the attack. The nun, in almost pained surprise, denied knowing anything about it. I closed in, making pleading noises; Ang Temba more bluntly started naming prices. But the inevitable crowd closed in, and the nun began telling her rosary and walked inscrutably away.

"Then some of the other lamas, with quick, unholy profit in view, burst into camp and offered a look at the fur for 1,000 rupees (\$210).

"Hurriedly we contacted the nun again, and she said she would see me. We hurried surreptitiously past the monastery and into

the nun's house. Ang Temba bolted the gate.

"The house was pitch black, full of unseen snares and whispers. Ang Temba and the nun were in urgent conversation.

"I could see the fur for 1,000 rupees, Ang Temba explained at last.

"Could I buy it outright?"

"Haggle, haggle. No, but I could see it for 500 rupees.

"Could I buy it outright?"

"No, but I could see it for 200 rupees.

"Could I buy it for 250 rupees?"

"No.

"Three hundred then, and no more.

"Finally the fur was being pulled from a yak-hide box, a smoky black fur with a golden glint to it and an ivory band across the shoulders.

"It was the fur of a bear.

"'Yeti, yeti,' the nun insisted.

"Money paid, the fur was stuffed into an old potato sack to hide the treasure from anyone intent on forbidding the transaction.

"Our secret was kept: For days after the transaction, we were asked repeatedly if we would like to purchase a yeti skin, owned by a nun in the village of Beding!"

Marlin Perkins and Larry Swan confirmed that the fur was that of the rare Tibetan blue bear. But the Sherpas insisted steadfastly that it was the *chutch*, largest of three varieties of the yeti.

Do-it-yourself Yeti Scalp

While the rest of us trooped back to the Mingbo Valley, Marlin Perkins and Desmond Doig remained in Khumjung to inspect other relics of the Abominable Snowman.

The monks at Khumjung treasured a yeti "scalp" said to be 240 years old. It resembled a Viking's conical war helmet. The skin was one piece of stiff, untanned hide. The coarse, bristly hair, dark henna and black in color, was badly worn (page 520).

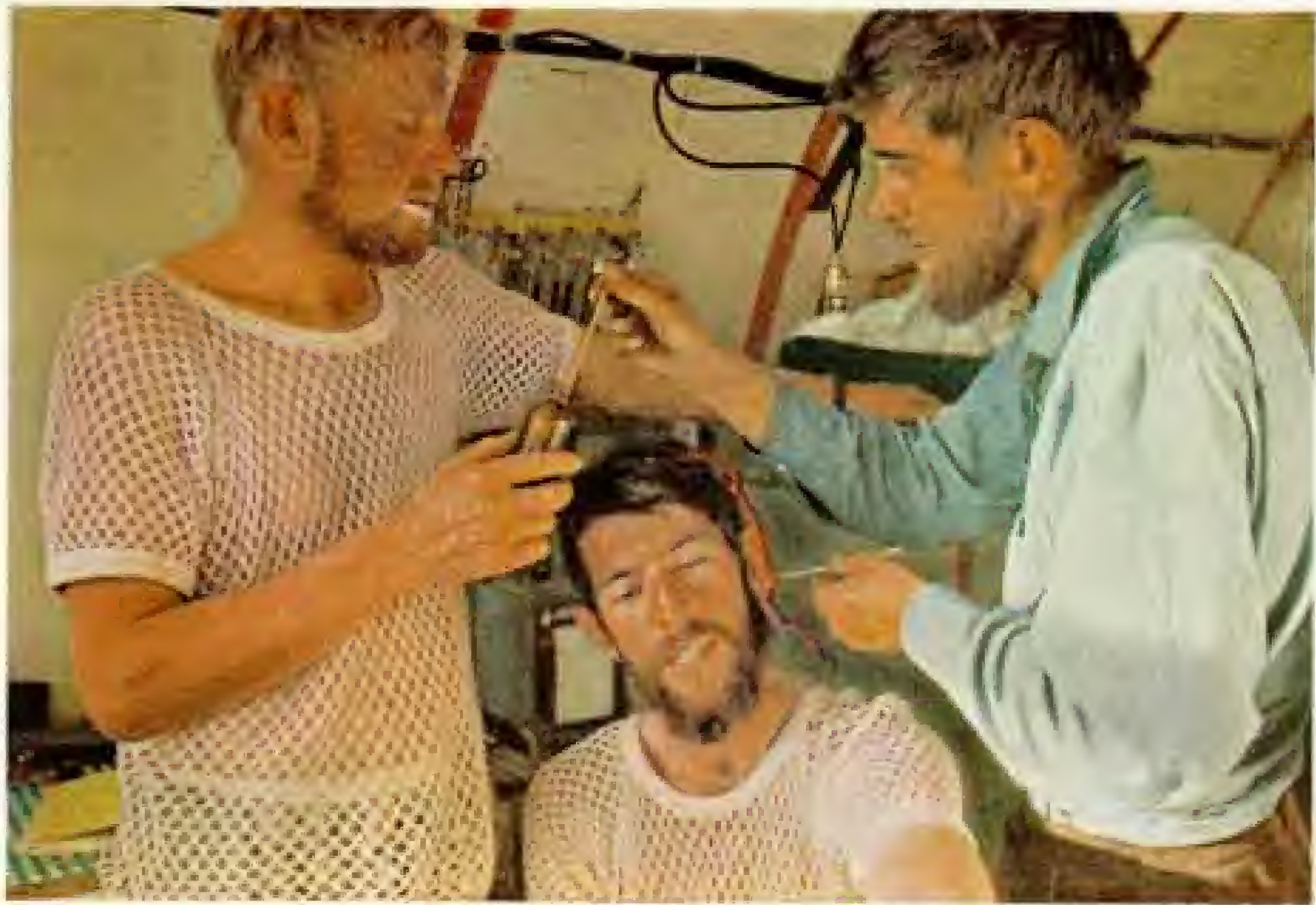
In nearby Pangboche our men found another scalp, almost identical to the Khumjung relic. Desmond and Marlin immediately suspected that both scalps were man-made—even made on the same mold.

Cotton Sea of Wind-driven Clouds Breaks Soundlessly Against Lofty Ridges

Dr. John B. West, pausing during a ski run, stands in line with sacred Khumbila, a peak that Sherpas say man must never climb.







PHOTOGRAPHS BY BARRETT (RIGHT) AND THOMAS D. NEVISON, JR.

Electrodes set in the scalp of Dr. Milledge enable Michael Gill and Thomas Nevison, Jr., to measure brain waves. Dr. Nevison develops instruments for the United States Air Force.

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The author pedals a test bicycle at 14,860 feet. A tube that collects exhaled breath and an electrocardiograph wired to his wrists record lung and heart reaction to measured work.





Sun casts an orange glow through tent fabric as Dr. Milledge runs an electrocardiogram to check Walter Romanes' heartbeat. Physiologists conducted many tests to learn how man's body adapts to high altitude.

Purplish lips reveal a shortage of oxygen in Mr. Romanes' blood at 18,765 feet. In contrast, his sunburned nose seems to be on fire. Color cards serve as standards for judging the hue of arterial blood.



REAR COURTESY BY TAMM C. FISHER © B.B.C.

One day Ang Temba brought in a dried pelt of the serow, a member of a rather rare goat-antelope family. Comparison of the hair and that from the Khumjung scalp led to the suspicion that they were identical.

"Why not make a scalp of our own?" asked Desmond. With Ang Temba's help, Desmond and Marlin chiseled a section of log into a mold with the same dimensions as those of the scalps. The serow skin was softened in mud, stretched over the mold, and nailed in place. After drying for 10 days it was trimmed and dyed a rusty red. Result: a fairly good yeti scalp.

Elders Release Yeti Scalp for Trip

Still Desmond and Marlin were hesitant to assert that the Khumjung and Pangboche scalps were made from a serow skin. Desmond negotiated with the Khumjung elders for permission to take their scalp to the United States and to Europe for scientific analysis.

The elders were exceedingly reluctant. They believed that the relic held religious significance, that its absence might bring famine, plagues, and other disasters.

Finally, after many sessions steeped in the intrigue of the East, the elders agreed to part with the scalp—but on stringent conditions. It must be returned within exactly six weeks. To guarantee its return, several of the expedition's prominent Sherpas, including Dawa Tenzing, must place their homes and all their property in escrow. They would forfeit everything if the scalp was not returned on time. Moreover, an elder of the village, Khunjo Chumbi, must accompany the scalp.

In late November, having agreed to these stern conditions, Sir Edmund, Desmond, Marlin, and Khunjo left the Solu Khumbu. There was no time to lose if the scalp was to be returned by early January. They traveled the rugged route to Katmandu in nine and a half days, and left by air for Chicago.

Those of us remaining in the mountains speculated on Sir Edmund's chances of meeting the deadline. Much was at stake, and we worried as the deadline approached.

In Sir Edmund's absence, Dr. Pugh directed the expedition as it launched into its winter objective—scientific research.

Our manpower was divided among our three camps, depending on the work we were doing. And at times, as when I undertook to map the Mingbo Valley in detail, we moved all over the area. All of us preferred the Silver Hut, despite the fact that we could breathe more easily at lower levels, because

of its warmth, its ready supply of electricity from a wind-powered generator, and its radio contact with the outside world. Base camp, by comparison, was a cold, miserable place.

In tents at the Silver Hut and at Mingbo base camp, and in the Silver Hut itself, the physiologists set up their equipment (pages 526-7). They periodically recorded the mental and physical performance of the ten men in the wintering party to see how prolonged exposure to high altitude affected us. Whenever we had a few spare moments, they led us to one of the stationary bicycles, instruments of subtle torture we came to regard with considerable disfavor.

Another small discomfort we endured was the surgical needle when our blood experts came around. One was Dr. S. Lahari, a professor at Calcutta's Presidency College, who studies the mysteries of blood chemistry.

Electrocardiograms were run on us frequently to see what was happening to our hearts. I found the results amazing. The right side of the heart, which pumps blood to the lungs, grew larger.

Weeks after leaving the mountains, I had another electrocardiogram in Washington, D.C. It showed that my heart apparently had returned to its usual size and normal functioning.

Capt. Thomas O. Nevison, Jr., a flight surgeon from the U.S. Air Force School of Aviation Medicine in San Antonio, Texas, was working with us to perfect monitoring equipment for craft that will carry men into space.

"What possible connection can there be between a mountain expedition and space travel?" I asked him.

"Here at 19,000 feet we are subject to a

number of adverse environmental factors, much as an astronaut will face in space," he explained. "We want to know how the space environment will affect the astronaut's heart-beat, respiration, and brain activity. We must have lightweight, fool-proof electronic devices that will monitor his condition and radio the information back to earth, and this is an ideal testing ground."

And so we found ourselves serving as stand-ins for a spaceman in Tom's experiments.

"This won't hurt at all," he would say, and before I could think of a good excuse he had shaved small areas of my scalp and slipped



Deep Blue Sky and Glaring Snow Give Up Secrets to Science

Trousers patched with tent cloth, the author stands on the Silver Hut Glacier and measures the sun's energy with Eppley radiometers. Instrument on his tripod looks toward the heavens; another, hanging from the wooden frame, measures snow reflection.

Mrs. Leigh Ortenburger, who records the figures, walked 180 miles from Katmandu with other wives to join the expedition.

The National Geographic Society made it possible for staff member Barry C. Bishop, an expert glaciologist, to carry out scientific studies in the high Himalayas.

needle electrodes under the skin. Wires from these needles led to a strange device we nicknamed "Frankenstein" that recorded brain waves as well as our pulse, respiration, and temperature.

We like to think that our experiences with Tom's fiendish device were of some help to Astronauts John Glenn and Scott Carpenter on their orbital flights months later.

Barefoot Mystic Ignores the Cold

One day a turbaned Nepalese mystic wandered into camp, barefoot and clad only in light garments. He was a carpenter from a

lowland village eight days' march away, who had been told in a vision to make a four months' pilgrimage to the abode of snow. Our cook gave him a bar of pressed beef, which he munched while sitting cross-legged in front of the cookhouse fire.

"Eat nothing but milk, raw meat, and unsugared tea," he told us, "if you would purify your souls."

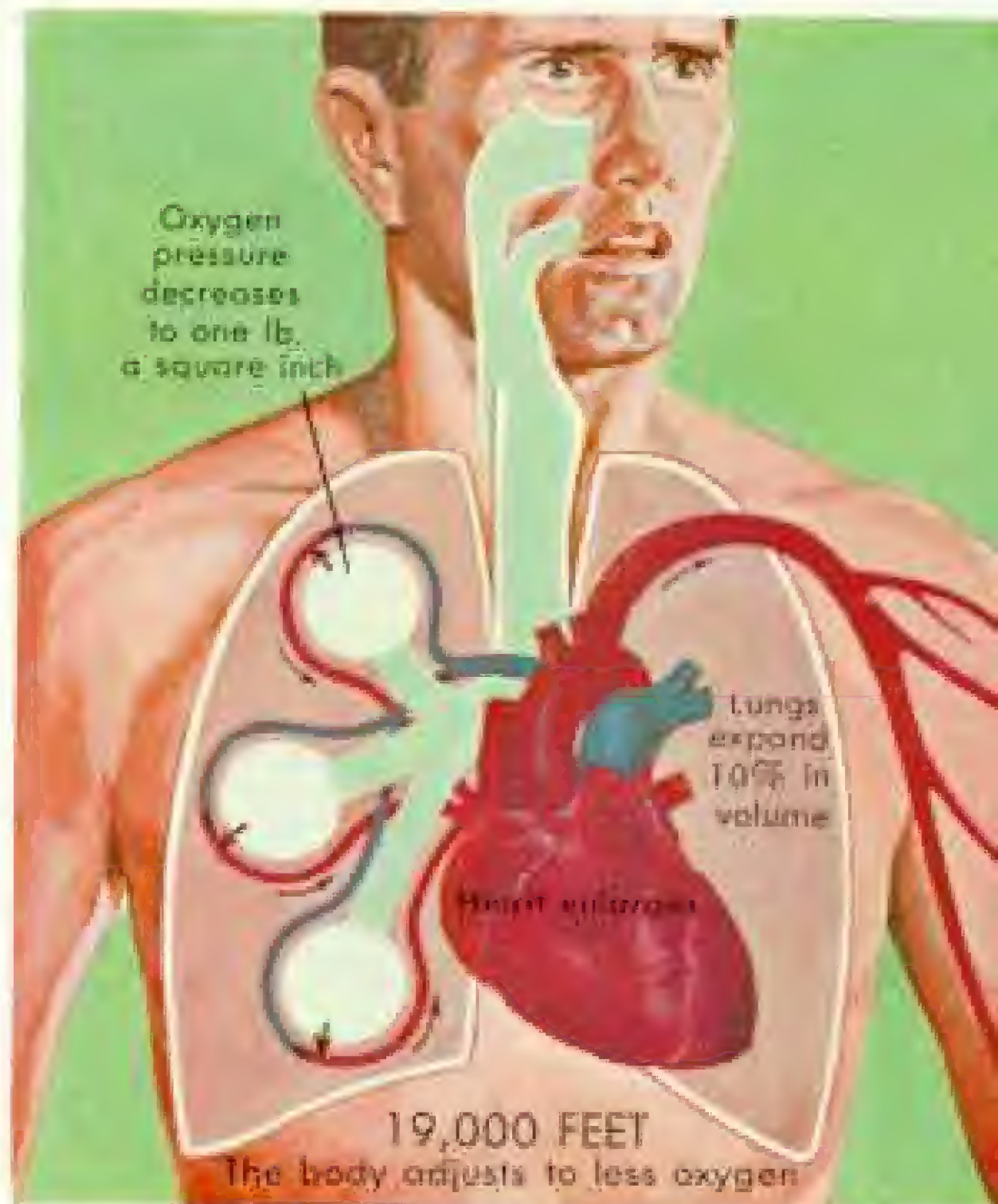
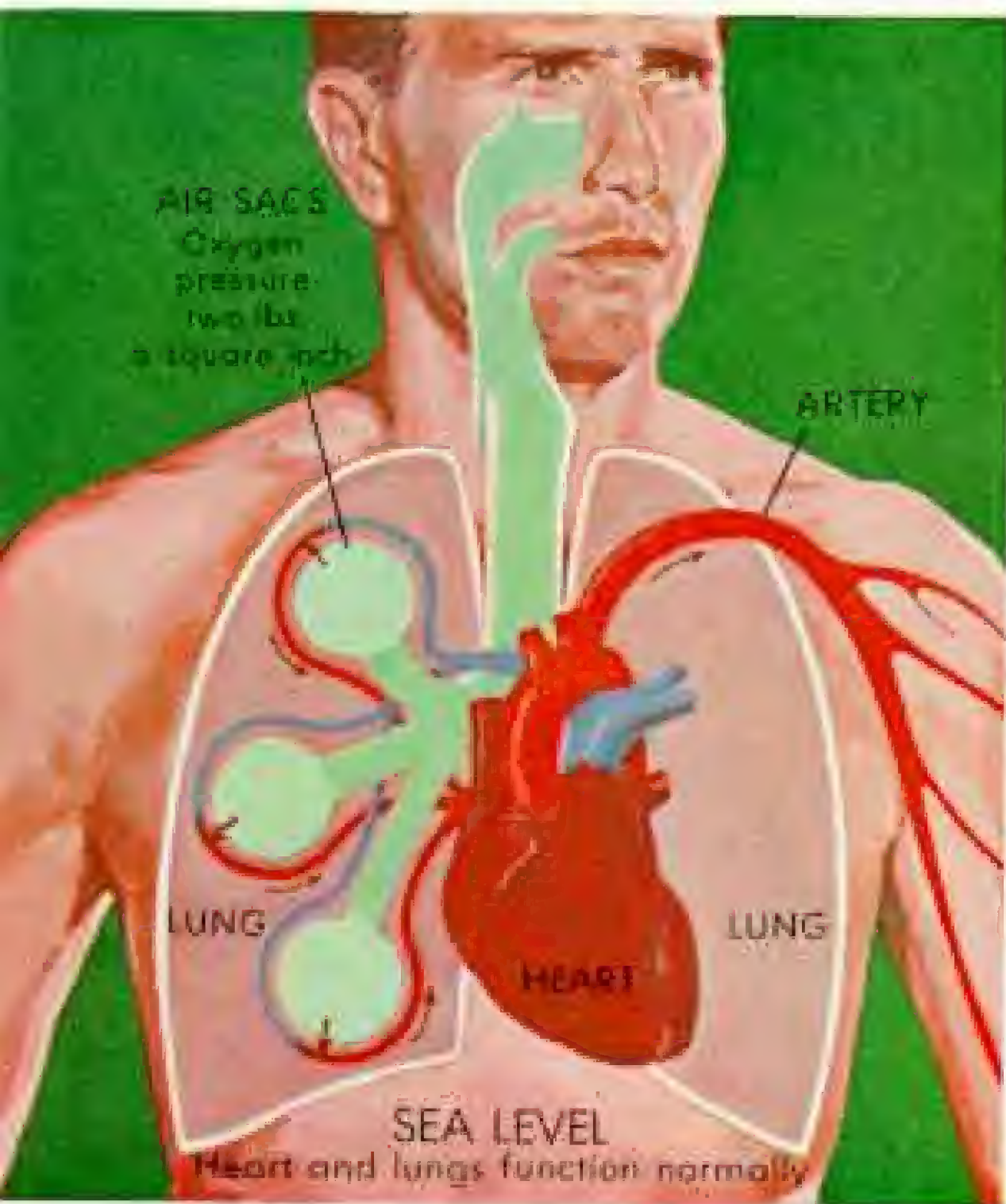
That night he disappeared from camp, and we did not see him for two days. During that time a fierce storm raged up the Mingbo Valley, with temperatures down to zero. Our

(Continued on page 534)

ILLUSTRATION BY GARY A. SHAW. ORIGINAL ILLUSTRATION BY GARY A. SHAW



Slow Death Threatens Man in the Thin Air of 19,000 Feet

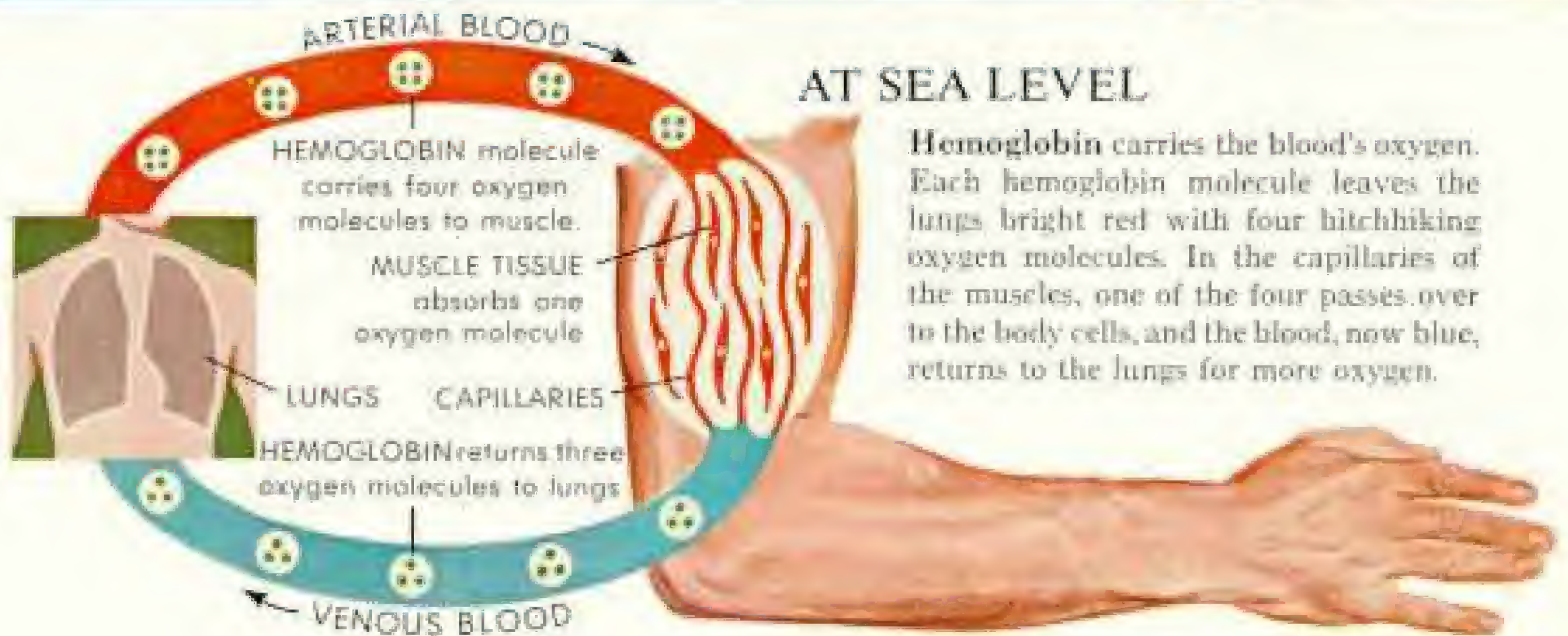


Blue venous blood, flowing by the walls of air sacs in the lungs, absorbs oxygen from the air. Changed to arterial blood (red), it distributes the life-giving gas throughout the body. At sea level, oxygen in the lung sacs maintains a pressure of some two pounds to the square inch. At 19,000 feet, as at the Silver Hut of the wintering party, pressure drops to less than half that. Though the lungs labor mightily, with deeper and faster breaths, the supply of oxygen barely suffices even while the body rests. Hard work cannot be sustained more than a few uninterrupted minutes. The right side of the heart enlarges to overcome the increased resistance in the small blood vessels of the lungs. Three air sacs symbolize the 300 million in each lung where the blood briefly comes into contact with oxygen.

Barry Bishop labors around a slope of Ama Dablam (left) while burdened with 30 pounds of equipment. Later, in a test at the Society's offices, the 150-pound author bore a 210-pound man up a flight of stairs and exclaimed, "This is just how I felt on Ama Dablam!" Bearing 50 pounds at 19,000 feet proved as difficult as carrying more than 200 pounds at sea level.

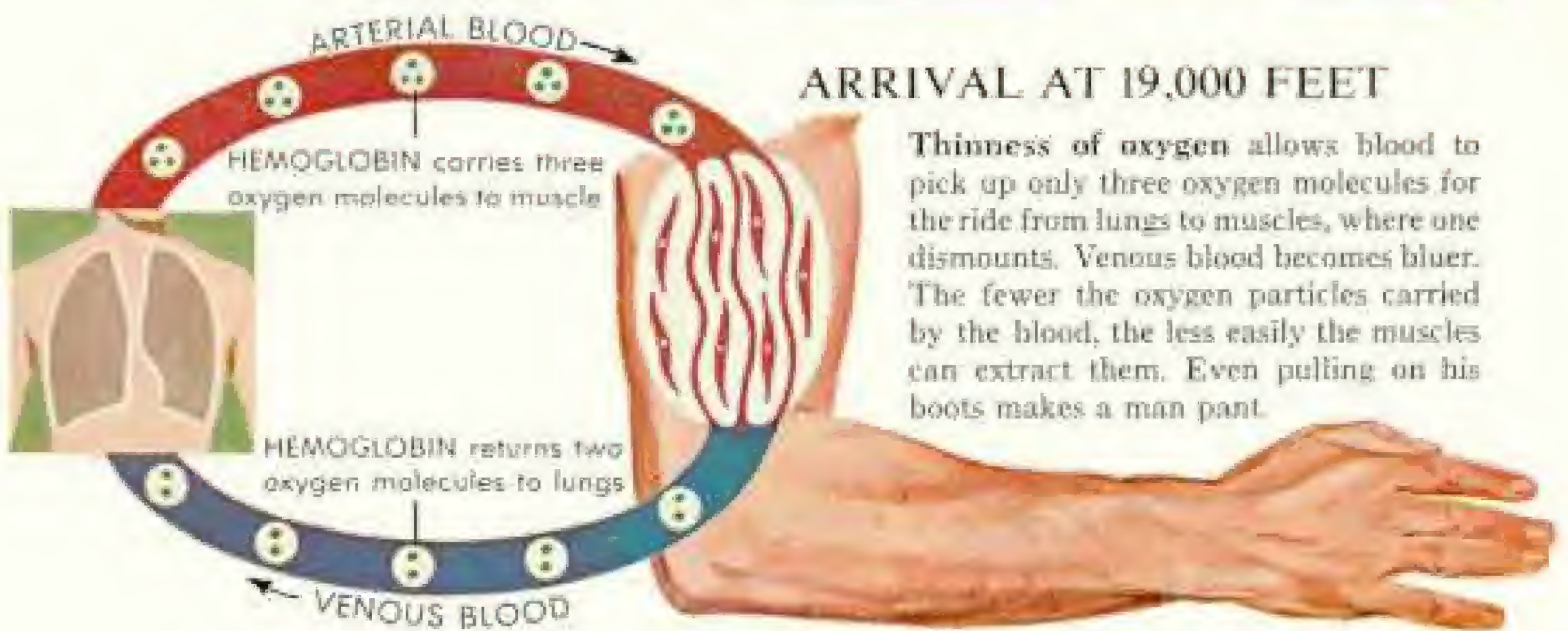
Though barrel-chested natives of the Andes have adapted to life at 17,500 feet, scientists who wintered with Mr. Bishop on Himalayan heights doubt that man can live indefinitely much higher than that. In rarefied air a climber's blood has little reserve of oxygen, and he must pause every few steps to catch his breath.

Other diagrams on these pages show how lungs and heart respond to the diminished oxygen supply of extreme altitudes.



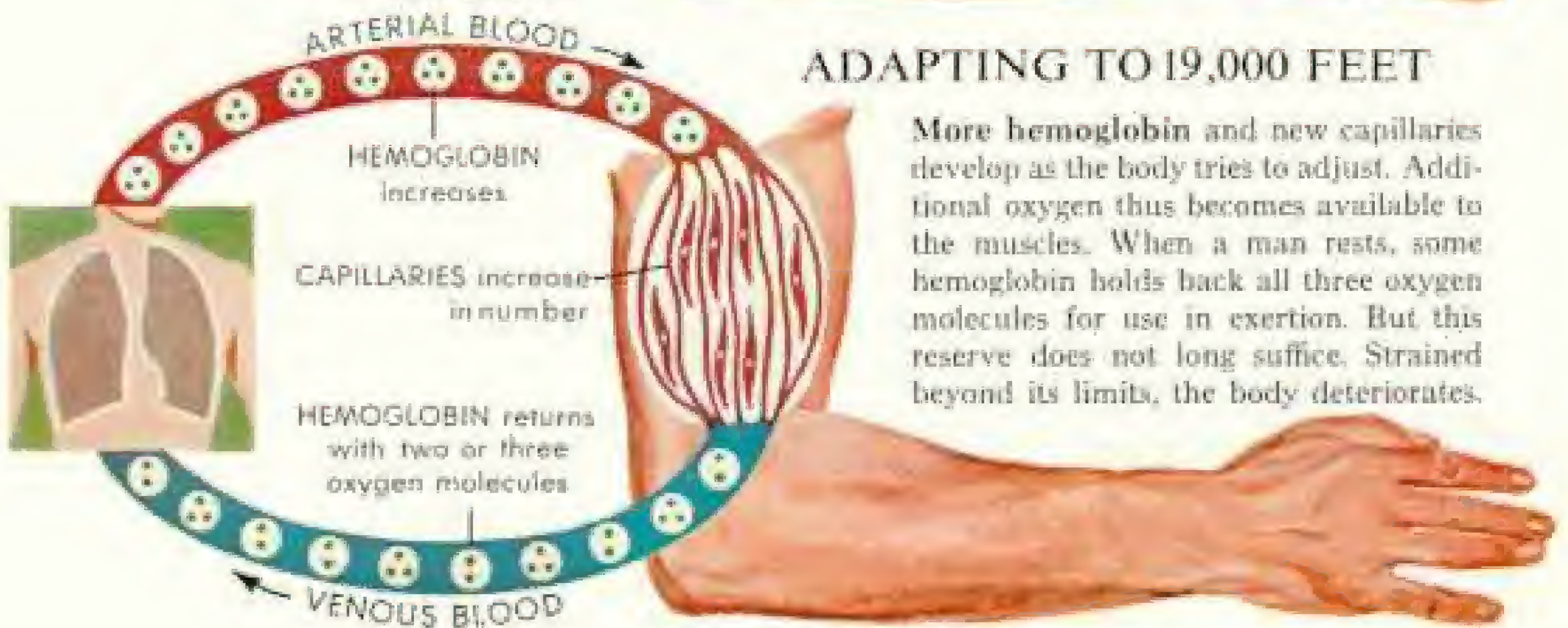
AT SEA LEVEL

Hemoglobin carries the blood's oxygen. Each hemoglobin molecule leaves the lungs bright red with four hitchhiking oxygen molecules. In the capillaries of the muscles, one of the four passes over to the body cells, and the blood, now blue, returns to the lungs for more oxygen.



ARRIVAL AT 19,000 FEET

Thinness of oxygen allows blood to pick up only three oxygen molecules for the ride from lungs to muscles, where one dismounts. Venous blood becomes bluer. The fewer the oxygen particles carried by the blood, the less easily the muscles can extract them. Even pulling on his boots makes a man pant.



ADAPTING TO 19,000 FEET

More hemoglobin and new capillaries develop as the body tries to adjust. Additional oxygen thus becomes available to the muscles. When a man rests, some hemoglobin holds back all three oxygen molecules for use in exertion. But this reserve does not long suffice. Strained beyond its limits, the body deteriorates.



AMA DABLAM and Expedition High Camps

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PHOTOGRAPH BY BARRY C. BISHOP © N.G.S.

Author maps Mingbo with a Wild theodolite. Without gloves, his hands would freeze to the metal.

Ice Rivers and Rock Walls Shape a Basin Never Before Mapped in Such Detail

Beginning his work, Barry Bishop set up Survey Stations 1 and 2 and determined the exact distance between them. This became his base line, the known side of a triangle from which he could extend an interlocking network of triangles across the basin.

Throughout the valley he established 47 rock cairns, spraying them with yellow paint for visibility. Mounting his theodolite on point after point, Mr. Bishop crisscrossed the region with lines of sight, forming his triangles. Finally, at each station he carefully leveled a camera on a tripod and photographed a 360° panorama.

Returning to Washington, D. C., Bishop laid out his photographs for use in a photoalidade, an instrument with which cartographers can fix many more points of a survey. Alster & Associates, Inc., of Washington, extending Bishop's work, developed and drew the contour lines. National Geographic cartographers Victor J. Kelley and Lisa Biganzoli plotted glaciers and icefalls and prepared the drawing. They highlighted northwest slopes to simulate sunlight and shadowed the southeast slopes.

Bishop's photogrammetric map extends an earlier survey by the Austrian engineer Erwin Schneider.

Sherpa wood carriers reported that they had seen the mystic wandering in the snow at about 17,000 feet. After two unsheltered nights he reappeared, apparently uninjured by the severe cold, although his hands and feet were swollen and he shivered periodically. Any of the rest of us would surely have lost our hands and feet from frostbite.

He became a willing subject for the physiologists, who wired him all over with thermocouples. They found that he had an amazing ability to control the circulation of blood to his extremities.

His powers, akin to those of a yogi, also enabled him to munch on glass tubing from our lab with no apparent ill effect. He seemed to regard glass as a delicacy (page 522).

Winter Lasts Only Six Weeks

While the physiologists were making guinea pigs of all of us, I was carrying out my studies of weather, glaciers, and radiation.

Near the Silver Hut I erected a simple but comprehensive weather station. On a 12-foot aluminum mast I installed four anemometers, wind-measuring cups that spin in the breeze. Other instruments were placed in a ventilated box five feet above the snow. Three times a day—at 7 a.m., 2 p.m., and 9 p.m.—the instruments had to be read. Until mid-May we kept records of maximum and minimum temperatures, barometric pressure, humidity, dew point, wind velocity and direction, cloud conditions, and precipitation.

By comparing readings at the Green Hut below, we secured a temperature profile, or difference, between the two levels.

Instead of the severe weather we had expected, we enjoyed relatively mild temperatures with generally clear skies from October through December and from mid-February to mid-May. Winter lasted only the month and a half in between. Even then the lowest recorded temperature at the Silver Hut was only minus 18° F. Winds commonly hit 50 miles an hour, but storms were few and snowfalls surprisingly light. Most Himalayan snows come during the monsoon season of June through September.

We also studied the behavior of the Silver Hut Glacier, a river of snow-turned-to-ice that reached depths of several hundred feet. I laboriously bored holes ten feet deep in the ice to install a system of 25 bamboo poles (page 519). Accurate surveys at the beginning and end of the program, comparing the position of the poles with other landmarks, showed that the glacier was flowing three-

quarters of an inch a day at the Silver Hut.

The glacier was coldest near the surface, where it varied with daily air temperatures and sometimes dropped below zero. But six thermistors, or temperature-sensing elements, buried in the ice to depths down to 30 feet, gave readings that *increased* with depth to about 15 feet, where they stabilized at 32° F.

This behavior is like that of temperate-zone glaciers, such as those in the Alps and Canadian Rockies, but is opposite to that of polar glaciers. These get colder as you go down, until they stabilize at the average annual temperature of the region.

Pits dug at several points in the glacial surface enabled us to study the snow's density, hardness, crystal composition, and stratigraphy, or layering. In the nearby icefall we could read as much as fifty years of glacial history. Such studies tell us much about the climate of the past.

My third major scientific project involved measuring the amount of solar energy received by the earth and the amount reflected



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by the snow. Such measurements had never before been attempted at so high an elevation. I had the skilled help of Irene Ortenburger, a physicist who came up in April with her climber husband, Leigh (page 529).

The results of all our studies will provide the basis for dozens of scientific papers. They are already aiding the work of research organizations around the world. For example, my solar-radiation findings have been put to use by the National Aeronautics and Space Administration in its Tiros weather satellite program and its Mercury man-in-space project.

Silver Hut Crowded With Gear

The Silver Hut was no place for a claustrophobia sufferer. Besides eight bunks, a laboratory, a kerosene heater, a dining table, and benches, it was helter-skelter with clothes, climbing and medical gear, air mattresses, and sleeping bags. Occasionally mercury was spilled from the physiologists' equipment. Then we *had* to clean up, for mercury can poison the air in a restricted area. On such occasions we crawled around on hands and knees, chasing quicksilver around the floor and into paper cups to put back into bottles.

Pitons, ice screws, and snap links pass muster. Michael Gill, a medical student from New Zealand, girds for the final assault on Ama Dablam, first major Himalayan peak to yield to an attack in winter.

Rope harness anchors Walter Romanes above a 100-foot drop on Ama Dablam. Pemba Tenzing climbs toward him on a wire ladder. Using iron pegs and rope stirrups, their teammates had blazed a trail up the sheer overhang, which stopped a British expedition in 1959. Mingbo Valley stretches to distant rampart.

PHOTOGRAPHS BY PETER L. BROWN © 1974





ASCENDING FROM BASE CAMP TO SUMMIT, NATIONAL GEOGRAPHIC SOCIETY, U.S.A.

Far-traveled flag, mounted on an ice-ax shaft, goes to its highest point on land, the 22,494-foot top of Ama Dablam. Sunburn cream masks the face of the author, a staff member of the Society.

Ama Dablam's Icy Chisel Rakes the Himalayan Sky

"Unclimbable" and "fantastically difficult," Sir Edmund Hillary termed Ama Dablam in 1955. But a winter spent at its foot convinced the author: "We were ready to try it."

Ama Dablam, meaning "mother's charm box," refers to a Sherpa woman's ornament. The mountain's icy charm box forms a bulge on the neck of the pinnacle.

Thyangboche Monastery lies in shadow at the bottom. Dotted square marks area of the picture that follows.

When the hut reached overflowing, some of us slept in nearby tents and ice caves.

For recreation and exercise, we had excellent opportunities for skiing (page 524), and a superb teacher in Dr. Pugh, a veteran of the 1936 Olympics. Our Tibetan terrier puppy frequently chased us all the way down the icefall as we made our runs.

Rakpa, incidentally, seemed not to get any bigger during his stay at the Silver Hut. He began to grow again after he was brought down to the lower elevation of base camp.

Mountain Festival Breaks Routine

Diversions came at intervals to break the winter monotony. During the first full moon in December, we all trekked down to Thyangboche for the festival of Mani Rimdu (page 511). Hundreds of Sherpa villagers were already there, swelling the community to fifty times normal size. Some had come from as far away as Katmandu itself. Each family brought its own food, firewood, and yak hides and blankets for sleeping.

Desmond Doig told us that only a handful of Westerners had ever witnessed these ceremonies.

Our first day found us sitting cross-legged in an open area near the *dgon-pa*, or temple. Sherpas surrounded us in their brightest

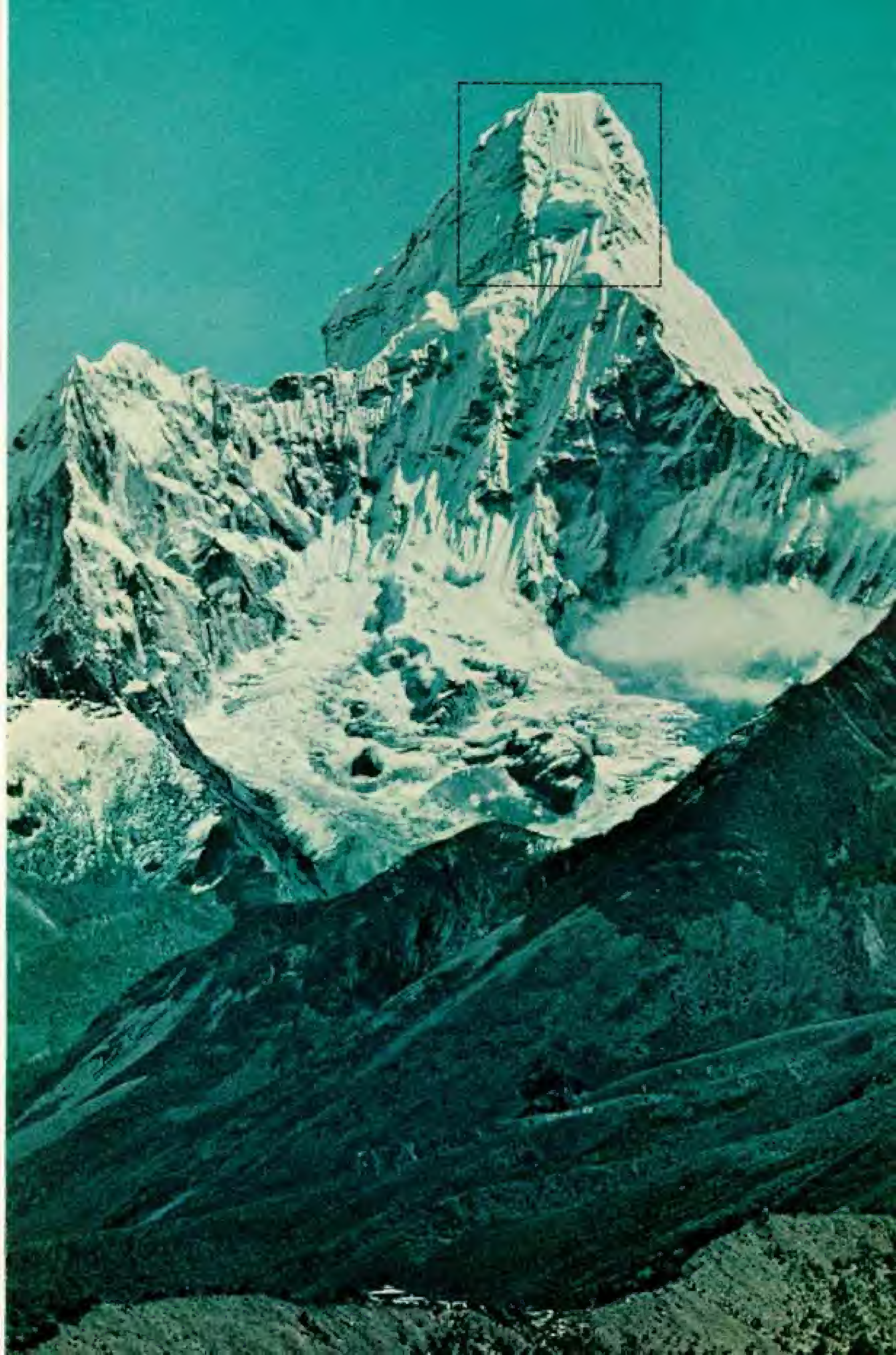
regalia: striped aprons, bright blouses, and huge gold earrings flashing in the sun. Many wore charm boxes of turquoise and silver hanging from their necks.

The day was filled with the praying and chanting of the lamas, the hooting of Tibetan horns, the burning of incense. At dusk the Sherpas, upon a signal, surged forward to be blessed by the presiding lama. This annual blessing is considered vital for existence in the rugged environment of Sherpaland.

The second morning, dancing began in the walled courtyard of the temple. It continued all day and far into the night, as the packed masses of onlookers filled the courtyard with the smells of chang and orange peels. To the discordant music of conch shells, cymbals, horns, and drums, lamas in bright silks and grotesque masks whirled through dances and comic pantomimes.

The head of the Red Hat sect of Buddhism had given the expedition a 10-foot white scarf. Dawa Tenzing now persuaded us that it should be presented to the shrine at Thyangboche. And so, at a pause in the ceremonies, Dawa rose to launch into profound oratory. Unfortunately, a blare of horns and the rush of a new group of dancers cut him short. Dawa, Dr. Pugh, and Bhanu Banerjee, a

(Continued on page 542)





Like midges on a whitewashed wall, four men cling to the 30° slope of Ama Dablam. Roped in pairs, they struggle up an ice flute above the "charm box," the smooth area ending at the icefall in center. Red line marks their six-hour, 1,745-foot ascent from Camp IV. Climbers occupy the broken section of the line. Using a telephoto lens, Thomas O. Nevison took the picture, greatly foreshortened, from the Mingbo base, a mile and a half below the summit.

EDUCATION IN SCIENCE 539



CAMP IV
ice cave at 20,750 feet





Backs straining beneath half-loaded packs, climbers inch up through the rarefied air of Makalu's southwest flank. Ascending without oxygen equipment, Hillary suffered a mild stroke, and other teammates fell ill. These misfortunes turned back the assault 370 feet from the summit. A French party using oxygen reached the top in 1955. Only Everest, K₂ (Godwin Austen), Kanchenjunga, and Lhotse, all in the Himalayas, top 27,824-foot Makalu.



Sun-drenched Peak 4 (left center) pitches its snowy tent on the roof of the world.

Bengali member of our expedition, disappeared into the gloom of the sanctuary to place the gift on the central altar.

On the third day, lamas placed a caldron of boiling yak butter on the altar in the courtyard. Thousands of prayers, inscribed on white cloth, were suspended over the caldron. As a lama poured highly alcoholic rakshū into the boiling butter, flames blazed high, consuming the prayers and lifting them to

heaven. At that moment all the Sherpas rose as one and, extending their right arms, shouted "*Lhagyela!*" (the gods are happy). The ceremonies were over.

Sahibs and Sherpas Celebrate Christmas

The advent of Christmas found us singing carols, although even one verse of "O Come, All Ye Faithful" at the Silver Hut left us breathless. On Christmas Eve, Tom Nevison



PHOTOGRAPH BY MICHAEL WOODS. © NATIONAL GEOGRAPHIC SOCIETY

Mists creep in through lofty valleys; a view from an ice ledge high on Makalu

returned from the valley with a small pine tree. Its fragrance brought pangs of nostalgia.

Such a flurry of activity that night! We made tinsel and ornaments from aluminum foil, strung spare bulbs from scientific instruments for tree lights, and hung lichens taken from trees near Thyangboche. Christmas greetings in all the languages we knew—English, French, German, Russian, and Tibetan—adorned doors and windows.

Next morning, as the men came up from the Green Hut, welcoming carols reverberated from the mountain walls. Griff Pugh played Santa Claus with the Christmas mail sack. And the Sherpas outdid themselves with a dinner of mushroom soup, freeze-dried shrimp, roast lamb, and yak steaks. Men of six nations, some Hindu, some Buddhist, joined in enthusiastic celebration of the most important birthday of Christendom.



BLANCHARD TENTS BY WARDEN C. FISHER (LEFT), AND CAMP HARBOR, JUNE 19, 1953.



Aluminum rods hold up a Blanchard tent. Two layers of cloth insulate against cold. Sherpa in red jacket melts snow for water the party needs in large amounts to stave off dehydration. Makalu looms above ridges that slash Hongu Valley, which the Hillary party crossed.

Sherpa Brings Down Peter Mulgrew, Casualty of the Makalu Climb

Trying for the top, the Royal New Zealand Navy lieutenant collapsed from lung damage just short of his goal. Six stout-hearted Sherpas took turns ferrying him to safety. Injury, illness, and weather combined to defeat the ascent.

After ten days of torment, Lieutenant Mulgrew awaits a helicopter for evacuation to Katmandu. Raw nose and blackened knuckles attest the frostbite that later necessitated amputation of several fingers and both legs below the knees. Undaunted, Mulgrew hopes to resume mountaineering with artificial limbs.

While we were observing Christmas at the highest inhabited point on earth, our friends Sir Edmund, Desmond, and Khunjo were celebrating the season in London, near the end of their round-the-world dash with the yeti scalp.

For Khunjo, the Sherpa villager, the trip had been a triumph. In Chicago he appeared on television, brought a night club audience to its feet with a Tibetan dance, and got lost in a dime store buying necklaces for his family.

In Paris he gravely explained to the scientists who examined the "yeti" scalp and fur: "In our villages people do not believe in giraffes and lions because there are none in Nepal. And so you don't believe in yetis. We can appreciate your ignorance."

In London he was alarmed by the flash and roar of the subway train, pronouncing it a creation of the gods of the underworld. He visited Buckingham Palace and decided that London was "a very fine village" where

the Queen's Guards wear large black yeti scalps.

He marveled at Western women, wondering why they are so white, why they smell so good, and how they balance on their heels.

Meanwhile, scientists in Chicago, Paris, and London handed down their unanimous verdict on the scalp: It was not a scalp at all, but the molded skin of a serow.

Now began the race to get back to the Himalayas by January 5, 1961, the deadline. The party arrived in Katmandu on December 31, planning to return to Khumjung on January 2. By great good fortune, two Americans, Ralph Dennis and Ralph Beacon, offered a helicopter they were using to install a radio-telephone system for Nepal.

Storms grounded the flight on the 2d and 3d. On the 4th Sir Edmund and Khunjo took off, but falling snow veiled their destination and forced them back.

In our camps in the Mingbo, apprehension rose sharply. In Khumjung, the lamas muttered darkly about famine, crop failure, and epidemics of dysentery—the fearful consequences of the scalp's delay. And the families of our Sherpa hostages glumly contemplated the loss of their homes and property.

But January 5 dawned brilliantly clear, and the helicopter with its treasure settled beside Khumjung's gilded temple in a swirl of rotor-driven snow. In a cliff-hanger finish, the yeti scalp came safely home (page 521).

Conquest of Ama Dablam

Mountaineering was only one of the objectives of our expedition, and we had intended to climb only Makalu. As it turned out, we added another difficult peak to our schedule.

Ama Dablam, the fantastic spire of rock and ice that thrust its lofty head above our valley to a height of 22,494 feet, seemed to taunt us every day.

The name means "mother's charm box." Two great ridges appear to be outstretched arms protecting the Mingbo, while a blob of hanging ice high on the west face resembles the charm box, or *dablam*, that Sherpa women wear suspended from the neck (page 537).

But there is nothing feminine about Ama Dablam. Its beautiful ice flutings and incredibly steep facings had repulsed every assault and claimed two lives. More than one veteran Himalayan climber considered the peak impossible.

Four of us—Britisher Mike Ward, New

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Zealanders Wally Romanes and Michael Gill, and I—decided in mid-February to take up the challenge. For three weeks we sought a route up the peak, driving dozens of pitons, or iron spikes, into its granite fissures and blue ice to secure our climbing ropes and 1,500 feet of fixed line (page 535).

We found our adversary technically far more difficult to climb than the Himalayan giants, whose major obstacles are tremendous height and bitter cold. Ama Dablam, because it presents only precipitous faces and jagged ridges on every side, required techniques usually reserved for the most demanding mountain challenges elsewhere in the world.

Dangling from overhangs, first in stirrups and then on 50-foot wire ladders, sometimes with a mile of space beneath us; cutting our way up steep slopes of exposed snow and ice; buffeted occasionally by screaming winds

that knocked us off our feet—we reached the top on March 13 (page 536). We had accomplished the unheard-of feat of climbing a high and difficult Himalayan peak in winter.

Our emotions had been so tightly contained during the climb that we found it hard to let go and revel in the awesome view. But with the 23 pounds of camera gear that I had hauled to the top, I recorded the tiny dots of our huts far below and the immense range of peaks just to the north, soaring unbelievably another mile and more above us.

Disaster Strikes on Makalu

In April, Sir Edmund and the bulk of the party undertook the final goal of the expedition—to climb Makalu, 15 miles to the east, without using oxygen equipment.

While the 27,824-foot peak had been brilliantly climbed by a French expedition in



PHOTOGRAPH BY JOHN HARRISON © NATIONAL GEOGRAPHIC SOCIETY

1953, our attempt was for scientific purposes. We collected physiological data even up to 25,500 feet. On this peak our expedition made a fateful discovery: Although we all had acclimatized to high altitudes, the long winter had taken a relentless toll of our bodies.

Sir Edmund suffered a mild stroke at 19,000 feet and had to leave the mountain. Mike Ward, who had led the Ama Dablam climb, took over, and the assault continued. On May 18 three of the party struggled to within 370 feet of the summit: Dr. Tom Nevison, Annulu, one of the greatest of the Sherpas, and New Zealander Peter Mulgrew. Suddenly Peter gave out and later collapsed, apparently with a blood clot in his lungs. Now hope of the summit was out; we had to get Peter off the mountain alive (page 544).

During ten nightmare days bringing Mulgrew down, Nevison suffered from congestion

Bitter Winds Whip Clouds of Snow off Everest (Center) and Lhotse

In 1963 the author will accompany the American Mount Everest Expedition and attempt to scale 29,028-foot Everest, world's highest peak. Mr. Bishop and his colleagues will also attack Nuptse and Lhotse. The National Geographic Society will sponsor studies in glaciology and solar radiation.

Here Nuptse's forbidding ridge walls off all but the peak of Everest, about ten miles away, from this climber's view.

of the lungs, Ward was weak from pneumonia, Romanes was punch drunk from exhaustion, and Gill had a frostbitten nose.

Only Leigh Ortenburger and John Harrison, who had joined the expedition in March, had the necessary reserves of strength, and even they were deteriorating rapidly.

And so the expedition came to an end; by early June we had all trickled out to civilization. By any standards our scientific efforts had been a notable success. We had harvested an unexpected plum in the winter climb of Ama Dablam. And, if we had not completely disproved the existence of the yeti, we had at least found rational explanations for most stories about the snowman.

High Altitude Kills Men Slowly

Even the disaster on Makalu gave us rich scientific information. Many of us feel now that no one should risk climbing above 25,000 feet without oxygen. Further, we have more evidence to indicate that men cannot hope to live indefinitely without oxygen above 18,000 feet. Each day at such heights a man dies a little, as progressive deterioration and weight loss set in.

Will I go back to the "abode of snow" after the hardships of the Mingbo Valley? My climbing gear, my altitude boots, my warm down jackets are already packed. Early next year, I go to Mount Everest as a member of the 18-man American Mount Everest Expedition, led by Norman G. Dyhrenfurth and supported in part by the National Geographic Society.

We will continue the scientific effort already begun. In addition we hope to put men on all three summits of that mighty trio (above)—Everest, the champion of mountains, Lhotse, world's fourth highest peak, and Nuptse.

And if you say to me, "Those mountains have all been climbed," I can only answer, "But they are still there!"

THE END

We Build a School for Sherpa Children

By SIR EDMUND HILLARY, K.B.E.

*Mist-shrouded Khumjung, high
in the Himalayas, gets its first
schoolhouse as an expedition gift*

WHEN our expedition retired from Makalu to lick its wounds, digest its scientific findings, and pack gear for the long march back to Katmandu, there remained one project that turned out to be perhaps the most satisfying of our Himalayan adventure.

In terms more meaningful than money, we wanted to show our gratitude to the Sherpas—high-altitude porters, cooks, and assistants, who had worked so hard for us in the mountains. Most of our Sherpas came from the Nepalese village of Khumjung, which lies in a valley 13,000 feet high and only 15 miles from the foot of Everest.

"What can we do for you and your village?" I asked our friends.

The unanimous answer was: "Build a school for the children of Khumjung."

So, with the support of our sponsors and others, we gave Khumjung a school. There had never been one before in the little



community inhabited by the hardy, amiable tribesmen, originally from Tibet, whose mountaineering feats have become famous throughout the world.

Indian Firm Donates Building

The Indian Aluminium Company, Ltd., donated a prefabricated structure. The International Committee of the Red Cross flew the parts to the expedition's airstrip at Mingbo. From there it was a vigorous day's march to Khumjung. Girders, beams, and long, rippling sheets of corrugated aluminum traveled across country on the backs of Sherpa porters.

From Mingbo the difficult route led down 5,000 feet to the foaming Inja Khola and past Thyangboche Monastery, gleaming like a jewel on the crest of a wooded spur. Then a steep path wound upward 2,000 back-breaking feet to Khumjung, nestling against the sacred mountain, Khumbila.

Erecting the two-room, 20-by-40-foot building proved a formidable feat. Four of us had remained behind to do the job—Wally Romanes, Desmond Doig, his colleague Bhanu Banerjee, and I. We were assisted by several Sherpas; they were strong and enthusiastic, but most of them had never wielded a wrench or driven a nail.

First we laid a foundation of peeled pine logs, weighting them with rocks to withstand the fierce Himalayan winds. Then we studied the instructions provided by the prefab's builders.

Here our troubles began. There were two sets of instructions, quite different; neither referred directly to this particular building.

With much trial and error, we finally got everything together. Desmond Doig's enthusiasm, which had been a strong motivating force behind the whole project, drove us on. Wally Romanes' jack-of-all-trades skill was invaluable, and Bhanu Banerjee's command





Learning Their ABC's, Pupils Await a School

Sitting on the ground where the building is about to rise, earnest Sherpa boys and girls recite their letters. All are in the same class; earlier only one youth in Khumjung knew his alphabet.

Pointer in hand, Sherpa teacher Tem Dorje conducts this recitation. Just to be near the site, he daily marched his charges out from town until the school was ready.

Bell-mouthed flageolets wail at the dedication. In a rain-soaked 3½-hour ceremony, chanting lamas circled the building, scattered saffron rice and sacred water, and distributed blessings.

Propped by planks, the two-room, prefabricated aluminum structure takes shape. The author and three teammates, helped by enthusiastic Sherpas who had never before screwed a nut on a bolt, completed the job in six dawn-to-dusk shifts, despite two contradictory sets of building instructions. A sturdy fence kept yaks off the grounds.

EDUCATION BY BARRY C. KIMMEL, PHOTOPHOTOGRAPHER, AND HIS DETACHEMENT OF THE UNITED STATES ARMY © N.Y.





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of Nepalese and Hindi eased communication with our helpers. Even so, I remember one depressing afternoon when we discovered that the internal partition had to be taken out and put back in the other way around so that the roof beams and trusses would fit.

Our labors were watched by an appreciative audience of grinning elder Sherpas and apple-cheeked youngsters. After six days of dawn-to-dusk toil, we completed the building—and a fine one it was. It may be the only schoolhouse in the world with a fence around it to keep yaks off the veranda.

Lama Band Salutes New School

On opening day our boss Sherpa, the venerable Dawa Tenzing, raised the Nepalese flag on a new pine pole. Tem Dorje, the Sherpa-born teacher I had imported from Darjeeling, stretched some red tape across the front door. Soon, out of the fog and drizzle, came a band of lamas clashing cymbals, beating drums, and tootling trumpets and clarinetlike flageolets (above). They were coming at my invitation, to give their blessing to this last project of our expedition.

The band circled the building twice, with the head lama of Thyangboche marching in their midst and intoning prayers. By now the rain had turned to a downpour, and we noted proudly that our new building did not leak. Even more proudly, we watched the crowd of Sherpas, who had come from miles around, stand dripping and solemn through the three-and-a-half-hour ceremony. To them, this was a historic day.

Tem Dorje handed me a pair of shears, and I snipped the ribbon. The head lama pronounced a final benediction. Khumjung's first school was in business.

Seesaws Delight Old and Young

While we were constructing the school, Desmond Doig had slipped off quietly and built seesaws and a swing. His project was a huge success, for no Sherpa had ever seen playthings like these before. Soon I had to appoint one of our largest and strongest men to push adult Sherpas off the seesaws so the youngsters could have a turn.

Just before we left Khumjung, we called at the school and saw fifty children sitting cross-legged on the floor. They ranged in age from 6 to 16 and none, till now, had been able to read or write. As Tem Dorje called out letters of the alphabet, the pupils repeated them and copied them carefully on their new slates.

We started for Katmandu with the heart-warming feeling that our enterprise had surely been worthwhile.

To maintain the supply of teachers, I drafted one of Khumjung's brightest boys, 15-year-old Kalden Sherpa. Kalden had learned to read and write from his father, a teaching lama, and he was the only boy in the village with these abilities. We sent him to a Jesuit school at Katmandu to increase his knowledge, and after three years of study he will return to his village to teach.

In March of 1963 we shall return to the Himalayas with further plans for "Expedition Schoolhouse." With the approval of the Nepalese Government, and the continued support of the World Book Encyclopedia, we will establish two more schools and supply each with a competent teacher.

We have several other objectives: a new and more convenient airstrip, a water system for Khumjung, a medical survey of the Sherpas' health and their future needs, and an attempt on unclimbed Taweche. It will be good to be back among old friends—men, children, and mountains. THE END

A wide, wet world of adventure

The Society's newest book chronicles centuries of seafaring

By Melville Bell Grosvenor, LL.D., D.Sc.
President and Editor, National Geographic Society

MANY THOUSANDS of years ago, one of our ancestors discovered that if he lashed two or three logs together and climbed aboard, he could travel with a running stream. This was the first ship, and he the first sailor.

Uncounted centuries went by before another nautical pioneer made a discovery that ranks with the wheel: He found that a breeze caught in a crude sail of woven reeds will drive a boat.

That is how Capt. Alan Villiers, in the National Geographic Society's newest book, *Men, Ships, and the Sea*, describes man's first venturings afloat, venturings that would shape all human history.

In commissioning Captain Villiers as the book's chief author, the Society chose the greatest sea writer of our time. He has sailed since boyhood—in square-riggers, Arab dhows, World War II landing craft, and recently in the Nuclear Ship *Savannah*. To *Men, Ships, and the Sea* he brings unique knowledge and a sailor's gift for spinning a yarn.

This book is particularly close to me, for I have been a sailor since I was six months old, when my parents took me on my first cruise. Since then I have never been far from the sight, sound, and smell of the sea—shoveling coal in a battleship's fireroom as a Naval Academy midshipman, racing a sloop on Chesapeake Bay, or sailing abroad.

Men, Ships, and the Sea tells the whole story of man's long and turbulent romance with a fickle and often cruel mistress. The book's 436 pages carry us from the first tentative voyages through the Age of Sail and the heyday of sea exploration to the advent of atomic vessels.

This is the kind of book I have always wanted the Society to publish. As I worked with skilled editor Merle Severy and his book staff, I found myself enthralled by Captain Villiers's account of how



Columbus lands on Hispaniola: a 16th-century engraving by Theodore de Bry. Burning curiosity drove the early explorers to seek the unknown and risk its imagined terrors. Their crude charts, blazing briny trails, lured conquerors, colonists, and adventurers. Stirring tales of this hardy breed run through the Society's new book, *Men, Ships, and the Sea*.

Barkentine Mercator, a Belgian school ship, flies the U. S. ensign at her fore truck as a courtesy in American waters. After 30 years at sea, she now serves Antwerp as a museum.

Columbus: westward to a new world

This stubborn visionary pitched across an unknown sea, groping for the Indies, and collided with a savage continent. Though a mistake, says Alan Villiers, it was history's greatest voyage of discovery.

THE THICKSET LITTLE SHIP lumbered through blue waters, and a roll of protesting foam hissed and tumbled away from her clumsy bows. It was as if the sea were reluctant to let this unbling ark pass by. Yet she pressed westward before

NATIONAL GEOGRAPHIC SOCIETY

MEN, SHIPS, AND THE SEA



MAN LEARNS TO SAIL

Of the many ways in which man has learned to sail, the most important was the discovery of the compass. This invention, which was first used in China, allowed sailors to navigate across the open sea without the aid of landmarks. The compass was a simple device consisting of a magnetized needle that pointed towards the Earth's magnetic north. It was used in conjunction with a map to determine a ship's direction and distance from a starting point.



HE DISCOVERS NEW WORLDS

The discovery of new worlds was a major achievement of the Age of Exploration. It was during this time that European explorers discovered the Americas, India, and other distant lands. These discoveries opened up new trade routes and led to the development of global trade networks. The discovery of new worlds also led to the spread of European culture and religion to other parts of the world.



HE EMPLOYS THE POWER OF STEAM

The invention of the steam engine revolutionized transportation and industry. It allowed for the development of steamships, which could travel much faster and farther than traditional sailing ships. Steamships also played a major role in the industrial revolution, providing power for factories and mills. The steam engine was a key invention that changed the way we live and work.

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War at sea

War at sea has been a major part of human history. It has shaped the course of nations and led to the development of powerful navies. The invention of the steam engine and the development of ironclad warships changed the way wars were fought at sea. The Battle of Trafalgar was a major naval battle that established British naval supremacy.



Profusely illustrated, *Men, Ships, and the Sea* tells the story of man's voyages from the first log raft to the nuclear-powered submarine. Roman round ship, Greek bireme, Viking dragon ship, South Seas tapukei, Portuguese galleon, British ship of the line, American clipper; river boat, whaling bark, and racing sloop

the sea brought great cultures together to trade food, metals, money, and ideas—and to fight.

Watch with me as the Athenians, inferior in numbers but superior in skill, vanquish the huge fleet of Persian King Xerxes. Had Xerxes won at Salamis, a large part of the world might have lived thereafter under Persian influence rather than the ideals of Greece.


Leaping forward in time, I read again the imperishable words, "England expects every man to do his duty," and hear the din of battle as Admiral Horatio Nelson falls mortally

wounded on H.M.S. *Victory*. Nelson's triumph at Trafalgar, coupled with that on the Nile, made Britain undisputed ruler of the seas.

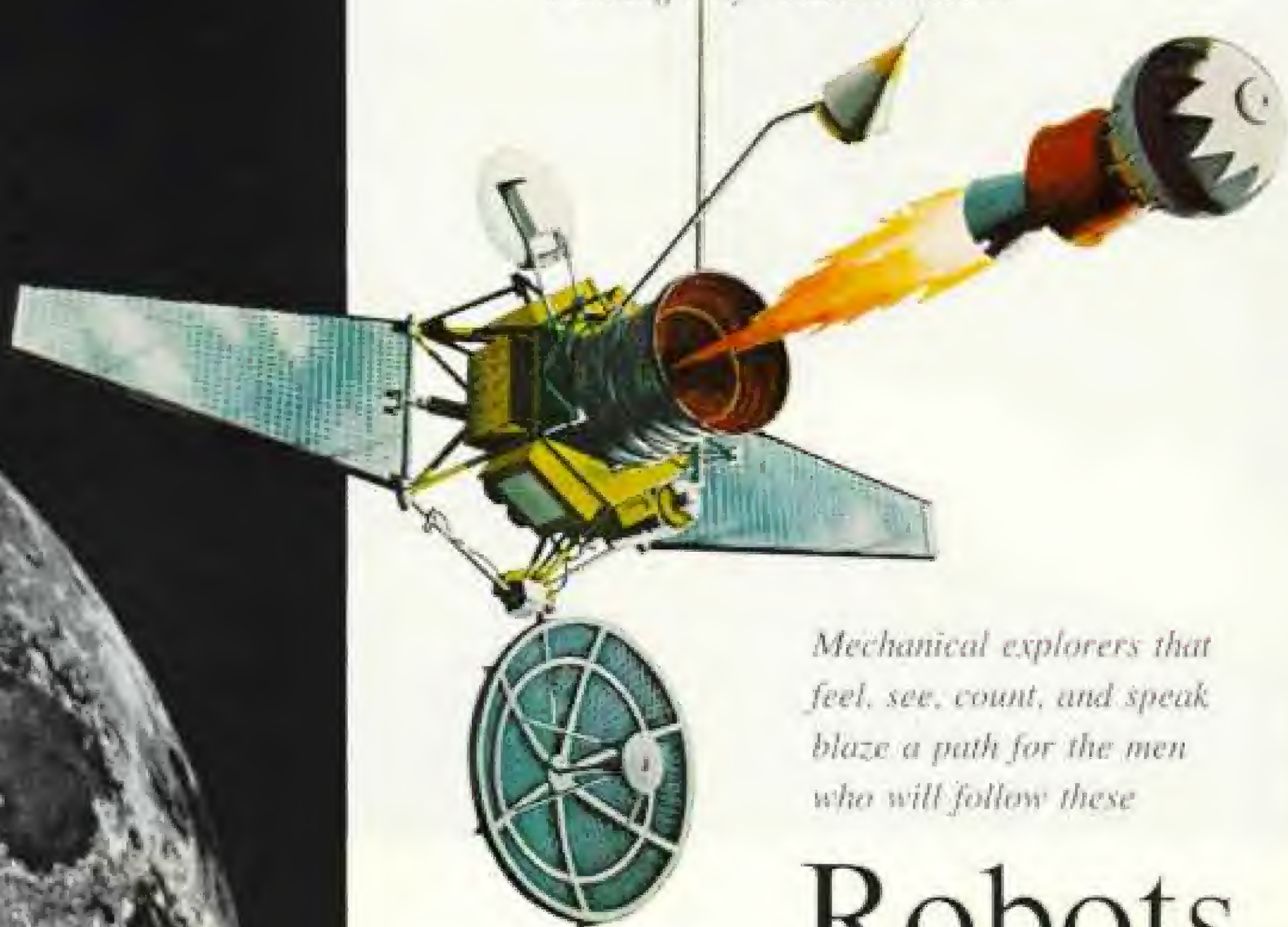
Enhancing the carefully documented text are 259 magnificent color illustrations, including 82 paintings, plus 27 maps. Homely anecdotes sprinkle the pages.

One of my favorites is about Capt. James Cook's efforts to combat scurvy. The Pacific explorer made his crew eat onions—once issuing 20 pounds to each man. The sailors, rebelling at their odd diet, tasted the cat-o'-nine-tails. Cook was right, as a captain must



By  FRANK SARTWELL
National Geographic Staff

Paintings by PIERRE MION



Mechanical explorers that feel, see, count, and speak blaze a path for the men who will follow these

Robots to the Moon

TODAY'S COLUMBUS is a machine. Someday man will make the great journey to the moon; now we send hardware to find the way.

It is as if Christopher Columbus had told the ship *Santa Maria*, "I think we can get to Cathay by sailing west; you go find out," and the ship had sailed off without a man aboard and done just that.

Suppose Columbus had been wrong. Suppose the earth had been flat. Then the *Santa Maria* might well have sailed off the edge—as some people believed it would. But Columbus and his men would have been safe at home.

On a 238,000-mile voyage to the moon there are real dangers worse than the sea monsters Columbus's crew imagined. To learn what they are, the National Aeronautics and Space Administration aims robots at the moon. The wis-

Target: Moon, as seen by Lick Observatory's 36-inch telescope in California. Photographs from earth cannot discern lunar features smaller than half a mile across. Close-ups from Ranger 5 (above) will reveal objects only 15 feet wide.



EDGACHOWICZ BY WITCZINSKI, NATIONAL AERONAUTICS SPACE (NASA)

dom of this approach was dramatically shown by the first two craft the United States tried to land on the moon. In each case, things went wrong that would have jeopardized any crew.

The first American moon machines are Rangers. Someday they will seem as crude as Columbus's *Santa Maria* today. But to our eyes they are amazing, and they do amazing things.

If the rockets and all the Ranger systems work, Ranger will see; it will feel; it will count; it will remember. It will turn and twist in space—by command or on its own initiative. Ranger will capture sunlight, turn it into electricity, then into radio waves. It will take pictures and relay them to earth. (Like human photographers, Ranger must be sure to remove its lens cap.) It will tell us much about what the moon is made of.

This talented spacecraft is an 8 $\frac{3}{4}$ -foot-high piece of hand-made hardware, divided into two major parts. Ranger's larger section, which its designers call the "basic bus," is a hexagon of gold-plated electronic boxes with two winglike solar panels and two antennas. Its job is to send TV pictures and information back to earth. Above these rests the second section, the lunar capsule, a 24 $\frac{1}{2}$ -inch ball that will alight on the moon.

Also part of Ranger are two small rockets. One will give Ranger its final guidance toward the moon; the other will slow

(Continued on page 563)

Moonbound Missile Blasts From the Earth

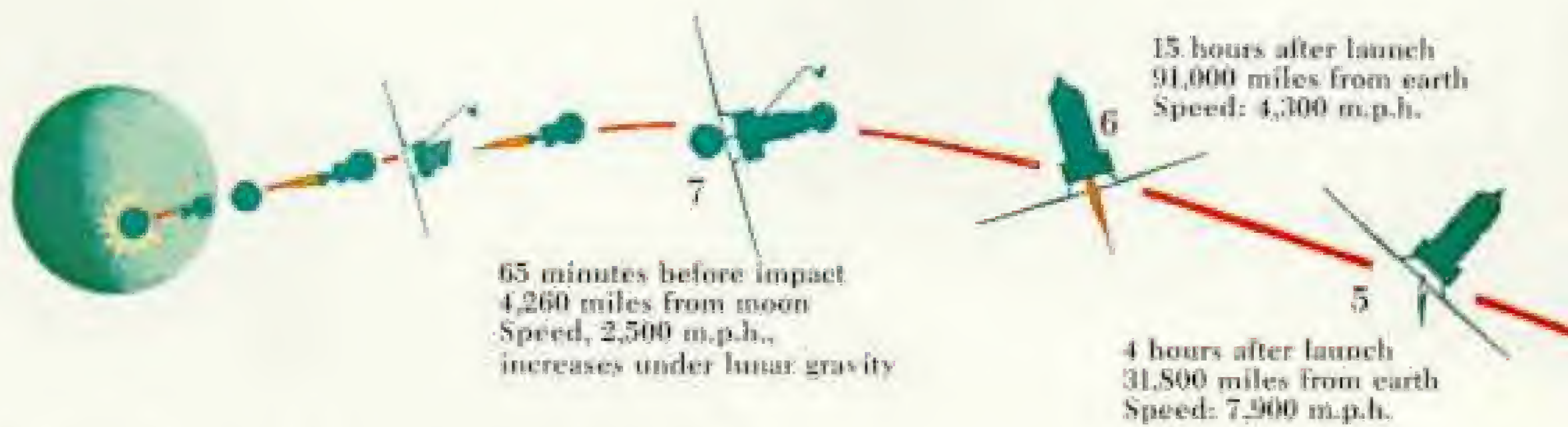
Trailing a frothy wake, a Ranger lunar probe heads toward the moon from Cape Canaveral on April 23, 1962. The probe, fourth in the Ranger series, bore a television camera and seismic instruments. A triumph in rocketry, it struck the far side of the moon but sent back no pictures or scientific data because of a malfunction in its electronic brain. This fall a twin machine, Ranger 5, will attempt the same experiments. On the following pages, paintings produced in close consultation with NASA experts depict the voyage.

On a plume of fire, icy Atlas lifts from its pad. Intense cold of liquid oxygen coats its metal skin with frost. Clouds of steam billow as water is sprayed on the blast deflector to prevent its melting. Ranger 4 is mounted above the second-stage Agena B, atop the Atlas.

The Author: Staff writer Frank Sartwell, a former assistant editor of *National Geographic School Bulletins*, traveled 9,000 earthbound miles to gather the story of man's 238,000-mile reach for the moon.

The Artist: Pierre Mion, of Chevy Chase, Md., relaxes from painting by racing sports cars; he was U. S. Class C¹ champion in 1961.



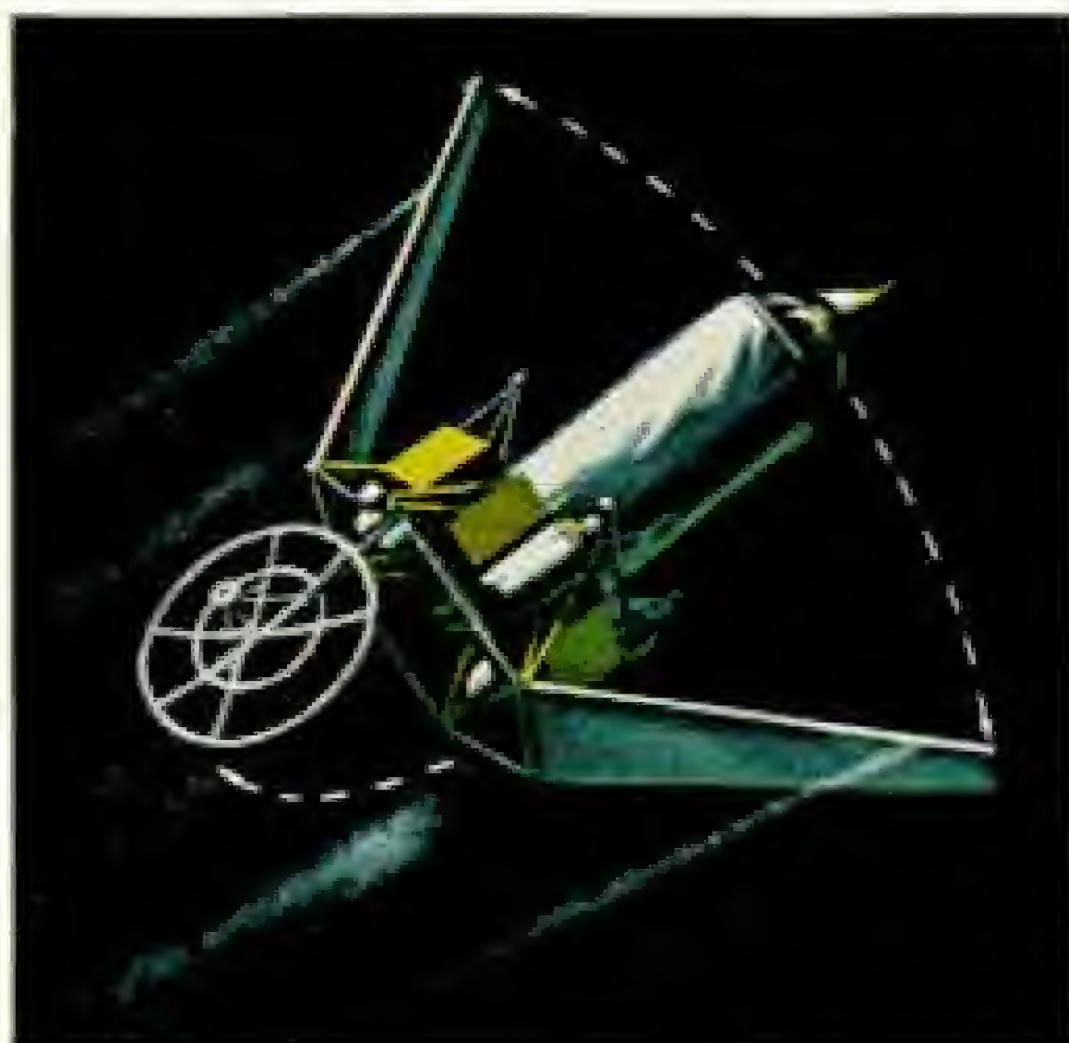


66 hours to the moon

Ranger 5's proposed 238,000-mile flight



1. One hundred miles above the Atlantic Missile Range, the Agena B-Ranger unit separates from its Atlas booster. Protective nose cone sprang away seconds earlier, exposing Ranger 5. Here and on following pages, artist Pierre Mion shows how this Ranger will function if the venture proves successful.



4. Solar panels unfold to capture energy from sunlight. High-gain antenna pivots out and prepares to send signals to tracking stations.



5. Flight attitude is achieved by firing gas jets. Ranger's power-gathering solar panels face the sun; its antenna aims at earth.



2. Second Agena B firing thrusts Ranger into moon trajectory. Agena's first blast, over the Atlantic, placed the mooncraft in earth orbit.



3. Spent Agena, parted from Ranger by springs, falls away. A retrorocket will take the glittering Agena away from Ranger's light-seeking devices.



6. Rocket fires on command from ground, placing Ranger on precise course. Then a ball-like gamma-ray counter extends at the end of boom.



7. Aluminized shroud retracts, exposing the spherical instrument capsule and retrorocket. All-directional antenna (wizard's cap) swings out.



Ranger's seismic instruments, encased in a ball, break from the carrier 70,000 feet above the moon. Radar altimeter, the dish-shaped appendage at left, gauged the distance and ordered a retrorocket to fire. By now the mesh antenna (right) has relayed 156 to 193 TV pictures to earth—if all goes well.



Retrorocket slows the sphere to a momentary dead stop about 1,100 feet above moon. Dotted line shows the carrier's crash. Impact at 6,000 miles an hour vaporizes metal in the lunar vacuum.

the wooden-hulled capsule for a safe landing.

These engines, of course, are puny by comparison to the nine-story tower of energy that blasts Ranger from Cape Canaveral, Florida—the Atlas and Agena B rockets (page 559). They will hurl Ranger through space at a peak speed of 24,500 miles an hour.

But when Ranger's capsule approaches the moon, its own small rocket will slow it to a stop some 1,100 feet above the lunar surface.

Lunar gravity is only one-sixth that of earth, but the moon has little or no atmosphere to slow a spacecraft. The basic bus will smash into the lunar surface at 6,000 miles an hour and instantly vaporize. The lunar capsule, however, braked by its retrorocket, will hit at less than 150 miles an hour.

First Moon Shots Go Astray

Ranger does all these things with a single purpose—to speed the day when human beings will walk the lunar plains.

This fall, Ranger 5 is scheduled to leap into the heavens. It is the third such craft the United States has aimed at the moon. The first two Rangers (fired in 1961) were designed to go into earth orbit only. Rocket failures put both into unsatisfactory orbits.

Ranger 3 took off January 26, 1962. A tiny part in the first-stage rocket, the Atlas, failed to shut down the engine soon enough.



Explosive bolts break a clamp. It flies apart, jettisoning the retrorocket.

Ranger technician in California sets springs that keep the sphere from wobbling on its retrorocket. Paint pattern, reflecting or absorbing sunlight, tempers extremes of heat and cold on trip to the moon.





Excess power pushed Ranger 3 across the path of the moon 14 hours before the moon arrived. The craft passed 22,862 miles ahead of its target and went on to become a man-made baby planet circling the sun.

Ranger 4 was launched perfectly April 23. Without further control it hit the moon—the first American object to do so. But this time the spacecraft suffered a stroke in its electronic brain and lost the power of communication. It could not gather or send scientific data back to earth.

Ranger 5 may be the last attempt to land an instrumented sphere on the moon. It is the last such shot planned by NASA and Ranger's

creator, Jet Propulsion Laboratory of Pasadena, California, operated for NASA by the California Institute of Technology.

Television Stations in Space

Rangers 6, 7, 8, and 9, scheduled for launching next year, will have a different job: Each will carry radiation instruments and six television cameras (page 567). The cameras will take more than 3,000 pictures of the moon, in far greater detail than those from Ranger 5. Sailing orders for these later machines are essentially the same as those for Ranger 5, except that the craft will be completely destroyed on impact.



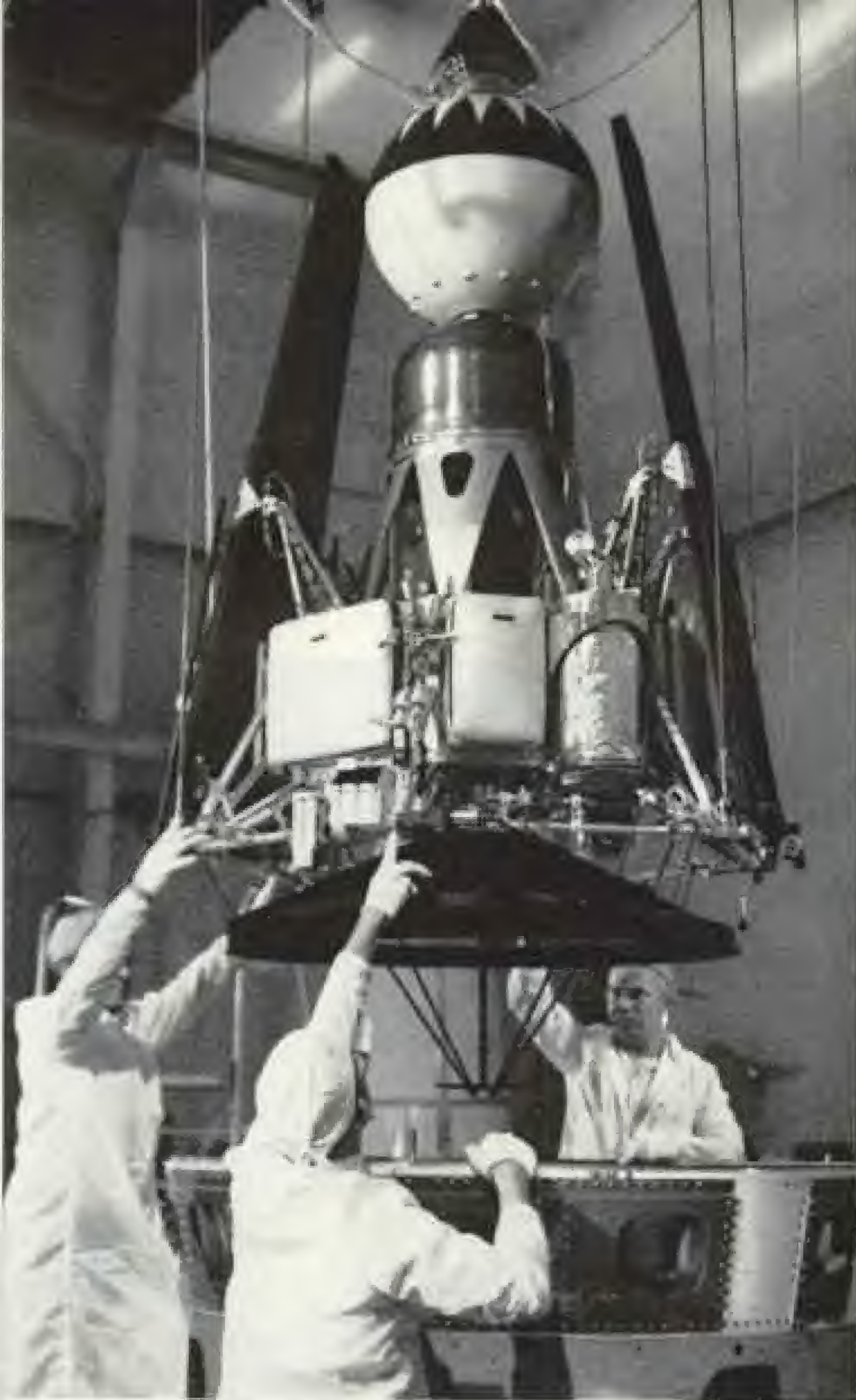
PHOTOGRAPH BY VICTOR WITTE AND VORSTANDER BY THOMAS KEELER © N.G.S.

Half spheres of balsa wood, formed from glued segments, hold Ranger's instrument package. A technician checks the "electronics pan" containing moon-to-earth radio transmitter.

Balsa Bowling Ball Hurlled From Earth Rolls to a Stop in a Lunar Crater

Carrying a sensitive seismometer to record tremblings of the moon from natural quakes or meteor impacts, the sphere strikes at less than 150 miles an hour (upper). Artist's cutaway shows the instruments within the soft outer shell, flattened on one side by the landing. Spent retrorocket lies where it fell.

Mounted gun, one of a pair, fires a bullet through Fiberglas and balsa spheres, releasing volatile Freon in which the instrument package floated. Now the seismometer (at center in the cutaway), locked in an upright position, can detect moon-quakes and meteor crashes, and the vaned radio antenna above it can send reports of these events.



Checkout for space: Jet Propulsion Laboratory men in surgical gowns prepare Ranger 4 for its voyage. Shiny aluminized plastic shields the television camera. Ranger is kept dust-free and then is sterilized lest earth-born micro-organisms infect the moon.

The Rangers will be followed, if all goes well, by Surveyors, which will land softly, bite into the moon's surface, chew it up, analyze it, and report. Surveyors, due to start flying in 1964, will also take pictures in color and stereo (pages 570-71). Other Surveyors could orbit the moon, search photographically for possible landing places, and give us our first detailed map of the surface.

Regardless of the varying experiments each will conduct, all U. S. moon probes will follow approximately the same flight plan.

Their carefully plotted gyrations in space will be similar to those of Ranger 5, pictured on pages 560-61.

If Ranger 5 does its job, and if by some miracle you could fly with it, here is what you would see.

Ranger 5's Weird Journey

After the familiar count-down, the ship thunders through, and out of, the atmosphere. Five minutes later, already in space, the rocket comes apart.

First to go is the nose cone that insulated the spacecraft from the friction heat of launching and sealed it from contamination. Ranger was sterilized before launching to keep earthly life, even bacteria, from reaching the moon and confusing later study.

The Atlas (the same booster that pushed Astronauts Glenn and Carpenter into orbit) falls away. Now the ship consists only of the Agena B rocket and Ranger itself. It is 100 miles above earth, and 490 miles downrange.

Slowly, it arcs over to parallel earth's curve. It coasts a moment; then the Agena fires, pushing itself and Ranger into earth orbit. After coasting some 25 minutes to reach the best take-off point for the moon, Agena flames again, driving into a lunar course at 24,500 miles an hour.

Agena has a final job: It uncouples from the spacecraft, turns around, and fires a retrorocket to slow itself and trail Ranger. If this maneuver were omitted, Agena might follow Ranger into the moon, and reflections from it could confuse Ranger's light-finding orientation devices.

Now Ranger goes to work. On command of its electronic brain, it unfolds two panels, each six feet long and faced with 4,340 solar cells. They are capable of producing from the sun's energy 148 to 155 watts of electricity—enough to light a large lamp bulb on earth.

This power will operate Ranger's array of electronic gear through most of its flight.

Three minutes later a third object swings out: the large, or high-gain, antenna, which is to transmit signals and pictures back to earth. Then Ranger begins a stately dance in space, seeking to face the sun with its solar panels while pointing its antenna to earth.

In response to signals from sun sensors—rather like photographic exposure meters—a computer jockeys the craft by releasing bursts of gas through clusters of nozzles. Swinging back and forth, Ranger achieves an attitude in which it gets maximum power from its solar panels. Then it rolls until its antenna is aimed at the earthlings searching for its signal (next page).

Ranger now coasts until its masters on earth figure out what to do next. They plot Ranger's path and compare it to the "perfect" path. Chances are the course is a little off.

Ranger begins another minute. It abandons its fix on the sun and turns as directed by earth until the spacecraft is aimed on a collision course with the moon. Earth says, "Now!" and a rocket in Ranger's base fires, kicking the craft into its final trajectory.

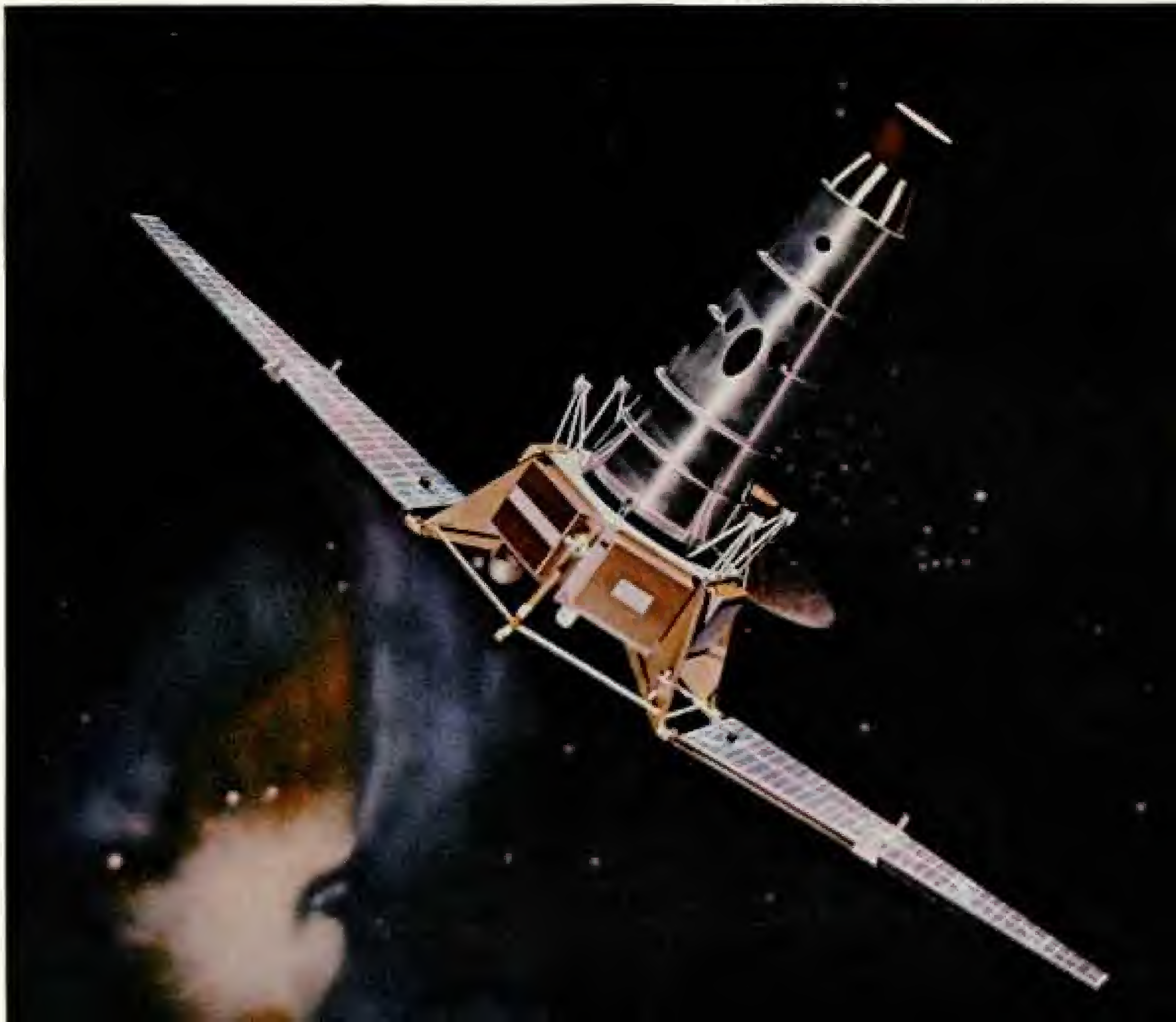
Instruments Study Moon From Space

Again Ranger gyrates to find sun and earth, stabilizes, and continues its cruise. A silvery ball moves out on a six-foot telescopic boom. This is the gamma-ray counter, which will help identify moon materials by picking up

Ranger 6, Yet to Fly, Carries Six Television Cameras in Its Conical Tower

No sphere will be landed. TV cameras that can define one-foot objects will look through apertures in the cone. NASA hopes to launch four craft of this type, which will be destroyed on hitting the moon. Solar panels extend as on earlier models.

PHOTOGRAPH OF MODEL BY JET PROPULSION LABORATORY





RECORDED BY TERRY BARTWELL, NATIONAL GEOGRAPHIC STAFF © N.G.S.

Goldstone, Ranger's command post in the Mojave Desert, sends orders and receives television pictures and instrument signals with its 85-foot dish antenna. Similar stations at Woomera, Australia, and Johannesburg, South Africa, help track the voyager.

distinctive radiation patterns.

Ranger has been slowing down. Earth's gravity clutches at it, trying to pull it back. But 220,000 miles out, when it has slowed to 2,150 miles an hour, a new tide tugs at this Space Age *Santa Maria*: the moon's gravity. Ranger acts like an automobile, engine off, coasting up a hill. Just as it is about to lose momentum, it crests the hill and starts down the other side.

Now comes the climax of the voyage. Ranger slews again, this time to point its TV camera at the moon. The lens cap moves aside. Ranger is 2,500 miles—32 minutes—from the moon. Its camera eye takes in a small piece of the sky-filling surface. Around the world, astronomers are holding their breath; earthlings are about to get close-up views of their nearest celestial neighbor.

Moon Is a Stranger

Although man has been peering at the moon since he first lifted his eyes from the ground, he really knows little about it. Earth's atmosphere, though life-giving, clouds our vision. We see and photograph through its shimmering, moving layers.

We know, of course, and can map the largest craters and plains. We can, by shadow length, calculate the height of its mountains. But at present, even with the best of telescopes, astronomers cannot distinguish anything smaller than a city block. (The justly famed Russian pictures of the far side of the moon had even less resolution than telescopic photographs, but they are the only ones obtained so far.) Ranger 5 should see objects the size of a compact car. Later Rangers will disclose objects down to one foot in diameter.

Ranger's TV camera opens for a 50th of a second for each

exposure. These shots are radioed to a NASA installation at Goldstone, California, 120 miles northeast of Los Angeles in the Mojave Desert (opposite). As Ranger flies ever nearer, it makes more than 150 lunar close-ups, each picture covering a smaller area than the one before, with increasingly better definition.

When Ranger's radar altimeter senses that it is 70,000 feet above the moon, it figuratively shouts, "Land ho!" The photographic mission is ended; Ranger is about to come apart and prepare for landing.

Retrorocket Brakes the Capsule

Now the lunar capsule begins its useful life. The outer shell of this 24½-inch ball is wood—balsa, six inches thick, light, springy, and tough. Inside the balsa are a variety of things: a moonquake sensor, a radio transmitter, two guns, three pints of water, half a pint of volatile heptane.

At the altimeter's signal, the lunar capsule is detached from the \$6,000,000 basic bus, which tumbles full speed into the moon. A small retrorocket slows the lunar capsule to a dead stop some 1,100 feet above the surface (page 563). Then the rocket drops off, and the lunar capsule, sucked in by the moon's gravity, hits the bleak landscape, bounces, and rolls to a stop. It lands silently (there is no noise on the moon, because there is no air to carry sound waves). The only damage is a crushing of the balsa on one side (page 564).

The balsa ball may have landed so that the instruments it contains are upside down, and this has been provided for. Inside the balsa shell nest two concentric Fiberglas spheres separated by one-tenth of an inch of liquid Freon. The inner sphere, holding the instruments, is weighted at the bottom. It rotates in the liquid by the force of gravity until the instruments are right side up and the antenna points toward earth and the listeners at Goldstone.

For at least a thousand million years, probably far longer, nothing has landed here but lifeless chunks of rock or metal, including an inert Russian probe and the dead Ranger 4. But today something happens that, so far as we know, has never occurred on the moon.

This intruder moves, moves of its own accord. It is a small movement, granted, and only a by-product of clearing the lunar capsule's interior for action. Two guns go off inside, and the capsule shudders as the bullets pierce the Fiberglas spheres and the balsa.

The Freon spurts out the holes, instantly vaporizing in the lunar vacuum, and so does the heptane that fills the moonquake sensor, or seismometer, to protect its moving parts during the rough landing. The capsule is now "frozen" in its working position.

This modern *Santa Maria*, which has been in its new world 20 minutes, is now ready to report to its masters. If the moonquake sensor jiggles, radio signals flash the fact to earth in less than two seconds.

Ranger's seismometer can feel the shock of a five-pound meteorite hitting the other side of the moon. At Goldstone, I saw a Ranger seismometer that had been dropped in its capsule from an airplane over the Mojave Desert in a test of its ruggedness. It survived, and remained so sensitive that it recorded the air motion of a piece of typing paper waved two feet away.

Walter Larkin, engineer in charge at Goldstone, said: "We had this set up once in a room with the door closed. Just by watching its reactions, we could tell when a girl was walking down the corridor—and we could tell the plump ones from the slim ones."

Instruments Survive Heat and Cold

The great problem on the moon's surface is the extreme heat and cold. During the lunar day, when the sun beats down, the moon's surface reaches 248° Fahrenheit. In the lunar night, the surface cools rapidly to minus 238°. The instruments could not work at all in these extremes, were it not for the temperature-controlling water in the capsule's tanks.

In daytime, the predominantly white color of the sphere will, by reflecting sunlight, hold down the internal temperature. The balsa wood and insulation inside the capsule will also help. Most important, however, is the water, which will temper the interior "climate" as oceans do the seacoasts. When temperatures rise too high, some of the water will boil off through a poppet valve, cooling the instruments by evaporation.

At night, the water will eventually freeze. But by the time the ice gets much below 32°, sunlight will be warming the capsule again. In about 30 days, all the water will have evaporated, and the signals will stop.

Why should our first lunar instrument be a seismometer? Because it can tell us much not only about the moon, but also about the earth and the formation of the solar system.

First, it can define the hazard that a human



RENDERING BY PERRY WISE © N.A.S.

Flying Laboratory Spews Fire, Braking Its Fall to the Moon

Surveyor, a later-generation moon machine, will tell man much about the lunar environment. Scheduled for 1964, Surveyor may ride an Atlas-Centaur rocket driven by liquid hydrogen-oxygen fuel. Lunar landings by men by 1970 are planned.

Surveyor goes to work, televising the moon's face in black and white, color, and stereo and analyzing its minerals, tenuous atmosphere (if any), temperature, radioactivity, and magnetic field for report to earth. Drilling holes and scraping the surface, Surveyor will test samples to determine their elements. A processing chamber will grind rocks, heat them, and detect gases. Bombardment with X-rays may submit other materials to analysis.

Here the artist depicts the three-legged machine aiming its solar panel at the sun, its antenna at earth. Surface sampler and drill dig in at left. A radiation detector extends on rod at right.

Columbus of the Space Age will encounter from meteors streaking into the moon. It can count their number and size.

Secondly, the seismometer can tell us what the moon's surface is like—whether there is a firm crust to support future Surveyor moon machines; and, eventually, manned ships.

But how can the seismometer yield a clue to the origin of the solar system?

There are two chief theories of the solar system's formation. One theory holds that the planets were pulled from the sun in blobs of hot gas when another star passed close by. The second theory maintains that the planets formed from a huge mass of cold dust and gas.

Earth is so large that its own weight could have squeezed its core into a molten state. Some astronomers do not believe that the moon is massive enough to create the interior heat necessary to form a molten core on its own. If a liquid lunar core is found, the hot-gas theory will be strengthened.

"Bug" Will Carry Lunarnauts

We learned about the nature of earth's core through study of earthquake shock waves. Ranger's moonquake recorder may give us the same knowledge about the moon.

But all this, however epochal, is a mere

toddling step toward man's destiny in space. By 1970, as planned, men will follow Ranger and Surveyor in a Project Apollo moonship.

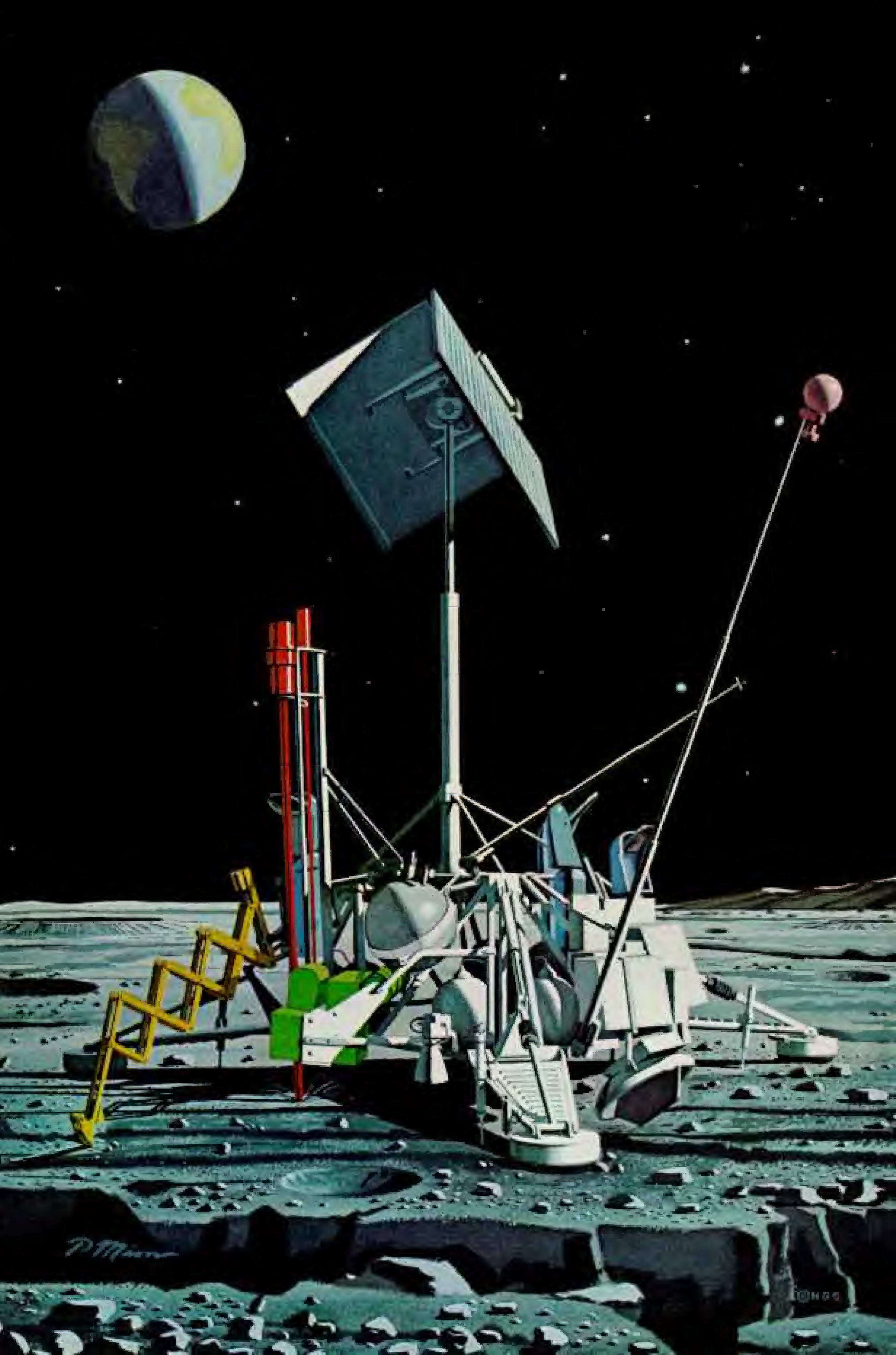
The most promising system for setting human feet on the lunar plains, NASA now thinks, is to send a three-man "mother craft" into orbit around the moon. From it a lunar exploration vehicle, or "bug," would detach, carry two men down to the surface, then ferry them back to join the third crewman for the return to earth, leaving the empty bug circling the moon.

Although this technique—rendezvous in lunar orbit—is now considered quickest and cheapest, other plans are under study.

A manned rocket might rendezvous in earth orbit with a "tanker," fuel, then blast off to the goal. Or a straight shot from earth to moon, without orbital rendezvous, might be attempted. Both two- and three-man craft are being considered for these missions.

Moon and earth today are closer, in time, than America and Europe were when *Santa Maria* sailed into the unknown. As man once burst from the Old World, so he must work his way out of the comfortable cocoon of earth's atmosphere and take not only the moon but the whole solar system as his New World.

THE END



P. Moore

©NAS



Headdress of human hair, bleached by sun and sea water, crowns a knife-waving dancer of newly independent Western Samoa. Festivities celebrating the birth of the Polynesian state took place near Apia on the island of Upolu.

Flag of the new nation rises January 1, 1962. The two titular heads of state, Malietoa Tamumafili (left) and Tupua Tamasese, hoist the red-and-blue banner. Prime Minister Fiame Mata'afa, a pandanus-berry 'ula over bare shoulders, stands directly behind Malietoa.

“SO YOU ARE A WRITER,” my Samoan seatmate said with a knowing smile. “Another come to find paradise?”

Our plane winged low over a coral reef toward his home island of Upolu. He and others aboard were returning to celebrate Western Samoa's forthcoming independence.

“No, there've been too many of those already,” I replied self-assuredly. “I'm here to look for facts—to watch Western Samoa become a new nation. I won't have time to look for paradise.”

“Ah,” my companion said, still smiling. “I shall be interested to see what you find.”

I looked down at neat villages, their thatched rooftops clustered about swaths of green, or around glistening coral sand. Fishermen's outriggers dotted a shimmering sea; inland, shifting mists of the rainy season cloaked great craggy peaks (page 579).

Something in my Samoan acquaintance's voice unsettled me a bit. I turned from the window and retreated to the security of the few facts I already knew.

Homeward Ticket Not For Sale

Scattered some 4,000 nautical miles southwest of San Francisco, 1,500 miles northeast of New Zealand, the Samoan islands straddle the 14th parallel of south latitude (map, page 583). With two main islands—Upolu and Savai'i—Western Samoa's land area totals some 1,130 square miles. Its population, now 117,000, has more than doubled in the past three decades. Apart from New Zealand, with its equally prolific Maoris, Western Samoa is the home of the biggest group of Polynesians in the Pacific. Soon it would be the first Polynesian state to become independent in the 20th century.

The plane bumped to a stop, and the dry figures vanished before the friendly faces of Western Samoa. Customs and immigration



PHOTOGRAPHER © NATIONAL GEOGRAPHIC SOCIETY

Western Samoa

THE PACIFIC'S NEWEST NATION

By MAURICE SHADBOLT

Illustrations by National Geographic
photographer ROBERT B. GOODMAN

officials were quick, polite, and pleasant; it was a good introduction to the people who are soberly getting down to the business of running their own affairs.

But one thing puzzled me. The immigration officer requested my return air ticket for safekeeping until I left the island.

"What do you want that for?" I asked.

"So you don't sell it," he said.

"Sorry," I said. "I still don't understand."

"The trouble is that some of our visitors don't want to leave when the time comes," he explained. "If they could, they'd sell their return tickets and settle down here."

"Well," I said, "I don't think you'll run any risk with me. Don't you think I could keep my ticket?"

The Author: New Zealander Maurice Shadbolt at 30 has traveled the world as a free-lance writer, but his heart is in the Pacific as a "pale-skinned Polynesian." His articles and stories about New Zealand have won wide praise; he wrote movingly of his native land in the April, 1962, *GEOGRAPHIC*.

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"Sorry," he smiled. "But we can't take chances. On anyone."

On the twenty-mile drive from Faleolo Airfield into Apia, villages run almost continuously along the seastrip. Churches, sometimes serving only one or two hundred villagers, rise almost to cathedral size. Only the best will do the Samoan for his church; villages compete for the biggest, most impressive place of worship (page 576).

Fales—the Samoan houses with thatched roofs—stand discreetly apart, but entirely open to the onlooker. In fact no dwelling in the world can be more open than the Samoan fale (pronounced fah-lay). Without doors, it invites cool breezes from all directions. In the event of slanting rain, mats are lowered. Outside, hibiscus and small yellow *lantalotalo* plants grow for decoration, and coconut, breadfruit, mango, and papaya trees for food.

It was Sunday, and now and then we passed swarms of villagers dressed in white, returning from church with Bibles and hymnbooks under their arms. We stopped for gasoline,



and children converged on us from all directions. I had no difficulty in believing that more than half of Western Samoa's population is under 15.

They fingered my clothes, they studied the car, they gazed at me steadily with wide, shy eyes. I heard one word over and over again as they chattered among themselves.

"*Papalagi*," they said. "*Papalagi*."

I asked a Samoan friend what it meant.

"*Papalagi*? It's our word for a European. Literally translated, it means 'sky-burster.'"

"Tell me the story," I said.

The ancient Samoans, he explained, conceived the universe to be shaped like a mushroom. The flat world, consisting of the ocean and its islands, sat like a disk upon a pillar; above rose the great dome of the heavens. There were no continents, no white people; only the islands of Samoa, Tonga, and Fiji. When the first Europeans came, they were presumed to have broken through the sky.

The first time, an enormous white bird appeared where the sky touches the sea. This

Tongue out, whip flailing, a shoeless jockey lashes his mount around the Apia racetrack. Rain transformed the oval into a quagmire but failed to dampen the ardor of horses, riders, or spectators.

Cricket player capers as her team scores. Samoans love to stay out in a cooling rain.



Undaunted by a downpour, a cricket player on Upolu, bat in hand, sprints for her wicket to the cheers of onlookers. Almost every village maintains a concrete pitch. Since cricket was brought to the islands in the 1880's, it has undergone changes to suit Samoan tastes. Teams field ten to 300 players, instead of the customary eleven. Contests last for days amid a carnival air. A successful bowler sometimes turns cartwheels down the pitch; impromptu dances celebrate a hit (lower left).





PHOTOGRAPH BY WALTER J. BOGARTON, POLYNESIAN PHOTO GALLERY © 2004

was the sailing ship of Dutch explorer Jacob Roggeveen in 1722. Later in the 18th century came other European explorers and whaling ships. The first papalagi settlers were ships' deserters and escaped convicts from Australia and Norfolk Island.

But in 1830 came the true sky-burster, the true messenger from the heavens. This was John Williams, of the interdenominational London Missionary Society. Williams, the strange, gentle white man with words of peace, has already passed into Samoan legend.

"To understand Samoa, you must understand our passion for religion," I was told. "We Samoans aren't called the Irishmen of the Pacific for nothing. There's nothing our old men enjoy more than arguing intricate points of theology."

We drove on through palm-ranked coconut plantations into Apia, Western Samoa's capital, numbering some 25,000 people. With tall white-washed churches and large pale trading buildings, the tree-shaded waterfront has an oddly Spanish flavor (page 598).

As lights flicker along the waterfront after dusk, parties of girls and boys, with flowers behind their ears and in garments as gay as butterflies, sing lilting South Sea melodies into the evening. Their shadows drift beneath the *pulu* trees, and their voices ride in perfect harmony out to the lights of ships at anchor in the reef-bordered lagoon.

A few yards from shore, on a coral reef, tangled wreckage rises from the water. "All that's left of the German warship *Adler*," my guide said, "after our hurricane of 1889."



Monumental church presides over the seaside village of Sale'imoa on Upolu (opposite). A semicircular array of beehive-like houses encloses the village green. Some forty churches flank the 10-mile road between Apia and Faleolo Airfield.

Before the missionaries came, Samoa knew no national religion. Every individual had his own guardian spirit, each family its minor god, each village its local deity. Priestly functions belonged to heads of families and village chiefs.

Christianity quickly took root in this fertile soil. By 1840 most Samoans had been converted. Today religion dominates Samoan life.

Islanders scrupulously observe the Sabbath and dress in their best for services, though often they go without shoes. Above, worshipers gather at a London Missionary Society church.

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Independence day banner borne by children attests religion's role. The nation's motto—*Fa'avae i le atua Samoa*—means "Samoa is founded on God."

When the storm roared out of the Pacific, the great powers of the day—the United States, Germany, and Great Britain—were poised for war over Samoa. Backing the claims of rival Samoan high chiefs, all three powers dispatched warships to Apia.

They faced each other tensely. Ashore, the factional Samoan quarrel grew.

Hurricane Ends International Crisis

Then the hurricane struck. Three German and three U. S. vessels were either wrecked or thrown ashore, and some 150 lives were lost in a murderous sea. The single British ship made a lucky escape, cheered on by doomed U. S. sailors.

The Samoans abandoned their quarrel and rescued injured and drowning from the

wrecks. The threat of international conflict was swept away by the storm.

Later, in 1899, Germany took control of Western Samoa by agreement with Great Britain. The U. S., under another agreement, retained the small eastern islands, known today as American Samoa.

But in 1914, at the onset of World War I, New Zealand occupied German Samoa, continuing to govern after the war under League of Nations mandate, and later under the United Nations Trusteeship Council. In 1947 New Zealand began preparing the Irishmen of the Pacific for political independence.

Samoaans, however, have smilingly resisted one aspect of the Western World's democratic ideal: Universal adult suffrage? Votes for all? They will have none of it.

Central to Samoan life is the extended family group—the *aiga*. It may range from a few dozen members to several hundred. The family elects a *matai*, or chief, to speak for it. Under Western Samoa's present system only the *matai*, on behalf of the family, has the right to vote.

Since the family is so important to Samoa, I decided to spend some time within one.

My host was Henry Wendt (page 582), a Samoan plumber and importer whose home stands just back from the Apia waterfront. It consists of three separate buildings around a courtyard, two in semi-European style. The third is a straight-forward Samoan fale. Here live his 86-year-old mother and any relatives who choose to stay with him in town.

Henry Wendt introduced me to his mother. "My son can have a European house if he likes," she said. "But I stay here, in the fale, where I'm cool and comfortable."

Palusami Weakens Author's Resistance

Afterward Henry led me across the courtyard to his living room. A long table was loaded with tropical fruit and dishes fresh from the *lowa*—the traditional Polynesian earthen oven warmed by hot stones. We settled down to a vast Sunday meal. Chinese food, a reminder of days when indentured Chinese laborers worked on Samoan plantations, jostled with traditional dishes.

I dipped experimentally into that most delicious of Samoan fare, *palusami*—thick cream of coconut cooked within fresh taro leaf and served on slices of taro.

Henry Wendt smiled when I asked for more. "Yes," he said. "If you enjoy our *palusami*, I think you will enjoy Samoa."

A bait for paradise? I was weakening.

After dinner we relaxed in the living room. With the gentle and dignified courtesy so characteristic of Samoans, Henry Wendt quickly made me feel at home. Open shutters allowed a mild sea breeze to cool the house. Simply furnished, with coconut matting on the floors and a multitude of chairs for relatives and friends, the long living room was dominated by a large radio-phonograph. I noticed that one wall was covered with certificates won at schools and universities by my host's children. If Samoans are passionate about anything in the modern world, it is education.

"I had to leave school when I was 16 years old," Henry explained. "So naturally I'm proud when my children are so successful."

We talked of the Samoan past. "As you might expect from my name, I have some German blood," he said. "We have

Apia, Western Samoa's Chief Town, Hugs the Sea; Its Verdant Arms Embrace a Reef-ribbed Harbor

Nestled on the northern coast of Upolu, Apia serves as a trading and administrative center. Its 25,000 residents occupy neat homes and promenade the tree-shaded waterfront.

More than half the nation's 117,000 people live on Upolu, a 430-square-mile volcanic dome. Villages dot the coastal rim; few islanders inhabit the rugged interior.

Distant clouds foretell a downpour that will pound sea and foliage with a locomotivelike roar.





absorbed a great deal of Europe here in Samoa. But we remain Samoan.

"The good thing in our tradition is respect for the family," he emphasized. "In Samoa you will never see anyone really poor and starving. No member of an aiga will let another member go hungry—it would disgrace his family."

Living in Apia, Henry Wendt retains his matai title and returns when necessary to the remote village where most of his aiga live. There he advises on the affairs of the family and settles disputes which may have arisen in his absence.

Prisoners Live in Jail Without Bars

Later that evening he guided me across the courtyard to my bedroom. The Samoan night was hot and still, flooded with moonlight. We paused a moment. Out of the night rose husky, melodic voices, spiraling on the notes of a guitar.

He pointed to the lighted windows of a large building nearby. "They are prisoners. That's our town jail."

"I don't see any bars," I observed.

"You won't, here," he replied. "During the day you will see prisoners wandering about

freely, doing their work and cooking their food. Besides, they will all be released soon to begin a better life in our new state."

"You place great faith in people here," I remarked.

"And in God," he added quietly, as we said goodnight.

On my bed, to replace my papalagi pajamas, lay a lava-lava, thoughtfully left by the women of the house. I wound it about my waist, slipped beneath a sheet, tucked down my mosquito net.

The night was alive with rustling insects, padding feet, the whispers of lovers, the muted strumming of guitars. Outside my window a laden coconut palm stood a vivid silver in the moonlight. I dozed, thinking of an old Samoan legend.

On the island of Savai'i, Samoans say, there once lived a beautiful girl named Sina. The King of Fiji, who heard tales of her beauty, resolved to win her for his wife. Through magic, he changed himself into an eel and swam to Samoa. As an eel, the king became Sina's pet. But in time she grew afraid of him and fled a great distance. The eel followed, but in the chase the king lost his magic powers. Deathly tired and unable to



Red Cross cap crowns the expressive face of a Samoan girl. Only the Maoris of New Zealand outnumber Samoa's branch of the Polynesians.



Polynesian beauty displays the dark eyes and hair typical of Samoans.

Fragrant blossoms cling to the spun-jet tresses of a South Seas maiden, 10-year-old Moira Fabricius of Apia. Her features reflect her mixed ancestry—Chinese, Polynesian, and Danish. She wears blooms over the left ear to signify that she is unmarried.

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Shoppers in downtown Apia raise parasols to escape the sun. Coastal temperatures seldom range beyond 65° or 90° F.; the humidity remains high.

Author's host, Henry Wendt, runs a plumbing business in Apia. He traces his surname to a grandfather who came to Samoa from Germany in 1860.

A village chief, Mr. Wendt serves as elected head of his *ai'oga*, a clanlike group related by blood, marriage, or adoption.

change his eel shape, he knew he would never win Sina's love.

Only death would heal his pain. With his last breath he whispered to Sina: "Cut off my head and bury it in front of your fale. A tree will grow from it. From its leaves you can weave fans to cool you when the northern breeze fails. From its fruit you will have both food and drink.

"Fulfill my wish, Sina, and drink from the fruit of this tree. Every time you do this you will be kissing me."

After Sina planted the head of the broken-hearted eel, a plant grew up—a most remarkable plant. Its trunk was tall and narrow, not unlike the eel's body. Its leaves waved like sadly pleading arms in the breeze, and in its top grew life-giving fruit.

This was the first coconut tree. And those who know the legend also know that on the coconut one can see the eyes and mouth of Sina's eel lover.

Cattle Graze Beneath the Coconuts

"Coconut trees?" said Pat Kelly. "I can show you thousands of them. They're the original wealth of most Pacific islands, you know. When the first European traders came, they were after copra. It's still big business in Samoa, but now we grow other things, too."

I bounced along in a Land-Rover with the man who could tell me most about Western Samoa's agriculture. Tanned and taciturn Pat Kelly, New Zealand born, came to Samoa 25 years ago—and stayed. For the past six years he has managed the biggest single

"Lovely and lost and half the world away," poet Rupert Brooke wrote of Samoa. The islands lie 14° south of the Equator on a line between Hawaii and New Zealand, 4,000 sea miles from California. Western Samoa's two main islands and seven islets have a combined area of 1,130 square miles, about the same as Rhode Island's. Seven eastern isles make up American Samoa, a ward of the United States. Because the Date Line separates Samoa and New Zealand, travelers between the two countries gain or lose a day.





Cacao harvester in a lava-lava, or wrap-around skirt, snips mature golden pods from the trunk and major branches of a tree. Each fruit yields 20 to 40 seeds, or beans.

Dried and fermented, cacao beans await shipment. Ground, they will produce cocoa, basis of all chocolate.





Like Plants in a Seedbed: a Forest of Coconut Palms

More than 8,000 of some 30,000 acres in the Western Samoa Trust Estates, former German plantations now administered for the Samoan people, are mantled by legions of stately palms. Upolu Islanders collect ripe nuts and split them; the dried kernels yield copra, source of coconut oil. WSTEC grows cacao, coffee, and cattle as well. Samoa's soil is so rich that even fence posts sometimes take root.

Cattle and coconuts go together on this WSTEC spread. Tended by cowboys, herds graze beneath the palms, making it easier to find fallen nuts.



PHOTOGRAPHS BY FREDERICK A. JOHNSON
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undertaking in the country—the Western Samoa Trust Estates Corporation.

Originally German property confiscated by New Zealand, the estates were developed into a prosperous, £1,000,000 (\$2,800,000) enterprise, and handed over to the Samoan people in 1957. WSTEC once covered more than a hundred thousand acres; it has shrunk to a third that size as land has returned to private hands. The remainder is run by the corporation to benefit the Samoan people.

"The annual profit goes to the government," Pat explained. "It's used for special projects, like new college buildings."

But not all the profit can be measured in hard cash. "We employ about 3,000 people on these estates," Pat continued. "Here they learn animal husbandry and agricultural methods. They carry this knowledge back to their village plantations."

We drove through miles of coconut groves. Here and there pickers gathered fallen nuts, loading them onto donkeys. In villages on the estates I saw men and women splitting and scraping the nuts and drying the meat.

I hadn't expected to find a cattle ranch in the tropical Pacific, but here it was. Herefords grazed on lush grass, under the golds and greens of sunlit coconut trees (page 585).

"Yes," Pat said. "Cattle and coconuts. The two go well together. The cattle keep down

the grass under the trees—makes it easy to find the nuts when they fall. We slaughter about 90 percent of Western Samoa's fresh meat on these estates, from a total herd of 10,000, and we export the hides."

The scene changed. We drove through hundreds of acres of thriving cacao plantations. "We're developing this in a big way," Pat said proudly. "Samoan cacao now has the reputation of being one of the best in the world for high-grade chocolate. In a good year, it earns more than a million pounds. Now we're experimenting with coffee, too."

Leisurely Bus Meanders Along Coast

Third big cash crop of Western Samoa is bananas. Shipped green to New Zealand, they ripen on the voyage south. I saw enough bananas to last me a lifetime in the next few days, as I traveled the villages of Western Samoa with Albert Wendt, Henry's 22-year-old student son. Just back from three years in New Zealand, Albert was keen to tour his native islands again.

"The best way to see Samoa is from a bus," Albert said. "It won't be a comfortable ride, but I promise you'll enjoy it."

We took a bus, with hard wooden seats and open windows, east from Apia. It was warm—Samoa stays about 80° F. all year round—and we moved along at a leisurely pace.



The road leaped steeply around coastal bluffs, curled across lowland watered by mountain rivers, curved beside long, surf-lashed beaches and around tranquil lagoons.

I saw Samoa as the first ocean-weary Polynesian voyagers must have seen it when they arrived before the time of Christ's birth—rock and river, surf and sand, forest and mountain, palm and lagoon, in serene blends of beauty.

They must have liked it, because Samoans, unlike most other Polynesians, quickly forgot their ancient migration from other lands or islands. For them, Samoa has always been home, regardless of what archeologists and anthropologists say. And who can blame them?

Pigs and chickens fled as we rumbled through villages tucked under the palms. Now and then children dived out onto the roadside, waving frantically to the driver. The first time this happened, I imagined some emergency. "What is it?" I asked. "An accident?"

"No," Albert said. "The child's just stopped the bus for his parents. They'll be along in a while."

Skillful healer, Moanani Ioane Okesene—his last name is the Samoan word for oxygen—treats a patient at Apia's hospital. Although largely self-taught, he performs delicate eye operations.

Tattooed chief shampoos in a fresh-water pool. Designs from waist to knee suggest tight lace pants. Artists form the patterns by dipping a comb in candlenut soot and hammering it into the skin.

Here Lies the Author of *Treasure Island*

Tomb of Tasiata, "writer of tales"—Robert Louis Stevenson—draws visitors to Mount Vaea. R.L.S. lived his last years in Samoa, dying in 1894. Plaque at left bears Stevenson's famous "Requiem"; inscription at right honors his wife.



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Sometimes it proved to be quite a while. Father would finish his work; mother would finish doing her hair. They would pack some food to take along to the relatives, or roll up some mats. Then they would stroll to the bus. The bus driver never complained. Samoans don't believe in running a fool's race with time and heat.

These long stops gave me plenty of time to see the quiet, scattered villages—mainly along the seacoast, beneath volcanic ranges. Samoans still live much as they have always lived, in easy harmony with soil and sea (right).

Necessities of Life Come Easy

These islands have no housing shortage. Any able-bodied man can build and thatch a fale. Clothing? A lava-lava—a couple of yards of bright material—suffices, except for a spotless white suit or frock for church on Sundays. Food is seldom a problem. Villagers cultivate taro, yam, breadfruit, and papaya; poultry, pork, and fish supplement their diet.

It's no wonder Samoans can surrender to an amiably timeless life.

"You're very quiet," Albert said suddenly. "What are you thinking?"

"Just how easy it would be to get off this bus," I said. "And take a fale for myself, by the sea."

"I thought you weren't here to find paradise," Albert chided, smilingly. "You're getting the papalagi disease!"

I was shaken out of my dream. For reassurance I looked for signs of modern Samoa—and found schools and hospitals built by villagers themselves, eager for good health and education for their children.

A vigorous health service, I learned, has encouragingly reduced disease and infant mortality.

I also saw, everywhere, quiet industry: Old women weaving baskets and mats from palm leaf, preparing tapa cloth from the bark of

Laundry and Bathers Wash Together Beneath the Palms of Faleasi'u

Wall-less with thatched roofs, Samoan houses hide no secrets. Occupants work and sleep in full view of their neighbors, although they lower palm-frond blinds against foul weather. Builders use few nails; they lash the frames with coconut fiber. Despite their flimsy appearance, fales withstand gale winds. Many have electric lights and radios. This seaside villa fronts Upolu's north shore.







40 REYNOLDS (ABOVE) AND BODENHORN © N. S. S.

the paper mulberry tree. Young women roasting cacao beans and spreading them to dry. Men cultivating their plantations from the cool of dawn till the thick heat of noon.

Afternoon is the time for siesta, and perhaps a game of cricket. Samoans play an old-style version, learned from early British voyagers (page 575).

We left the seaside villages behind, traveling inland past the beautiful Falefa Falls, where small children dive from a dizzying height into turbulent water, and up over the Mafa Pass. Banana plantations gave way to the bearded trees of rain forest. If our driver came upon people walking the roadside, he gave them free rides. They repaid him with village gossip.

Bus Driver Turns Host

At the end of the journey, where the bus emptied before turning for Apia again, Albert and I wandered toward the sea. The bus driver, with a smile, called us back. "I have some relatives here, and you must join us in a meal," he insisted.

We sat cross-legged, Samoan style, on the matting floor of a fale and ate a simple lunch of fish and breadfruit. The driver asked what I was doing in Samoa. I explained I was writing about his country.



Legislators in Lava-lavas Gather to Guide a New Nation

Speech from the Throne by Malietoa Tanumafili opens the first session of Parliament. He speaks first in Samoan, then in English. Attentive lawmakers wear skirts of bark cloth. Malietoa and Tupua Tamasese, chiefs of two noble families, will serve for life as heads of state. Parliament eventually will elect a single successor for a five-year term.

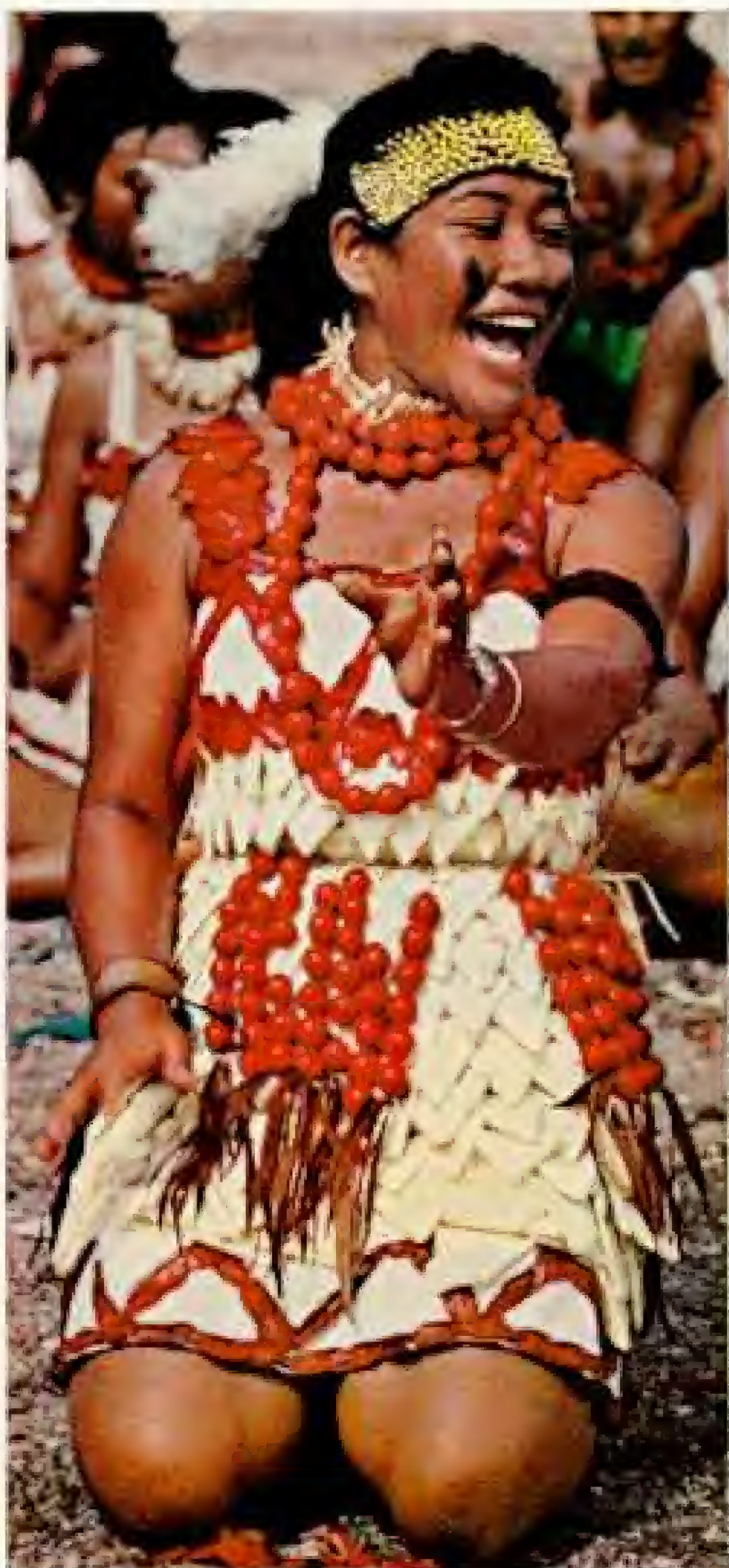
Bewigged and bemedaled, Chief Justice C. C. Marsack watches the ceremony after swearing in the new heads of state. A New Zealander, he retired soon after Western Samoa became independent.

Gaily garbed celebrators fill the green at Mulina'u, near Apia, center of much of Samoa's history. Peaked roof at center identifies the Falefono, home of Parliament.

For a time the new nation will look to New Zealand, its former administrator, for help in its foreign affairs. But Western Samoa joins the world community as a fully independent state.







ROBERTO WELLS © NATIONAL GEOGRAPHIC SOCIETY

Kneeling dancer, her hands and face expressing joy, competes in a contest during the independence celebration at Mulimū.

Young or old, Samoans love to dance. Unlike the Hawaiian hula, with its use of expressive hands and undulating hips, the Samoan *rēu* is marked by leaping steps and rhythmic clapping.

Puckish smile lights the face of a young performer jumping and strutting in an exuberant solo. His seed necklace rattles as he dances.

When we climbed back aboard the bus, I noticed that the passengers grew strangely silent. Only the driver spoke.

"What's he saying?" I asked Albert. "Why is everyone so quiet?"

"He's warning them that you are a *tusitala*—a writer of tales—and that if they don't behave, they will find themselves in one of your stories." Albert paused. "You see, in Samoa everyone has tremendous respect for a *tusitala*."

At the end of the journey, when I tried to pay, the driver shook his head. There was no charge for the *tusitala* and his friend.

Tusitala Lies at Peace in Samoa

Perhaps I owed my free ride to *the* papalagi *Tusitala*—Robert Louis Stevenson—who came to Samoa in 1889 for his health, and lived there with his American wife until his death in 1894. His home at Vailima, later the residence of New Zealand High Commissioners, reverted to the Samoan Government and may become the Samoan White House.

This frail writer of stories from Scotland endeared himself to the Samoan people. His short life in Samoa, like that of the French artist Gauguin in Tahiti, quickly became part of the legend of the South Seas. When Stevenson died, grief-stricken Samoans bore his body up the steep flanks of Mount Vaea. On his tomb at the summit (page 586), they carved his "Requiem," ending with the words:

HERE HE LIES WHERE HE LONGED TO BE
HOME IS THE SAILOR, HOME FROM THE SEA
AND THE HUNTER HOME FROM THE HILL

I climbed the muddy track in the cool of early morning. At the top I looked out on a scene that would have delighted Stevenson, who involved himself passionately in the cause of the Samoan people—the neat cultivations of Avelé Agricultural College, far below, where young Samoans train for life on the land. And I looked out to sea, where I would travel next day, toward the 5,000- and 6,000-foot peaks of Savai'i.

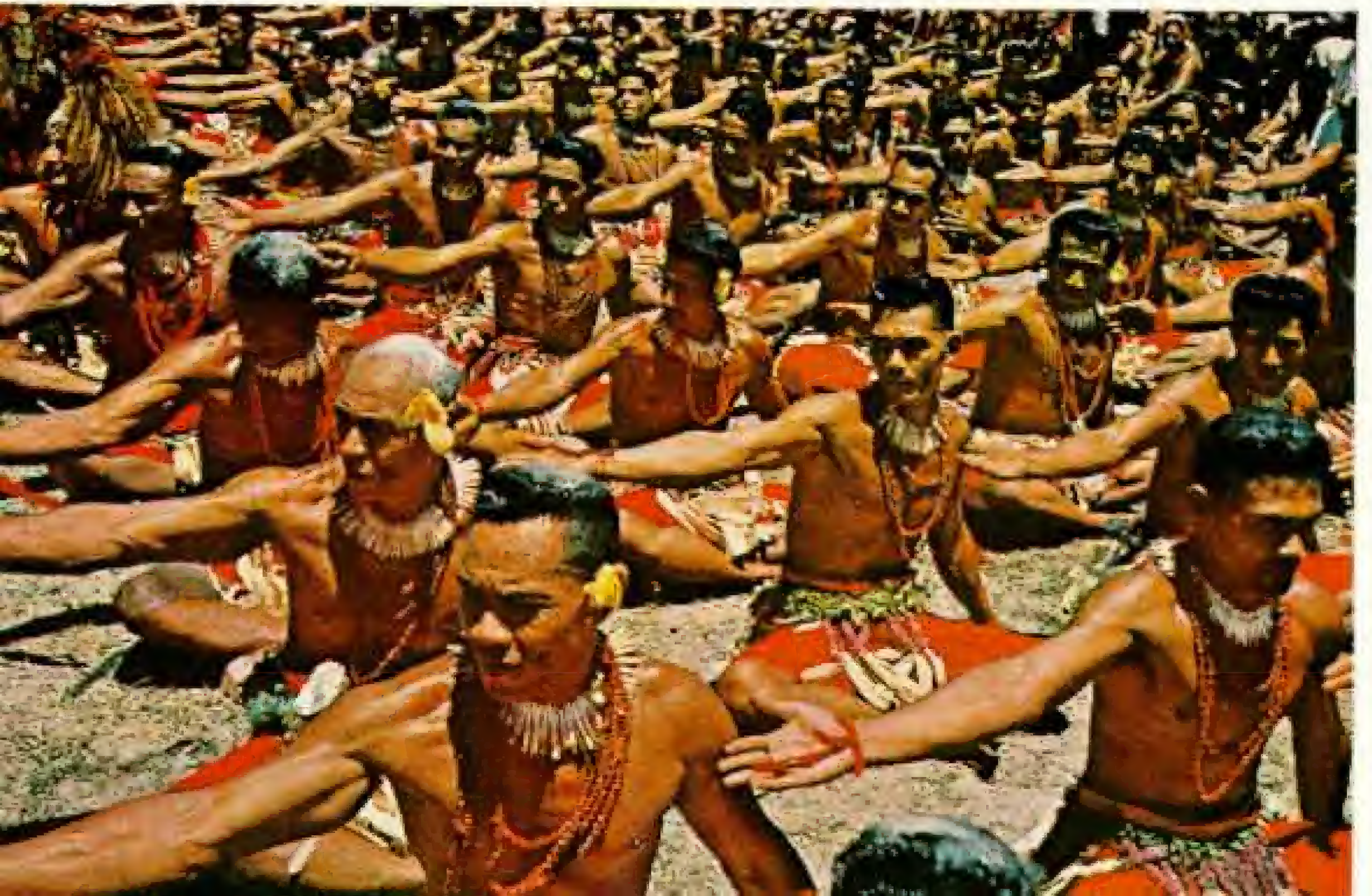
Savai'i, biggest island of Western Samoa, sprawls over about 700 square miles, but fewer than a third of the nation's people live here. Vast banana plantations employ many of them.

Past the twin tiny islands of Manono and Apolima—each with only a handful of inhabitants—a rolling launch carried me to Savai'i (map, page 583). A Land-Rover jolted me over its rugged roads to Sapapali'i, where a monument marks the spot on which



Marchers at Mulinu'a face the future with confidence. Young men and women of an

Seated dancers of a village troupe extend their arms with the precision of massed gymnasts.





NATIONAL GEOGRAPHIC PHOTOGRAPHY BY ROBERT E. ROYCE © 1981

Island school wear identical kilts uniforms.



Boy Scout trumpeter, resplendent in merit badges, waits to play. A troop leader, he belongs to the senior group in British Boy Scouting.



Clowning for the crowd, a hatchet-brandishing celebrator flashes a two-toothed grimace.



Beads and mirrors glitter in the ceremonial headdress of a matai, or chief. Candlesnut soot streaks his cheeks and upper lip.

John Williams stepped ashore with his missionary message of peace on earth, good will to men. In the distance he saw the smoke of villages blazing after bitter warfare.

Seaside villages, dreamy in noon sunlight, gave way to gloomy inland forest, thick and tall. We hurtled downhill and ran across great, black lava fields. Thrown up during eruptions between 1905 and 1911, this lava buried much rich land in its hissing plunge out to sea.

The fields looked bleak, forbidding. We stepped cautiously over the dark, brittle lava. Here and there lonely wild flowers sprang out of cracks. My companions, leading the way, promised me an unusual sight.

Lava Flow Spares Sainly Grave

Then we stopped and gazed downward. What I saw, down there in a gap in the lava, was a grave—untouched. The lava had swirled around it and frozen.

"It's the grave of a *tanpos*—the virgin daughter of a village chief," one of my friends explained.

"It's said she was a true saint, and even in death heaven protected her. You see—the lava also spared the village church where she worshiped!"

I looked up at the distant cone of Matavau, draped lightly with mist. "It still rumbles, at times," said our driver. "Perhaps, one day. . . ."

It was near dusk when we arrived at the village of Asau, like a little Pacific Venice with its fales perched on rock about a labyrinthine lagoon. We stopped at the agricultural station, where we were to spend the night.

An elderly gray-haired man with wiry physique and erect bearing emerged from the station to greet us. I didn't need to be told he was a chief.

Tonga Gives Neighboring Samoa a 600-foot-long Birthday Present

Singing and dancing. Tongans step forward with a gift of tapa cloth at the independence ceremonies. Handmade from inner bark of paper mulberry saplings, the offering would extend the length of two football fields.

Crown Prince Tungi of Tonga, eldest son of Queen Salote, watches the presentation with a parasol between his knees.

Eager spectator (top) mounts the seat of his motor scooter to obtain a better view.





His name was Taulu, and he was in charge of shipping copra, bananas, and cacao from his part of Savai'i. His waist, I noticed, bore the traditional Samoan tattoo. This way of marking the arrival of manhood fell from use for many years. But the custom revived, surprisingly, with the approach of independence. I saw many young men limping after painful knee-to-waist tattooing (page 587).

Sunset flamed, and sea and lagoon took vivid, flashing colors from the sky. Dusk fell quickly as we dived into the calm, lukewarm water and returned, dripping, to the house.

Before dinner I took a stroll outside. Moonlight and shadow, silence and stillness took

a grip on me. I supposed it was such warm, tropical nights as this that bred Samoa's eerie ghost stories—tales of beautiful dead women, cold to the touch, who wander forever in grief and discontent. Even sophisticated Samoans will not always laugh off these stories. And after a while, walking the night, I was in no mood to laugh them off either.

Pisupo Came to Samoa in Cans

We feasted upon succulent Samoan pigeon. "And try some *pisupo*," Taulu said, pushing a plate toward me. "A very special Samoan delicacy."

"Pisupo?" I said. "You mean pea soup?"



"That looks like corned beef to me." I tasted it. "It *is* corned beef!"

Taua'a chuckled. "The first canned food to come here was pea soup. The next was canned corned beef. Samoans took a great liking to it. But out of habit the name pisupo stuck. Nowadays no Samoan meal is complete without its pisupo."

As we ate, womenfolk and junior members of Taua'a's aiga sang softly to a guitar in an adjoining room. Taua'a talked of his work.

"I visit all the villagers in my district," he explained. "I advise them on what they should grow, and inspect their crops to see that they are in good condition."

Centipede-like Longboat Backs Water in Apia Harbor

Evolved from whale boats, *fa'atasi* skim across water to the heaves of 40 or more oarsmen. Some 15,000 persons lined the waterfront during the independence observance to watch the boats race. Starting from Five-mile Reef, they surged toward shore. Here the winning boat, having crossed the finish line at left, backs away.

Rusty wreckage at upper right, all that remains of the German steam sloop *Adler*, attests the violence of the hurricane of 1889. The blow sank six warships; only one steamed to safety in the open sea. Thereafter international tension over Samoa eased.

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"Is your advice always accepted?" I asked.

"Always," he said. "Or almost always. Too bad if it's not." He fixed me with a tough stare. "We in Samoa must keep up good standards for our produce. Otherwise, how can we win respect in the world?"

Next morning, after breakfast, Tautua made me a formal speech of farewell. "We are proud of our nation," he said. "Proud of our independence. All the sons of our country have worked hard and studied well for it. May you take back the news of our pride to all the people in the world."

I assured him I would.

"Then God bless you and your family, sir," he concluded, and shook my hand and kissed my cheek, papalagi style.

Tautua typifies Samoans who are determined to borrow only the best from the modern world, and to retain the best of what their islands offer. Another such man is Moananu Iuane Okesene (page 587). Okesene is the Samoan word for oxygen, and he has, in truth, been the breath of life for many of his people. I met him on the green grounds of Apia's 300-bed hospital.

As skillful healers, Samoan medical practitioners have won themselves an extraordinary reputation throughout the South Pacific. Okesene, at 55, is perhaps the most famous of them. With only a little formal education in missionary schools, he worked in Apia Hospital as a youth. At 21 he was sent off to a medical school in Fiji for three years.



Flaming lure baits a fish trap near Upolu's offshore reef. Poised spearman stabs fish that swim within reach. Most villages choose a head fisherman to direct the work and divide the catch.



Pulling together, Samoans stroke a many-oared fautasi through a practice run off Upolu. Drummer in the bow beats out the rowing tempo on a tin can.

Samoans descend from an unexcelled line of primitive navigators. Their Polynesian ancestors crossed and recrossed the trackless South Pacific, settling the islands in a vast triangle bounded by Hawaii in the north, New Zealand in the south, and Easter Island in the east.

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Though not a fully qualified doctor by European standards, he returned to Samoa and cared for the ill of outback villages, where emergencies often called for complex surgery. In these lonely circumstances, Okesene developed his skill; he learned to perform Caesareans with ease, as well as delicate eye operations.

But the greatest call on Okesene's ingenuity came during the war.

"We ran out of surgical catgut," he recalled. "For a long while I had wondered what I might do when that happened. Then an emergency call came in—a man with a bad knife wound, in danger of bleeding to death.

"I sent a boy up a tree to fetch down a coconut. I bathed the wound with coconut milk and stitched it up with coconut fiber. It healed beautifully, with no trace of infection.

"Later I had a laboratory test made that proved the inside of a coconut is sterile. As a result, coconut fiber was used in emergencies on many Pacific islands during the war. I still use it in preference to catgut."

Traditional Howl Opens Parliament

A Salelesi villager dressed in tapa, with a garland of pandanus berries about his neck, uttered the weird and piercing howl with which his clan, by long tradition, marks important feasts or ceremonies. Then I watched the legislators of Western Samoa settle down to draft laws for the new nation in the Falefono, or meeting house (page 590).

The Parliament consists of 45 members elected by the 5,000 matais of Western Samoa, plus two members elected by those not in aigas, or family groups. Samoa's royal fam-

ilies still head the nation. The elected prime minister bears the royal name of Fiaame Mata'afa, and the titular, or duly decreed, heads of state are Malietoa Tanumafili and Tupua Tamasese.

I spent an evening with Tupua Tamasese, eldest and most distinguished of these three royal leaders, who led the Samoan self-government movement. It was the night before Samoa's official independence day, something Tamasese had worked toward for more than thirty years.

I asked him how he felt now that his ambition for a free, self-governing Samoa was at last realized.

"I've no worries," he replied. "Our strength as a nation comes from our traditions. The matai unites the family to the village, and the village is united to the nation. I'll give you an example. Have you ever seen a policeman in a Samoan village?"

"No," I confessed. "I haven't."

"That's because the matais in each village make sure the people behave. Policemen aren't needed." He paused. "Nor do we need a state social security system. The family—the aiga—looks after its own elderly and sick. This is the traditional Samoan way.

"Of course, we have our differences," he continued. "Some young Samoans would like to imitate the Western World wholeheartedly. Some old ones would like to return to pure Polynesia. I ask these old ones, 'Would you like to be without health services, education, and the material goods we've got from the modern world?' That makes them hesitate. They're too fond of the cans of corned beef we get from New Zealand!

One People, One Language

"We are fortunate to be one nation," he added—"one people, speaking one language. We are determined to preserve our culture and all the things that we hold to be of value. We welcome visitors, but we don't plan to build luxury hotels and encourage large-scale tourism. We don't wish to become like other Pacific countries that have been stripped of their true culture and tradition."

He smiled, and summed up: "So we're steering, really, a middle course in the modern world."

I was sorry to part with Tamasese. I still remember his strong, confident handshake. It was the grip of a good helmsman.

Then the time arrived—the events I had

come here to witness. I heard speeches of hope and confidence, the bold blare of brass bands. Choirs thundered out national songs with pride; Samoans may be the Irishmen of the Pacific, but they sing with the electrifying fervor of Welshmen. Church bells rang out, thousands of Samoans knelt in prayer, rockets exploded gaily in the sky. I saw the tiny new state of Western Samoa launch itself, in jubilation, upon the world.

Under their newly hoisted flag—red and blue, bearing the stars of the Southern Cross—thousands of spirited Samoans leaped and swayed in traditional dances to the beat of drums. Longboats raced in over the reef and horses thudded to victory on the Apia race-track (pages 598 and 574). For five days I was caught up in the islands' swirl of celebration.

Samoans Still Polynesians at Heart

Modern Samoa is working hard to make itself an ornament to the world community. But scratch the skin of the modern Samoan, no matter how serious and industrious he may seem, and underneath you will still find the laughing, happy Polynesian who has been the envy of more-staid Europeans for nearly three centuries.

After church on a warm, bright Sunday, I joined a picnic party of young Samoans. On an old truck that labored under the weight of food, drink, and a fantastic tangle of young bodies, we headed out from Apia to Lefaga Bay, on the southern side of Upolu. The youngsters sang, laughed, danced all the way on the back of the crowded truck. They were enjoying themselves as only Samoans can enjoy themselves. The journey seemed very short.

We came to a beach of luminous beauty. Between dramatic heaps of black volcanic rock lay a crescent of white coral sand, beneath tall and graceful palms. Without hesitation the young people dashed themselves into the sunlit sea.

No, it was no use. It was time to give up. Time to accept my defeat gracefully.

Lying lazily on the sand, in the shade of palms, I joined the long line of papalagis who have surrendered to the old enchantment of these islands. Samoa had given me all I wanted and more—the facts and figures, a knowledge of the warm, life-loving people who make up the Pacific's newest nation.

Yes, all I wanted and more. For I too had found a paradise. THE END



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"Snail fever"—another name for schistosomiasis, or bilharziasis—is now one of the world's most important medical problems.

This dread disease is caused by parasites from three specific types of snails. These parasites penetrate the skin of humans and animals and enter the blood stream. Here they produce many tiny eggs, which progressively damage vital organs.

An estimated 100 million people, most of them living in tropical climates, are now stricken by this debilitating disease. It invades new countries and afflicts more people every year.

For over 10 years, Parke-Davis scientists have been working intensively on methods to control "snail

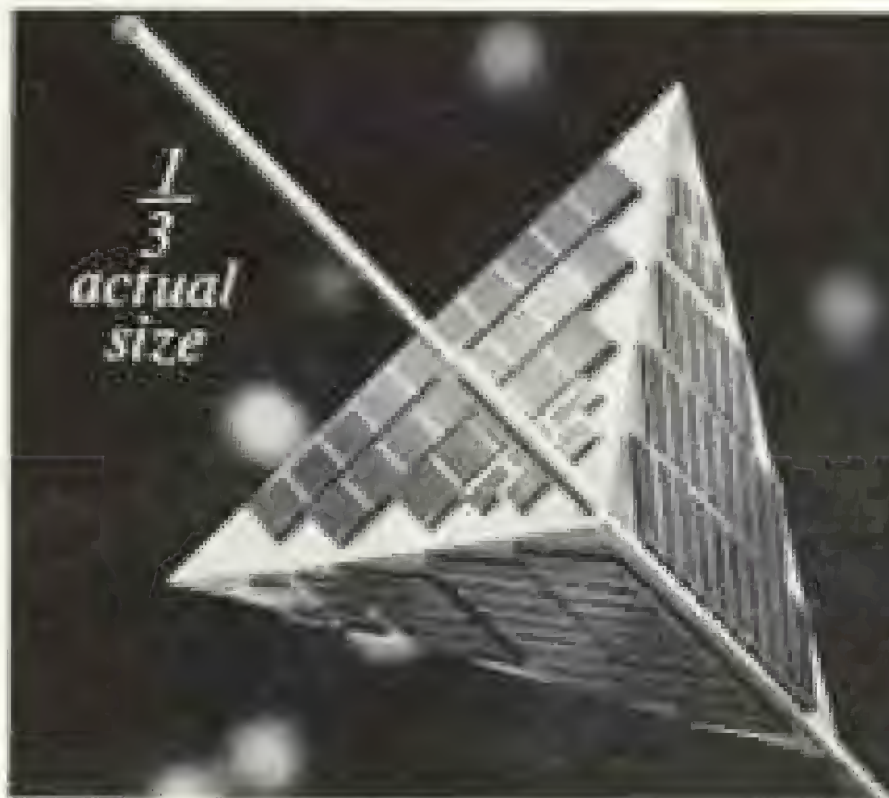
fever." One answer may be a new drug to prevent infection or kill the parasites after they enter the body.

Research on "snail fever" is but one of several problems of world-wide importance now being investigated at Parke-Davis. Along with research against heart disease, cancer and other diseases, it represents the sincere and active concern at Parke-Davis for the betterment of the health of people in all parts of the world.

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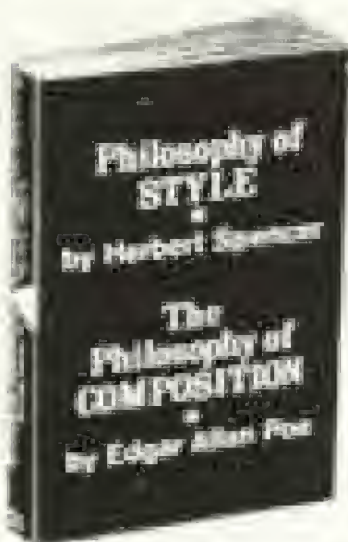


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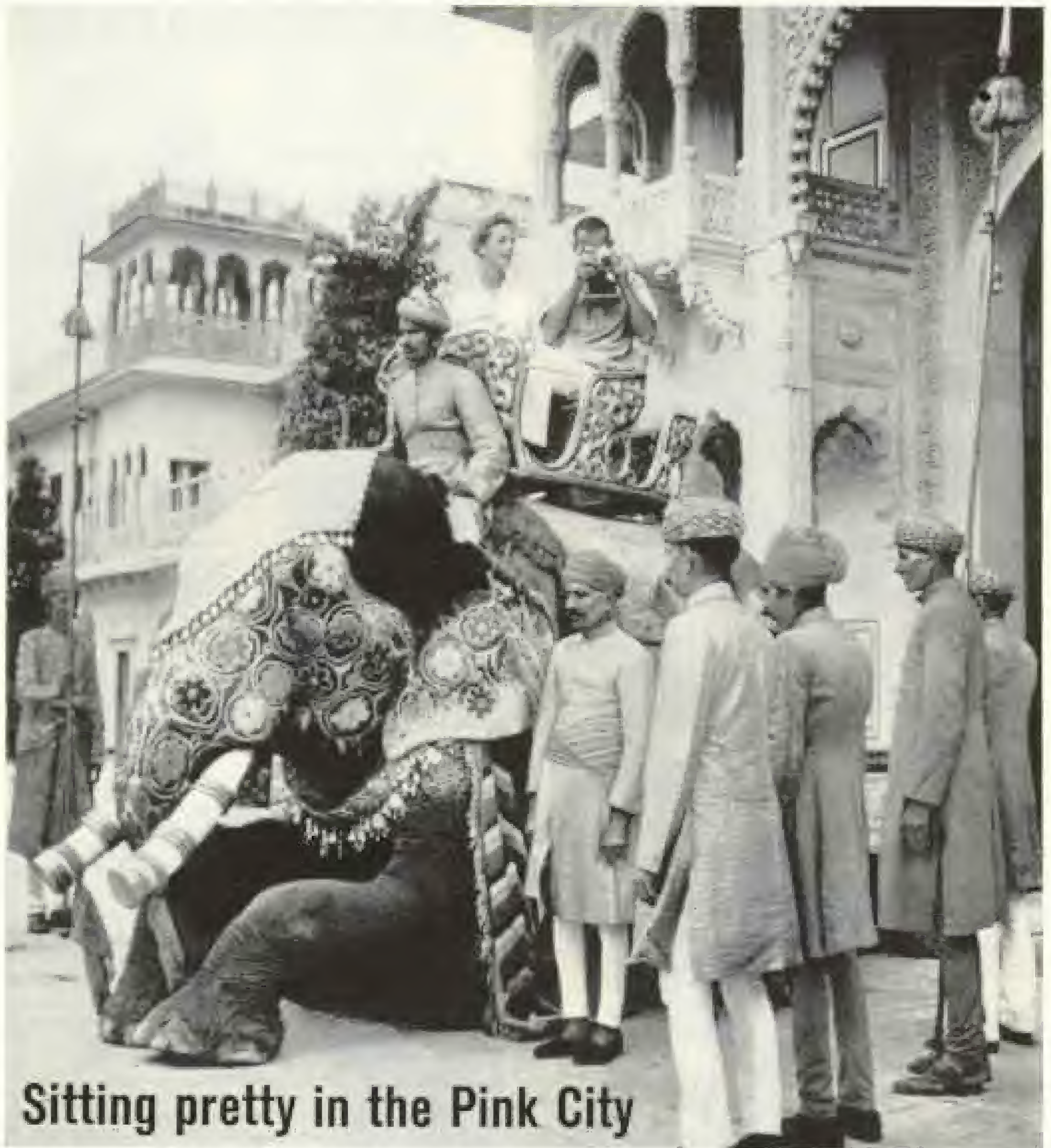


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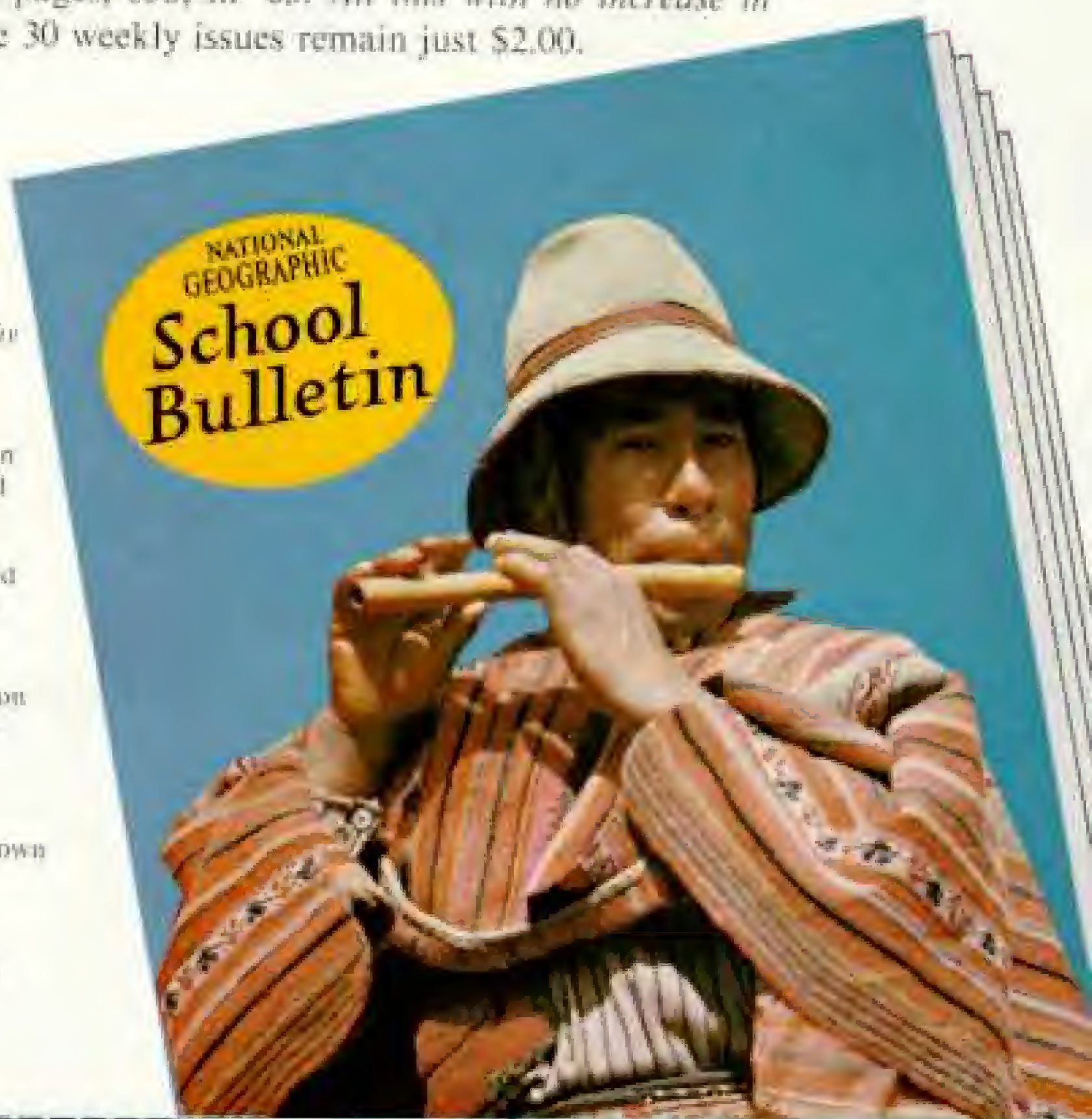
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