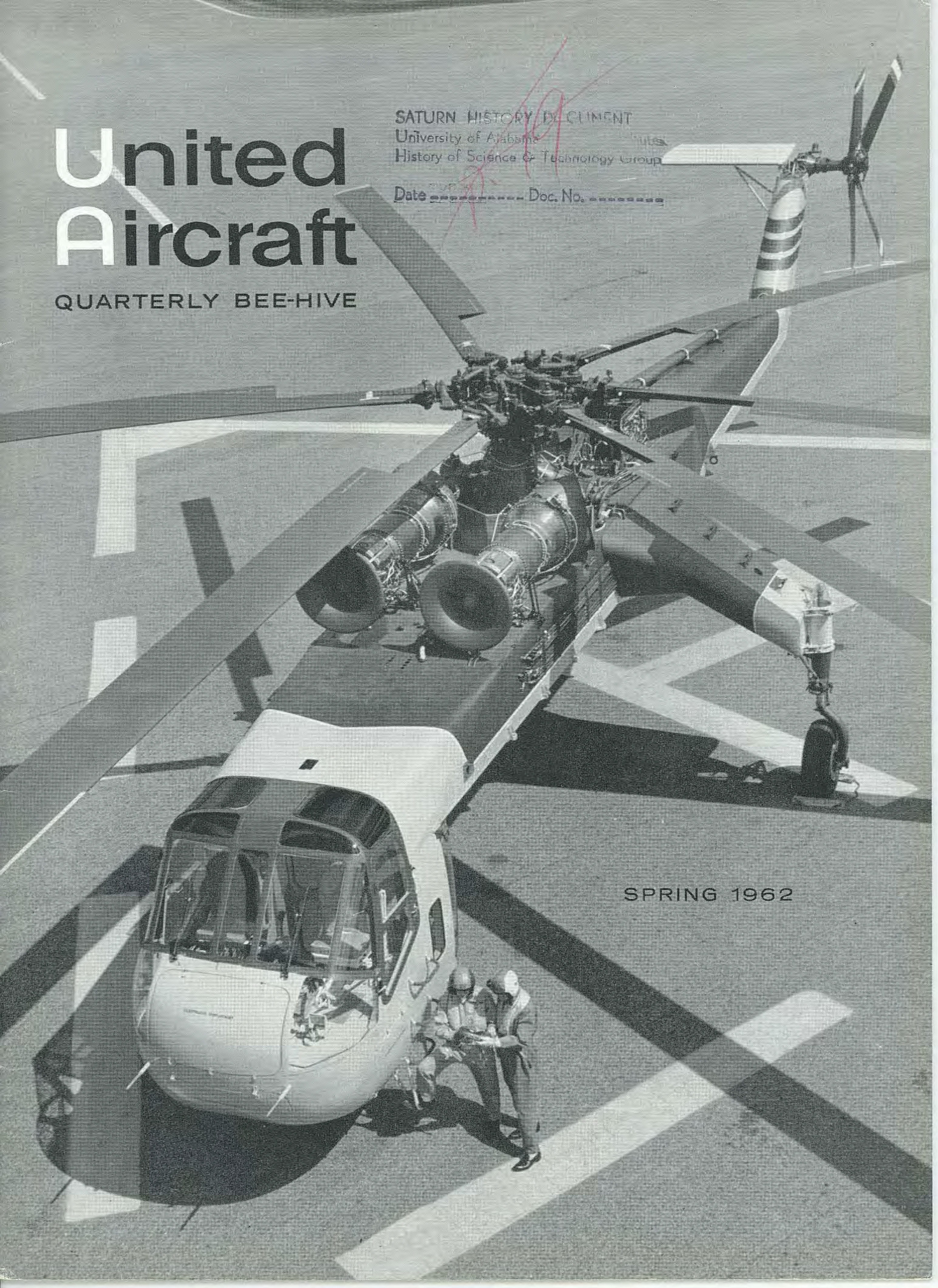
United Aircraft

QUARTERLY BEE-HIVE



SPRING 1962

$urprise from Sweden

EARLY in the fall of 1945, a few weeks after the close of World War II, a letter arrived at United Aircraft's head office. A Royal Swedish Air Force delegation headed by General Bengt Nordenskiold, the letter said, was in Washington on official business and was anxious to come to East Hartford to talk to officials of the corporation and view its operations. General Nordenskiold, the letter added, also wanted to discuss the matter of engine royalties due United Aircraft.

"What royalties?" company officials asked. "Pratt & Whitney Aircraft doesn't have any licensing agreement with Sweden, does it?"

No, it didn't. But the Swedes, during their subsequent visit to Connecticut, insisted they owed the corporation $193,500 for Pratt & Whitney Aircraft R-1830 Twin Wasp engines that they had built during the war. The Swedes, to be sure, had no licensing agreement with the company to pay royalties on the engines. But they felt the money was due anyway — and they paid it.

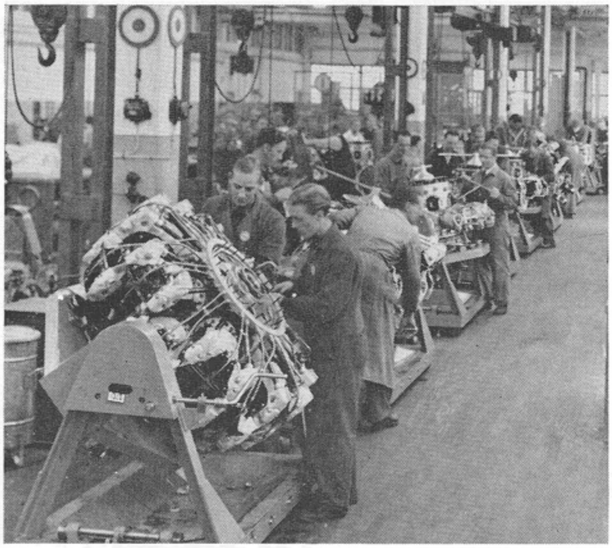
Even by New England's rigid business ethics, this was a rare exercise of commercial conscience. The Swedes not only had lacked a specific agreement calling for the payment of royalties, but they had built the engine without any blueprints or production data from Pratt & Whitney Aircraft. Instead, in an uncommon display of engineering virtuosity, they had painstakingly copied the parts of an actual engine.

As early as 1936, the Swedish Air Force had expressed interest in negotiating an agreement with United Aircraft for production of the Twin Wasp in Sweden. Discussions were accelerated during the months before the war. Just as an agreement was about to be concluded, with the war clouds hovering closer, the United States War and Navy Departments advised United Aircraft not to grant the license. The matter was dropped there as far as the company was concerned.

The Swedes, meanwhile, were well along in the development of three combat aircraft types designed around the R-1830 powerplant and envisioned as the heart of their nation's air defenses. These planes — the B-17 single-engined attack bomber, the J-22 fighter, and the B-18 twin-engined bomber — also were to be equipped with Hamilton Standard Hydromatic propellers, for which a license had been negotiated with United Aircraft before the government imposed restrictions on foreign manufacturing rights.

"Even with the licensing negotiations stopped by the war, our whole Air Force depended on our getting the engines," General Nordenskiold said recently. "We had to have them for our aircraft." General Nordenskiold was chief of the Swedish Air Force at the time.

So the Swedes obtained an early model of the R-1830 built by Pratt & Whitney Aircraft and gave the task of copying and producing it to Svenska Flygmotor Aktiebolaget, the aero-engine manufacturer in Trolhattan. Gustaf Gudmundson, now vice-president and engineering manager of Flygmotor, had had considerable experience with the R-1830 engines operated by ABA, the predecessor air carrier to Scandinavian Airlines System. When the decision was made to go ahead with building the engine, Gudmundson was assigned to Flygmotor to head the engineering staff.



Svenska Flygmotor produced P&WA engine without blueprints.

Today, two decades later, Gudmundson clearly recalls the difficulties his company faced when, in the absence of essential engineering and manufacturing data, it undertook to copy the parts from the engine itself. "The main bearings and the cylinder heads were the biggest problems," he says. "We particularly had trouble trying to determine the amount and location of porosity which could be accepted in a cylinder head casting."

Designating their version the STW C3 (for Swedish Twin Wasp C3), the Swedes had their first engine ready for testing in mid-1942 and began making deliveries the following year. The powerplant weighed 1,505 pounds and developed 1,065 horsepower at 2,700 revolutions a minute. Later the engine's performance was advanced, through refinements, to 1,200 horsepower at takeoff, equivalent to the output of the Twin Wasps which Pratt & Whitney Aircraft was manufacturing in the States around the same time.

All told, Flygmotor produced 430 Twin Wasps. Once it surmounted the initial problems of duplicating the original components, it went on to build high reliability and performance into the R-1830. The engine proved to be almost as dependable as the Swedes who built it — and who then came here after the war to discharge a debt they felt they were morally, if not legally, obligated to pay.

— James R. Patterson

United Aircraft

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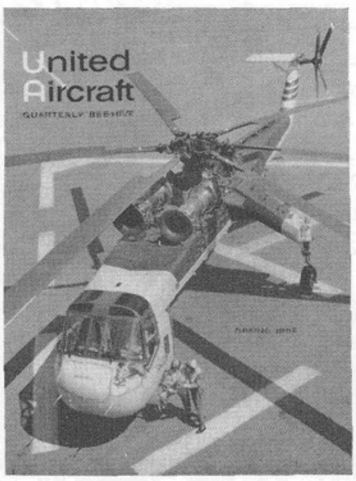

THE COVER — The Sikorsky S-64 Skycrane, scheduled to make its first flight this spring, will have a maximum payload of about nine tons. The turbine-powered helicopter will be capable of a wide variety of military and commercial missions, including cargo and missile transport, timber hauling, power line construction, and (fitted with pods) troop or passenger transport. The S-64 is powered by two Pratt & Whitney Aircraft JFTD-12 engines with a normal rating of 3,200 shaft horsepower each. Two S-64s are being built for the West German government, while a third will be used by Sikorsky for demonstrations in the United States.

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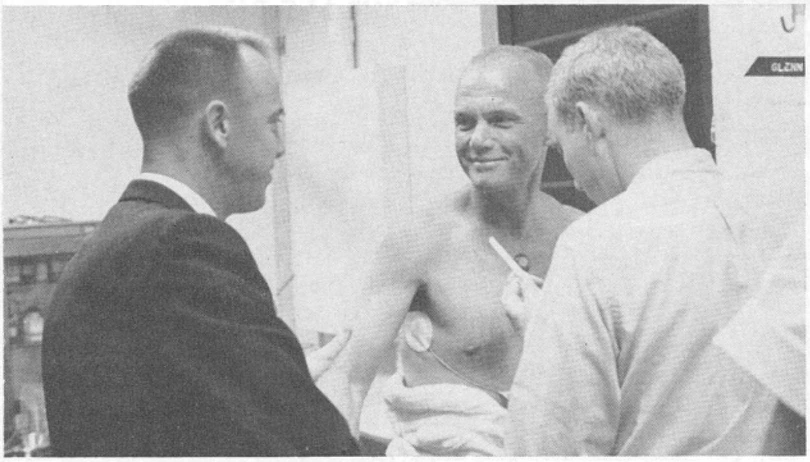
THE ASTRONAUT TEAM'S *Physician*



Astronaut Alan Shepard shakes hands with Glenn during pre-launch physical as Dr. Douglas affixes medical sensors.

By Robert Zaiman

AT one o'clock on the morning of February 20, the telephone rang in a darkened office at Cape Canaveral. Its summons brought a slim, gray-haired man leaping from his improvised bed — an ambulance litter on the floor beside the desk. He flicked on the lights, glanced at his wrist watch, and picked up the receiver.

"Douglas here," he said softly.

"There's a long distance call from Hawaii," the base telephone operator said excitedly. "A radio announcer wants to talk to John Glenn. What should I tell him?"

The man sighed. "Tell him Glenn's sleeping and can't be disturbed." He replaced the receiver, turned off the lights, and sank back onto the litter.

Thus began the most eventful day in the life of Dr. William K. Douglas, the 39-year-old physician for the seven astronauts of Project Mercury. There was still an hour to go before he was scheduled to rouse John H. Glenn, Jr., and prepare him for his historic three-orbital flight. But the telephone kept ringing with reports on the weather and progress of the countdown. Further sleep was impossible.

So, at 2 a.m., Dr. Douglas got up, washed, shaved, and donned a set of white coveralls. Then he walked into a dark room two doors from his office where John Glenn lay soundly asleep.

The Procedure Was Almost Routine. There was no question in his mind on the morning's procedure. He had performed his vital medical role in dozens of simulated missions since becoming a part of Project Mercury in 1959; he had gone through the entire procedure with Alan B. Shepard, Jr., on the first U. S. space flight and again with Virgil I. Grissom on the second flight; and he had worked with John Glenn through the many postponements that preceded this orbital attempt. The operation was almost routine to him.

He walked to the bed and gently shook Glenn's shoulder. "It's time to get up, John," he said.

Glenn sat up and smiled a greeting. "How's it look?" he asked.

"It looks like a good day," the doctor replied. He briefed the astronaut on the weather reports and the status of the countdown, waited while Glenn washed and shaved, and then accompanied him to breakfast.

As they sat down to their steak and eggs, Miss Beatrice Finkelstein, dietician for the astronauts, placed a tiny tree with a toy bluebird sitting on one of the branches beside Glenn's plate.

"I tried to find a yellow bird," the dietician said, "because I know 'Yellow Bird' is one of your favorite songs, but there just wasn't one anywhere."

Glenn thanked her and then began to discuss old times with Dr. Douglas. The doctor stared intently at Glenn's face as they talked. "You can tell a lot by looking at a person's face," he explained later. "You can tell if anything is ailing him or if he's extremely nervous. It's an important thing."

Satisfied that the astronaut was outwardly fit, Dr. Douglas escorted him to a nearby examination room for the second phase of his physical examination. The first — designed to collect baseline physical data — had been completed two days before. Now all that was necessary was to ascertain that he was still in perfect health.

For 30 minutes, the doctor worked on Glenn, checking his heart, blood pressure, lungs, temperature, and pulse. He was looking for anything in the way of a symptom. A sore throat or an earache could postpone the flight. So could an upset stomach. One of the previous astronauts had come up with a case of the sniffles on the morning of a subsequently postponed flight, but it wasn't serious enough to call off the operation. When he finally flew, the sniffles were gone.

Sensors Affixed To Astronaut's Body. Glenn checked out perfectly, and Dr. Douglas next began to apply to the astronaut's body the sensors which would keep the control group on the ground supplied with physical data throughout the flight. It took the doctor 15 minutes to perform this task, and then he plugged the sensor wires into a test apparatus to make sure they were functioning. Finally he told Glenn to put on his underwear and pressure suit. The sensors were checked again after Glenn was fully dressed, and then he and Dr. Douglas walked out to the transfer van that would take them to the launch site.

Along the way, they joked with each other. "The astronauts are so familiar with the operation," Dr. Douglas said later, "that there is no gloom or deadly serious talk. It was the same with Shepard and Grissom. We just engaged in small talk."

The conversation ceased once they entered the transfer van. Dr. Douglas immediately hooked up the many wires from Glenn's pressure suit to a recording strip chart which monitored his temperature, respiration, and blood pressure as they rode toward the launch pad. Simultaneously, a final weather briefing was given the astronaut by a meteorologist.

Dr. Douglas, right, the astronauts' personal physician, checks John Glenn's pressure suit prior to orbital flight.

As Dr. Douglas and Glenn entered the elevator that would take them up to the space craft itself, Glenn smiled broadly. "Boy," he exclaimed, "we're going to do it today."

Dr. Douglas stood to one side while Glenn was boosted into the space craft and while Joe Schmitt, the pressure suit technician, attached the various hoses, sensors, and communication lines. Next, other technicians purged the suit and the environmental control system with 100 per cent oxygen to remove all of the ambient air trapped in them. A sample of the air within the suit was taken and analyzed on the spot. It was now time to affix the hatch to the craft.

First, however, Dr. Douglas stuck his head inside the cabin and took one long, last look at Glenn's face. The astronaut appeared calm and ready. The doctor smiled a farewell, made sure the visor seal was closed on the pressure suit, and stood by while the hatch was fastened. The cabin was purged with oxygen and the doctor departed.

A car was waiting on the ground to take him to the special one-bed emergency hospital set up two miles from the pad. Four helicopters and a number of amphibious vehicles were parked there, fully manned, prepared to move at an instant's notice in the event of a mishap in the early stages of the launch.

Thirty minutes before Glenn was

scheduled to take off, Dr. Douglas climbed into one of the Sikorsky helicopters, settled back in the cabin, and waited for the launch to take place. He was still there when Glenn was shot into space.

When the astronaut attained orbit, Dr. Douglas moved to the Mercury control center where he monitored instrument reports from the space craft and listened to Glenn's radioed comments, all the while wishing he could be up there with him.

"By the time they get ready to take doctors aloft on space flights, I'll be too old," he remarked.

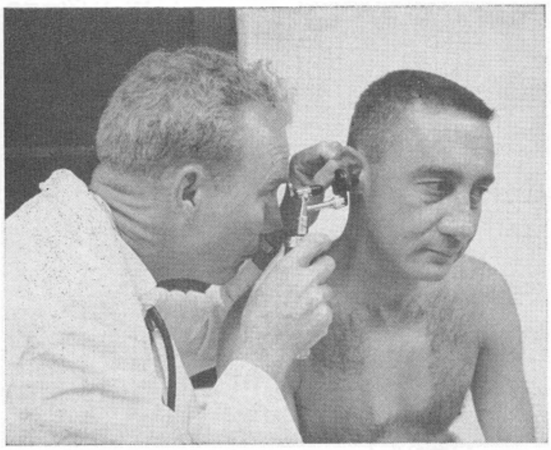
The Doctor Moved To Grand Turk Island. Once the word was flashed that Glenn had been picked up by a destroyer, Dr. Douglas was on the move again. This time he boarded an airplane for Grand Turk Island in the Bahamas. He was waiting at the hospital there when the astronaut arrived. They exchanged warm greetings, joked about the flight, and then the doctor conducted another thorough physical examination.

Dr. Douglas possesses the same trim physique and alert bearing that characterizes the seven astronauts. He has elected to remain in the background throughout the Project Mercury program, seeking to avoid almost completely the glare of publicity focused on his charges.

"I'm only one of nearly 100 Department of Defense medical people supporting the program," he said. "Why, we've got specialists from every field except obstetrics working on the astronauts. I'm just the physician."

Quiet and soft-spoken, Dr. Douglas is quick to smile at funny stories. But, like most people, he has difficulty in remembering them later. He exchanged a number of jokes with Shepard, Grissom, and Glenn while preparing them for their flights; yet today he says he cannot recall a single one of them.

He is extremely friendly with visitors and newsmen but is also reluctant to discuss the details of his work. When a reporter asked him which of the first two astronauts had contracted a case of the sniffles on the morning of his flight, Dr. Douglas bowed his head, pondered a moment, and then said: "I'd prefer not to say. I don't think the man in question would want me to tell about it."



Virgil Grissom sits quietly as team physician performs thorough checkup.

The man who has played such an important part in all of the nation's space flights has specialized in aerospace medicine for the last six years.

"I've never had a day's medical practice in civilian life," Dr. Douglas said. "Never collected a fee. But I don't regret it, especially when I talk to my colleagues in civilian practice."

A lieutenant colonel in the Air Force, he is a native of Estancia, New Mexico, and got his pre-medical schooling at the University of New Mexico and Texas Western College. He obtained his medical degree in 1948 from the University of Texas Medical School at Galveston and then interned at Wayne County General Hospital at Eloise, Michigan. He joined the Air Force immediately after completing his internship.

After taking advanced courses at the Air Force School of Aviation Medicine, he served three years in Newfoundland as a flight surgeon. Later he received a master's degree in public health after study at Johns Hopkins School of Hygiene and Public Health. He also served as a resident physician in aviation medicine at the base hospital at Langley Field, Virginia, and in 1956 was certified in aviation medicine by the American Board of Preventive Medicine.

Dr. Douglas has nothing but the highest praise for Shepard, Grissom, Glenn, and the rest of the astronauts.

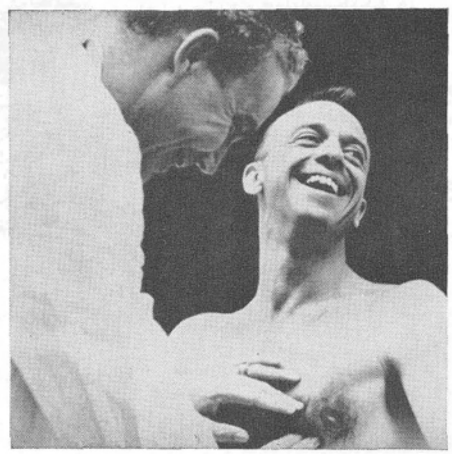
"You know, through all those disappointing delays, Glenn never broke up," Dr. Douglas said. "He never got mad at anybody and his reactions were normal and healthy. When he heard that one of the previous spacemen had contracted a slight case of the sniffles on the morning of the launch, he and Joe Schmitt saw to it that a handkerchief was in the pocket on the sleeve of his pressure suit just in case it happened to him. He didn't want anything to stop him from making the flight."

None of the astronauts has had any trouble sleeping on the night prior to a flight, the physician said. Mild sedatives are available for their use, but thus far there has been no call for them.

"I'm the one who has trouble sleeping," he laughed. "Just before the Grissom flight, I had a phone call from a radio station in Santiago, Chile. The announcer wanted to talk to Gus. I had to turn him down. It beats me why I get these calls but that phone is ringing for one reason or another from the time I lie down in my office at 10 p.m. until it's time to wake up the astronaut."

All three of the astronauts who have made space flights have been visibly awed by the sight of the launch vehicle when they walked out of the transfer van, he said.

Glenn has lunch with Dr. Douglas at Grand Turk Island following his flight.



Shepard laughs heartily at one of Dr. Douglas' jokes during examination.

"The sight of the booster at that moment seems to make them humble," he said, "even though they've seen it close up hundreds of times before."

Family Friendships Are Close. Dr. Douglas, his wife, and their 14-year-old son Michael have been living at Langley Field since he joined Project Mercury, but their permanent home is in El Paso, Texas. At Langley, they have been close to all the astronauts and their families during off-duty hours.

"We baby sit for each other, have dinner at each other's homes, and go out together a lot," he said. "We're all really very close friends."

Despite this close relationship and his obvious enjoyment of his work, Dr. Douglas will leave Project Mercury June 1 to return to the Air Force in the office of Assistant for Bioastronautics at Patrick Air Force Base, Florida.

"This move is nothing sudden," he said. "I've wanted to return to the Air Force for a long time. The military is my career and, frankly, I'm homesick. I got into Project Mercury because I'm vitally interested in space medicine and Project Mercury was a logical extension of space medicine. With this new assignment I can be back in a 'blue suit' and still work with manned space flight projects."

When he leaves, he will carry with him a small gold lapel button that has become his most priceless possession.

"About a month after Glenn's flight," Dr. Douglas said, "John walked into my office and handed me the button. He told me he had had it made up before his flight and had carried it with him during the three orbits and he wanted me to have it. I'm real proud of it."

Jet Jargon

One of the strange contrasts at Pratt & Whitney Aircraft is the nomenclature of parts — precisely labeled by those who design them and metaphorized by those who make them.

No engine designer in his right mind would specify such parts as banjos, bookends, waffle irons, waterwheels, handle bars, windsocks, and bathtubs, to make high performance devices like gas turbine engines.

But busy craftsmen, with neither time nor flair for specifics, have given fanciful names to formal parts and then turned to the serious business of making them. Because a case weldment-turbine nozzle, outer, looked like an elephant's foot, it became known as one.

"These terms have almost become a new medium of communication in the factory," a veteran supervisor said. "It has always amazed me to see the rapidity with which men, often talking by telephone from one end of the factory to the other, can comprehend problems and effect solutions by recognizing particular items, not as parts of thrust reversers, but as mustaches or snow shoes."

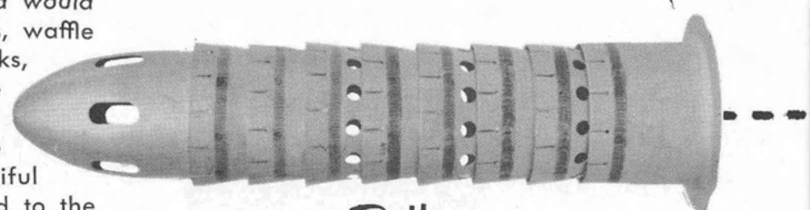
Without consulting blueprints or checking part numbers, few shop employees would recognize a J-75 main bearing oil tube support by that name. Call it a bazooka and any number of employees in various departments will quickly ask, "With or without the flower pot?" The latter is another piece which slips over one end of the part.

The shape of the part usually prompts its label. In P&WA's heavy press section, for instance, they make birdcages, beer barrels, space hats, and Ubangis — large semi-circular parts more properly known as fire seals, combustion chamber, lower, for J-75 gas turbine engines.

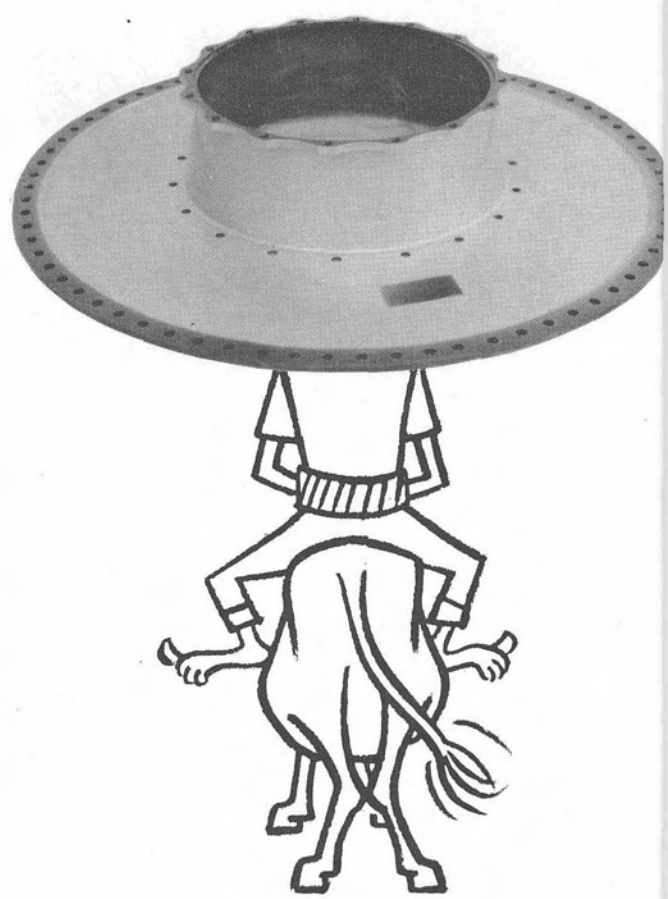
A large, circular piece made of titanium is fed into the big Erie press. The huge, hydraulic pistons, exerting 400 tons' pressure, fashion two holes resembling eyes. Formally, the part is a compressor case; informally, it is dubbed the "double whammy."

Elsewhere about the factory, tote boxes are filled with chimney pipes, dishpans, banana hinges, trombones, kidney beans, suitcase handles, toenails, shower heads, and even a Taj Mahal — a delicately formed exhaust plug used on the J-52 turbojet engine.

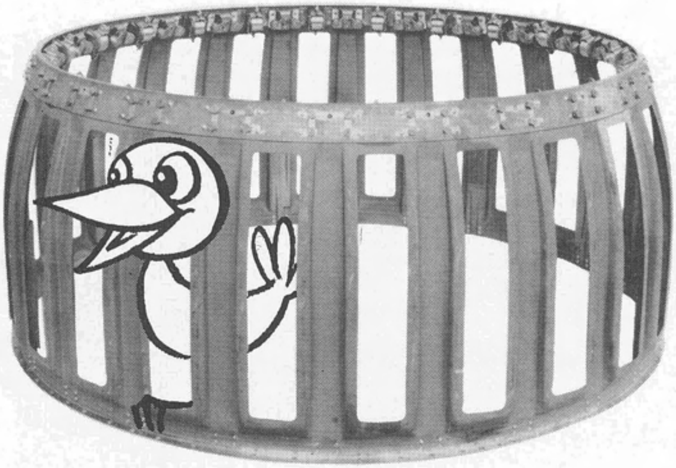
— John A. Cox



Bullet
(inner liner assembly — J-57)

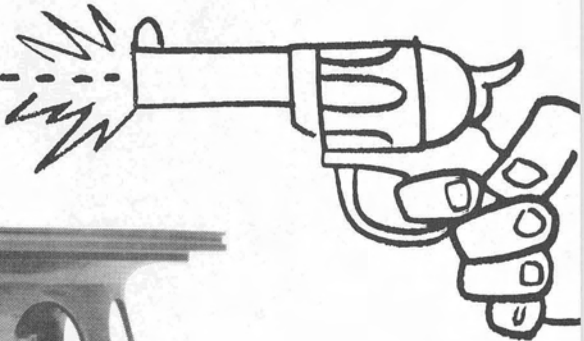


Mexican Hat
(main bearing seal housing — JT-3)



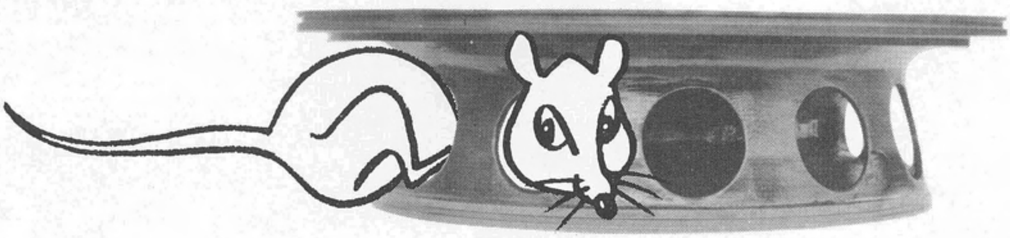
Bird Cage

(afterburner liner — J-75)



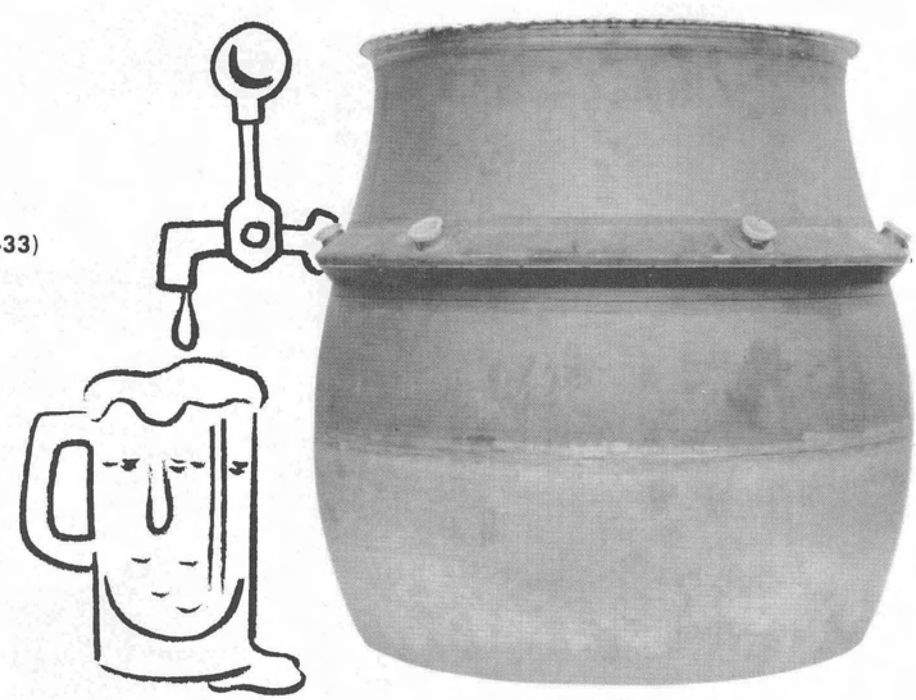
Rat Trap

(compressor bearing support — J-57)



Umbrella

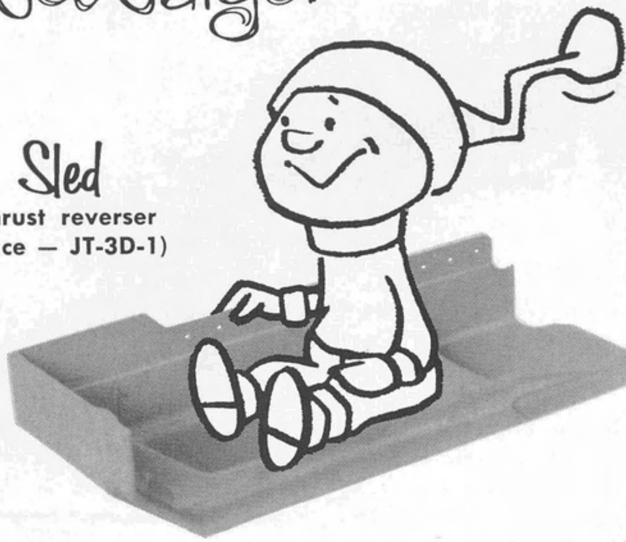
(shield assembly — TF-33)



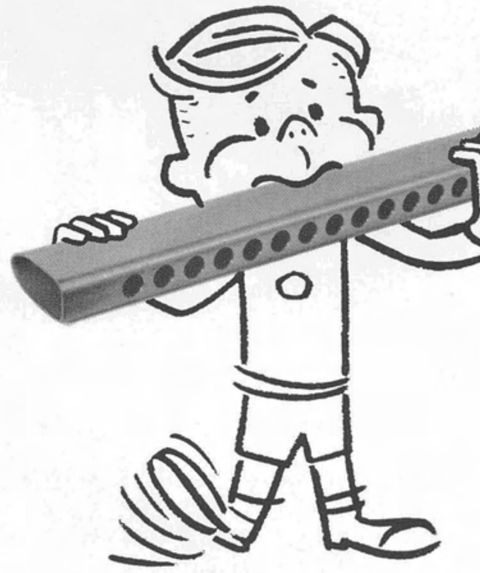
Beer Barrel

(duct assembly — J-52)

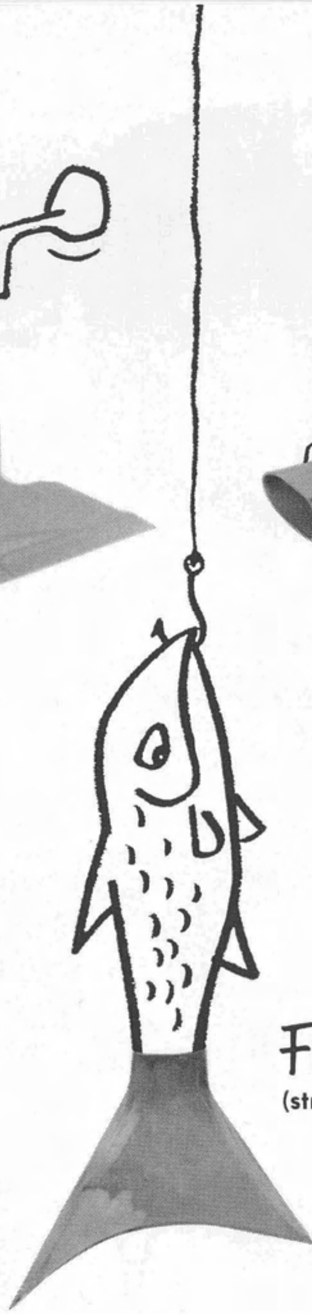
Jet Jargon



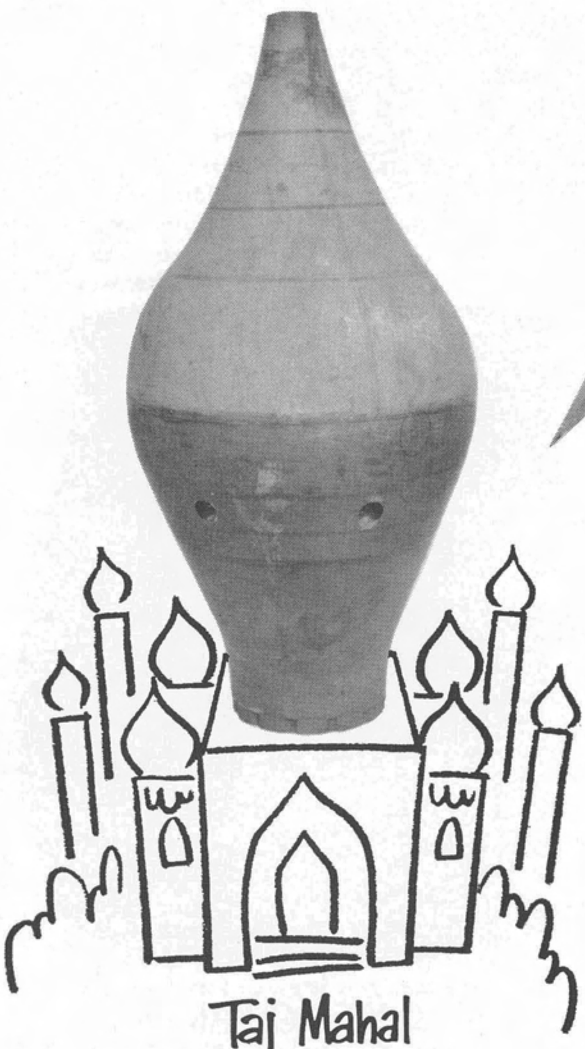
Sled
(thrust reverser brace — JT-3D-1)



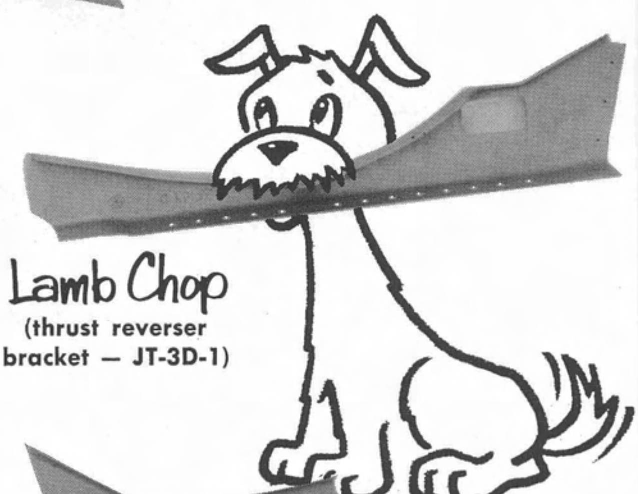
Mouth Organ
(strut — J-57)



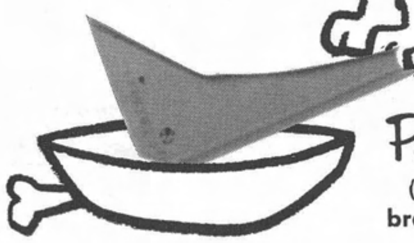
Fish Tail
(strut weldment — J-52)



Taj Mahal
(exhaust plug — J-52)



Lamb Chop
(thrust reverser bracket — JT-3D-1)



Pork Chop
(thrust reverser bracket — JT-3D-1)

Against a backdrop of piled-up produce, merchants dicker over price in New York's Washington Market, 50 acres in area.

Jet transports, carrying fresh foods from all parts of the world, are now participating in New York's daily drama of

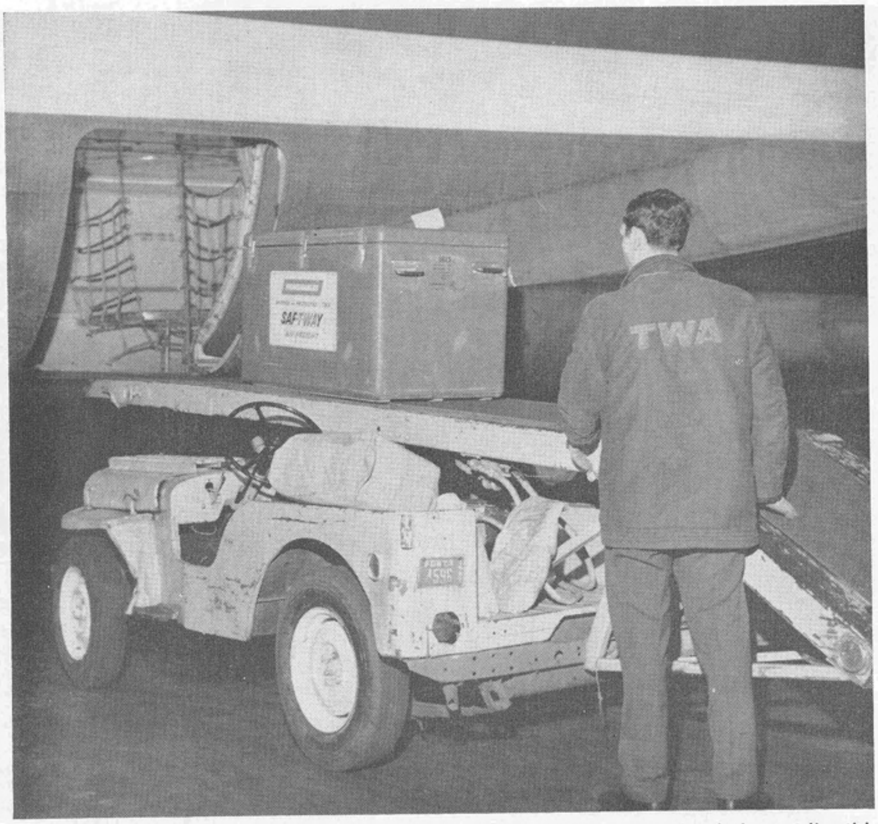
SATISFYING EIGHT MILLION APPETITES

By *John Ferris*

A HEAVY layer of clouds hides the big commercial jetliner as it streaks westward over the Breton coast. To the fishermen on the dock, the sound of its passing is so faint it seems no more than a rumor of sound. They rarely talk now of the jets as they did in the beginning; the novelty has worn thin. Still, a man sometimes cocks his head and listens, wondering if that one carries any of the fish he and his mates so lately took from the sea.

Americans are getting fresh Channel sole from France by air as they get turbot, oysters, clams, pink shrimps, and other seafood; and from the French farmers their truffles and paté de foie gras, Burgundian escargots (snails), pheasants, wild strawberries, and cheeses. The jets' speed assures delivery of perishable foods in good condition, and French exporters are doing a brisk trade with New York — not a noticeably large one but an important one that seems certain to expand.

Jets are flying not only from France but from every other country which has the foods New York wants. While the amounts, as yet, are a relatively small percentage of the total food shipments, commercial routines already are neatly fixed. A hotel director or restaurant owner with an eye on the prestige of his dining room merely gives his order to an importer, to an agent abroad, or to



A shipment of Dover sole flown from Portugal by jetliner is unloaded at Idlewild.

an airline representative assigned the job of filling such orders.

Delivery is made with results that mock time and distance. The Spanish lobsterman's Monday morning catch is served at a New York hotel on Wednesday. A smart Italian restaurant carries on its Saturday dinner menu forest quail, guinea hen, eels, squab, and cheese dispatched from Rome the night before. The passenger who arrives at Idlewild Airport in the morning may eat Belgian celery, artichokes, and endives that were put aboard his jet as cargo at Paris.

The presence of jet-flown foods on a menu imparts a new zest to eating, as if the flight communicated some of its own excitement. Even the domestic foods brought in by air seem to acquire new value. Trays of bright red Texas or Louisiana strawberries, carried to the New York market by piston-powered cargo planes, somehow look fresher and more appetizing than their New Jersey counterparts seem later in the season. This may be a trick of the fancy, but its persistence can hardly be denied.

All men — or most men — enjoy eating and they like variety; and just as the mind and spirit are stimulated by good books and music, a piece of sculpture, or the sight of precious gems, so, too, do they respond to good food. Thomas Jefferson, who loved music and architecture and literature as he loved man's freedom, could unblushingly write of the joys of eating a cool pickle at Monticello on a summer morning.

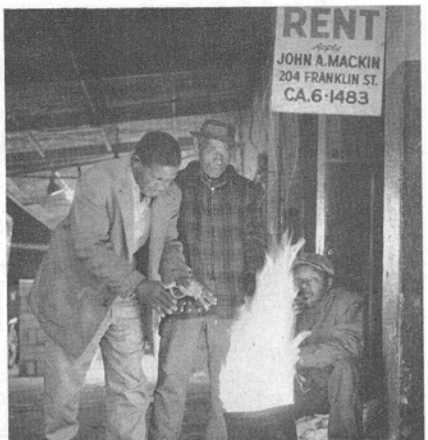
For want of other conversational topics, people often talk happily about food. A man will recall, item by item, a dinner he ate 15 years ago; women exchange recipes; men and women seek out new restaurants. The theatergoer, concertgoer, or operagoer, having momentarily appeased his esthetic appetite, is apt to turn to the pleasures of food. Today, the task of supplying the wants of highly cultivated tastes as well as grosser tastes has become a drama — or spectacle — bewildering in its vastness and complexities. The demands of a city like New York call for the efforts of multitudes of men and women the world over. This drama touches the lives of people in remote areas to whom New York is a place beyond comprehension — a label on a box, a stenciled name, a magazine photograph of dazzling towers and crushing masses of human beings.

Few of New York's eight million residents and the city's 100,000 daily visitors, to say nothing of the other eight million in the metropolitan area, have a very clear notion of the magnitude of the drama in its infinite detail. New York's 12,000 eating places employ 124,600 persons and do a billion-dollar annual business. The city has 10,500 grocery stores and delicatessens; 5,000 meat markets; 2,200 fruit and vegetable stores; 1,750 retail bakeries; 800 sea food stores; 3,500 candy, nut, and confectionery stores. Others dealing in eggs and poultry, dairy products and special foods, bring the total to 25,000, with yearly sales of more than $2.6-billion.

Food From Many Nations

A simple statistic like New York's 12,000 restaurants and lunchrooms, even when it is known, is likely to arouse only indifference. Similarly, the existence of numerous places specializing in national cuisines makes only a slight impact on the individual consciousness. Not many people, after all, consistently make the rounds of Rumanian, Japanese, Hungarian, Polynesian, Hawaiian, Dutch, Polish, East Indian, Russian, French, Italian, Greek, Armenian, and Swedish restaurants.

Still, the restaurants are there and they must be supplied. New Yorkers, accustomed to getting whatever their



Employees of market ward off night chill by building fires in abandoned oil drums.

More than 150 varieties of fish pour into the Fulton Street Market each year. A small but growing proportion arrive by air.

appetites crave, must also be supplied — the year round and at any time of day or night. Thus the gathering of food to keep New York sated is endless. The Chilean peasant plucks seedless grapes from vines on a lower slope of the Andes. A dark Egyptian on the other side of the world collects red lentils or packs dried squash skins. The Armenian molds braid cheese. A Danish farmer cures hams. A Greek girl stuffs small eggplants with chopped celery, mint, and garlic, and drowns it all in rich oil, or bottles figs in vinegar with pine nuts and slices of turnips. A French farmer picks mushrooms (cepes and girolles) within sight of Chartres Cathedral. The Honduran peon swings his machete in a banana plantation.

Over two billion pounds of meat are shipped into New York annually for the city's eight million inhabitants, some 100,000 daily visitors, and the eight million people who live outside the city boundaries but still within the metropolitan area. Other figures on food shipments are equally impressive:

Butter: 146,339,000 pounds.
Eggs: 155,355,000 dozen.
Fluid milk: 3,187,755,000 pounds.
Fresh cream: 545,681,000 pounds.
Fresh fish and shell fish: 168,818,000 pounds.
Live poultry: 50,852,818 pounds.
Processed poultry: 310,132 pounds.
Fruit and vegetables: 4,776,720,000 pounds.

There is a cheese store in downtown New York that boasts it has cheeses from all parts of the world, and there are scores of small retail establishments where an Arab, a Syrian, a Turk, an Algerian, or a Norwegian can satisfy any whim of appetite.

New York has grocery stores, delicatessens, and specialty shops stocked with fresh Mexican strawberries, Iranian caviar, Jaffa oranges from Israel; English sprats, salmon from Scotland, Ireland and Nova Scotia; frogs' legs from Japan; German sausages, Roman cookies, liqueured candies from France, and other delicacies. One New York importer alone brings in half a million dollars worth of canned paté de foie gras a year and during the Christmas season has half a ton shipped by air to sell at $25 a pound retail.

One can buy grasshoppers, chocolate-covered ants, fried butterflies, and baby bees in soy sauce; broiled sparrows en brochette, cuttlefish, octopus, quail eggs, and rattlesnake meat if the taste or the sense of humor — many people buy these things to serve their drinking guests — runs in that form.

Markets Present Full Drama

Still, retail shops offer the great drama of food in fragmentary bits. The spectacle in New York is best enjoyed in the wholesale markets — in two to be exact: Fulton Fish Market on the East River, a short walk from the Wall Street financial district, and Washington Produce Market (it is also the wholesale butter and egg center) on the other side of town, a few blocks west of City Hall.

New York has another wholesale produce market in the Bronx, a live poultry terminal in Long Island City in Queens, and two big wholesale meat markets, one in Brooklyn and the other, Gansevoort Market, on the northwest fringe of Greenwich Village. But the downtown markets are by far the biggest, noisiest, and most colorful, though much of the excitement that once characterized the Fulton Fish Market has passed with the times.

Business in that ancient mart where Al Smith worked as a boy is now conducted smoothly and efficiently, if loudly. Nobody dances barefoot in a box of live crabs or gets drunk and tries to swim to Brooklyn. Even the restaurant life of the area has been tamed. The most famous of the eating places, Sloppy Louie's, now keeps strict daytime hours and has as many businessmen as fish dealers among its customers.

Into the fish market every year come vast shoals of porgies, flukes, and whitings; butterfish, cod, hake, flounder, squid, mackerel, and eels; crabs, lobsters, oysters, shrimps – some 85,000 tons of fish of more than 150 varieties from the Atlantic and the Pacific and from inland lakes and rivers, a small but growing percentage of which now arrives by air.

Oddballs Are Rare

Even with the use of old-fashioned scales, sales are swiftly consummated. There is no place for horseplay or for the oddball characters of the past. Selling starts around 6 a.m. Salesmen shout, customers shout, bookkeepers blandly enter orders and prices. The voices are harsh or shrill and marked by the hoarseness that comes from raising the voice constantly out of doors.

Within four hours the bulk of the fish is sold, but business goes on in a desultory way till midafternoon when the cement floors of the old buildings – there is only one modern structure, occupying a whole block – are hosed down and quiet settles over the neighborhood.

The spirit of Washington Market is more boisterous, but if the place at its busiest seems to the visitor to be wild, chaotic, and utterly disorganized, it is giving a false impression. Two men who appear to be engaged in violent argument are probably old friends simply exchanging views on the price one wants for lettuce and what the other wants to pay.

Sea urchins typify the unusual kinds of seafood sold through Fulton Street mart.

Washington Market is a long and narrow area of 50 acres. It runs mainly along Washington Street for a dozen blocks, embracing all the cross streets for a block on either side as well as parts of Greenwich Street, one block to the west, and West Street, a block away on the Hudson River waterfront. Every commission house is called a "store," no matter how big it is. All are housed in century-old brick buildings, five or six stories high, painted red or gray, yellow, green, or brown, or just left to be darkened by smoke and sootfall and the grimy fogs that roll in from the river.

The buildings generally are empty above the second floor and the windows either bricked over or boarded up, giving the whole district a slightly melancholy air in daylight. In the morning hours these marks of desolation are striking. Building after building seems deserted. The big street level doors are closed; the owners and their clerical staffs are busy in the second floor offices with paperwork. Few people are abroad. Here and there a shabby old woman pokes along with a shopping bag, looking for stray pieces of fruit or vegetables, or a man sprawls in a doorway, an empty wine bottle at his side. The sidewalks are always in shade, since they are covered by building-to-curb metal awnings supported by cables extending from the wall at the third floor level.

A man paints a merchant's big old weathered signboard; another hangs out a small seasonal sign: *Chilean Melons In,* or *Texas Strawberries Here,* or *No Mushrooms Christmas Night.* A few cellar doors leading from the sidewalk are open but no sound comes from below. Few trucks pass. It is only 11 a.m.

Trucks Arrive Snorting

At noon the big trailer trucks start rolling down West Street, snorting and slamming. Because trucks 33 feet or more in length are barred in Washington and Greenwich Streets, they unload on West Street and the produce is carried off to the stores in smaller trucks or hand carts. The big sidewalk doors of the buildings open and by late afternoon their interiors and the curbside area are jammed with thousands of crates and baskets: lettuce and dates and tangerines from Arizona; California and Florida melons; asparagus from New Mexico and Texas; beet tops and greens from New Jersey; cabbages from Holland and Texas; Mexican cantaloupes; cipolini (small onions) from Morocco; Israeli lemons; potatoes from Long Island and Idaho; apples from New York, New England, the Northwest; boxes of cherries, chickpeas, sacks of peanuts; crates of spinach, celery; baskets of turnips, sweet potatoes, rutabagas, radishes, peppers, broccoli, endives, mushrooms; Puerto Rican pineapples, Spanish melons from Argentine; Chilean nectarines; plums and peaches; cucumbers from Jamaica and Guatemala; kale, kohlrabi, rappini, sorrel, Swiss chard, parsley, watercress, berries, plantains and pears.

And great piles of fruits and vegetables from the Caribbean: apio, arum, breadfruit, culantros, dasheens, gandules, ginger root, honeyberry, quenapas, yams, and yucca, and among the citrus fruits, kumquats, tangelos, and uglifruit.

At precisely 3 p.m., "Straw Hat" Johnnie Weinstein takes his stand in his wide doorway. He is 70 and looks years younger. He has spent most of his life in the market and is reported to be rich, as most of the oldtimers are, but with no silly notion about retiring. For 45 years he has worn a straw hat at work. He bought the first; after that customers made him Christmas presents of straw hats — expensive ones. From 3 to 11 p.m. Johnnie sells or watches his salesmen sell. He has 30 employees, sells everything but fruit (for some reason he does sell peaches but can't remember why).

"Down here," says Johnnie, "a millionaire owner works side by side with his clerks. Everything is honest. It has to be that way or nobody could survive."

Still, the market suffers a loss of about a million dollars a year through thefts; another $11 million from spoilage.

A few early buyers drift into the market—retailers, purveyors for hotels and restaurant chains, secondary wholesalers, brokers for out-of-town customers. They park their trucks or cars in the choked streets. Their choice of produce is without parallel anywhere: 125 different kinds of fruits and vegetables from every state except Alaska and South Dakota and from 25 foreign countries. The man who wants fresh grapes or berries flown from California, Georgia, or Florida, Mexican strawberries, or jet-borne foreign fruits knows exactly where to go.

The market salesmen wear long tan dusters and write their orders at delivery benches, a kind of tall wooden desk. They are crisp, friendly, knowing men, who bear winter's cold and summer's heat with fortitude, joking when the moment calls for a joke, sympathetic over a piece of sad personal news. Some have aged in the business and have aged customers.

Merchants Jam Sidewalks

Around 6 p.m. the pace gets faster as buyers begin arriving in larger numbers. Sidewalks are so jammed they are all but impassable. The interiors of the 200 or more "stores" blaze with light; there is a constant movement of laborers wheeling crates and baskets back and forth with sharp warning cries. When the street lights come on, they shine with a garish brilliance. Up and down the streets in cold weather flame the dull blue and orange coke fires in scores of fire cans — old steel oil drums. A kind of timelessness pervades the market: it could be 9 p.m. or 4 a.m.

Business quickens: produce is examined, pinched, squeezed, hefted, smelled. The air is filled with voices — bargaining, cajoling, arguing, threatening, pleading; bland or angry voices, jovial or morose voices, voices full of laughter or profanity. Buyers turn from salesmen with an elaborate show of disgust and turn back with feigned reluctance. Arms and hands cut figures in the strange glaring light; heads shake or nod or wag extravagantly as bargains are sealed. The atmosphere, the movements, the noise seem parts of an amiable bedlam, a skilfully wrought lunacy under tight control.

Motor trucks crawl through the streets. An occasional horse-drawn wagon passes. The hand trucks rumble with a metallic bumping here and there. Pedestrians shuffle. The uproar mounts to a dull booming level where the sound seems the most natural thing in all the world.

By 10 p.m. the hubbub starts to diminish, first slowly, then more rapidly. By midnight, 75 per cent of the selling is over. From then until 7 a.m. the streets gradually clear as small retailers come in and clean up what remains, though there are days when much that comes in never goes out — hence the $11-million annual spoilage. By 8 a.m., the sanitation trucks move in and restore final order. The street level doors are closed; the office staffs begin arriving for the mass of paperwork.

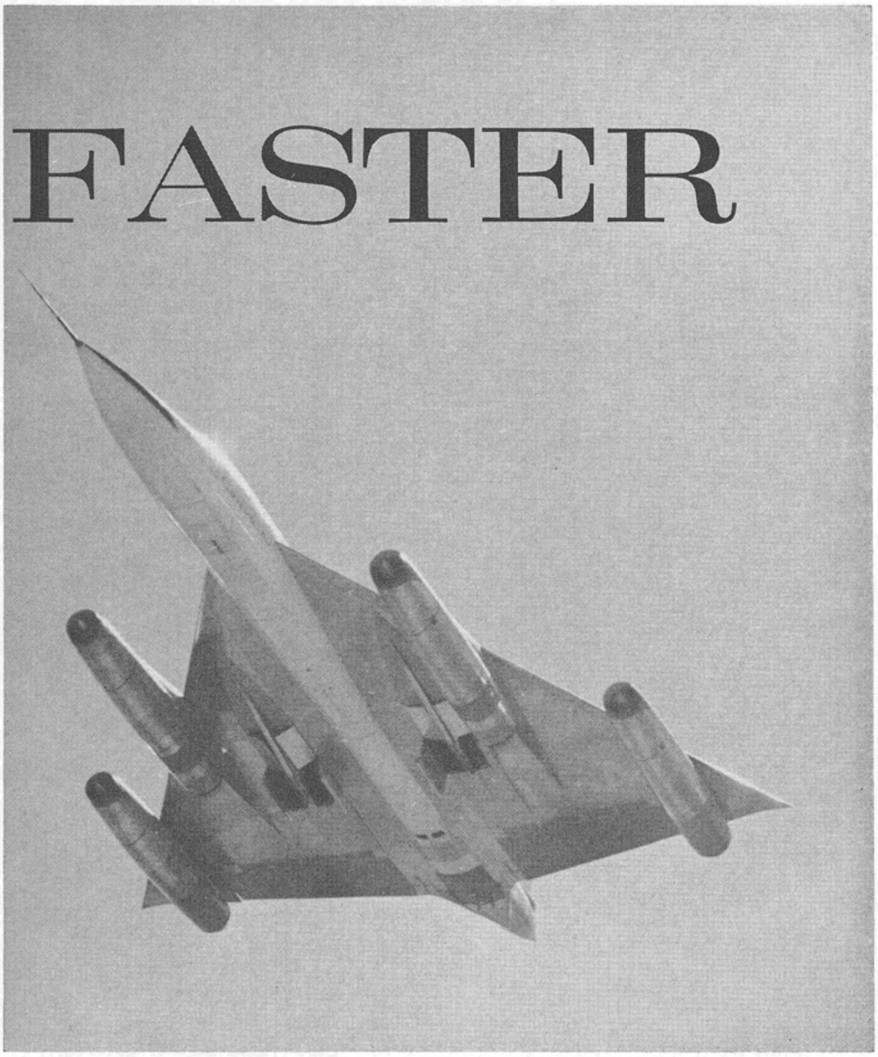
And out over the continents of the world, growers, pickers, and freighters are making up new loads for the world's biggest market.

Although swift jet aircraft bring much of the food to New York, transportation within the market is by a somewhat slower mode.

FARTHER

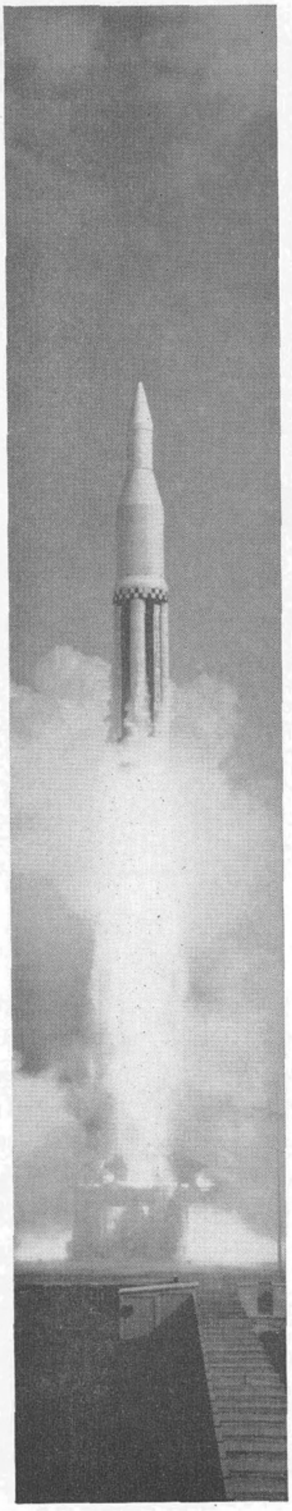
LONG-DISTANCE PACE SETTER This Series 50 Douglas DC-8 jetliner, the Pacific Pacer, shattered all distance records for commercial transports and established new marks for payload and speed in two recent demonstration flights. Equipped with Pratt & Whitney Aircraft JT-3D-3 turbofan engines with Hamilton Standard controls, the Pacific Pacer first carried an equivalent payload of 40,962 pounds from Seattle to Tokyo, the largest commercial jet payload ever transported non-stop across the Pacific from East to West. Then, four days later, it flew from Tokyo's Haneda Airport to Miami, Florida, a distance of 8,792 statute miles, in 13 hours and 52 minutes. This flight, with 49 passengers aboard, covered more than one third the circumference of the earth and exceeded by almost 1,700 miles the previous non-stop record for commercial airliners. Average speed for the West-bound flight with favoring winds was 634 miles an hour. Top speed during the flight was 790 miles an hour, reached when the jetliner was about two and a half hours out of Tokyo.

and FASTER



CROSS-COUNTRY SPEEDSTER In two sweeps across the country, an Air Force B-58 Hustler erased three transcontinental speed records in March. The Convair-built bomber flew from Los Angeles to New York in two hours, one minute, and 39 seconds, chopping 48 minutes off the old record. Over the Atlantic Ocean near New York, it slowed for 26 minutes for a midair refueling from a Boeing KC-135 tanker before flying to Los Angeles on the return leg. Despite a second air-to-air refueling, the flight back took only two hours and 15 minutes, shattering the previous record of three hours and 36 minutes. The round trip of four hours and 42 minutes sliced two hours and four minutes from the prior record. With the craft flying more than 1,200 miles an hour, its cabin would have been heated to 260 degrees Fahrenheit if it had not been cooled by an air conditioning system developed by Hamilton Standard. The division also provides the pressurization system, engine starters, and fuel controls. Norden's contributions to the B-58 include a pressure ratio device.

THE ROCKETMEN OF HUNTS



FROM a distance, it looks something like a cluster of outsized fence posts. It is 82 feet long, 22 feet thick, and weighs 50 tons. To work on it, reposing horizontally in its sturdy rigging, the men climb ladders, mount access platforms, and step gingerly over catwalks running across it. They wear hard hats, white coveralls, and sneakers as they crawl over it. Probing, examining, adjusting, they give special attention to one end where, from a labyrinth of plumbing, eight hollow red cones jut out, each large enough for two men to curl up inside.

These men are rocket technicians and the object of their ministrations is the lift-off stage of Saturn, the Big Daddy of the nation's space program.

The scene of this activity is Saturn's home, the George C. Marshall Space Flight Center at Huntsville, Alabama. Here the mighty rocket – which is not so much a single vehicle as an evolving family of vehicles, each bigger and more potent than its predecessor – moves from blueprint to assembly floor to test stand in preparation for launches from Cape Canaveral. Here, too, is being shaped a growing inventory of other systems and vehicles for clambering into the cosmos.

"We're the truckers of the space business," one of the men at Marshall remarked the other day. "Our job is to provide the transportation systems for getting the guys up there."

With 6,000 employees and a budget of $800 million for fiscal 1962, the Marshall Center is the largest field installation of the National Aeronautics and Space Administration (NASA). Its rocketeers have been delivering the kickoffs for American space shots since the first U. S. satellite went into orbit in 1958.

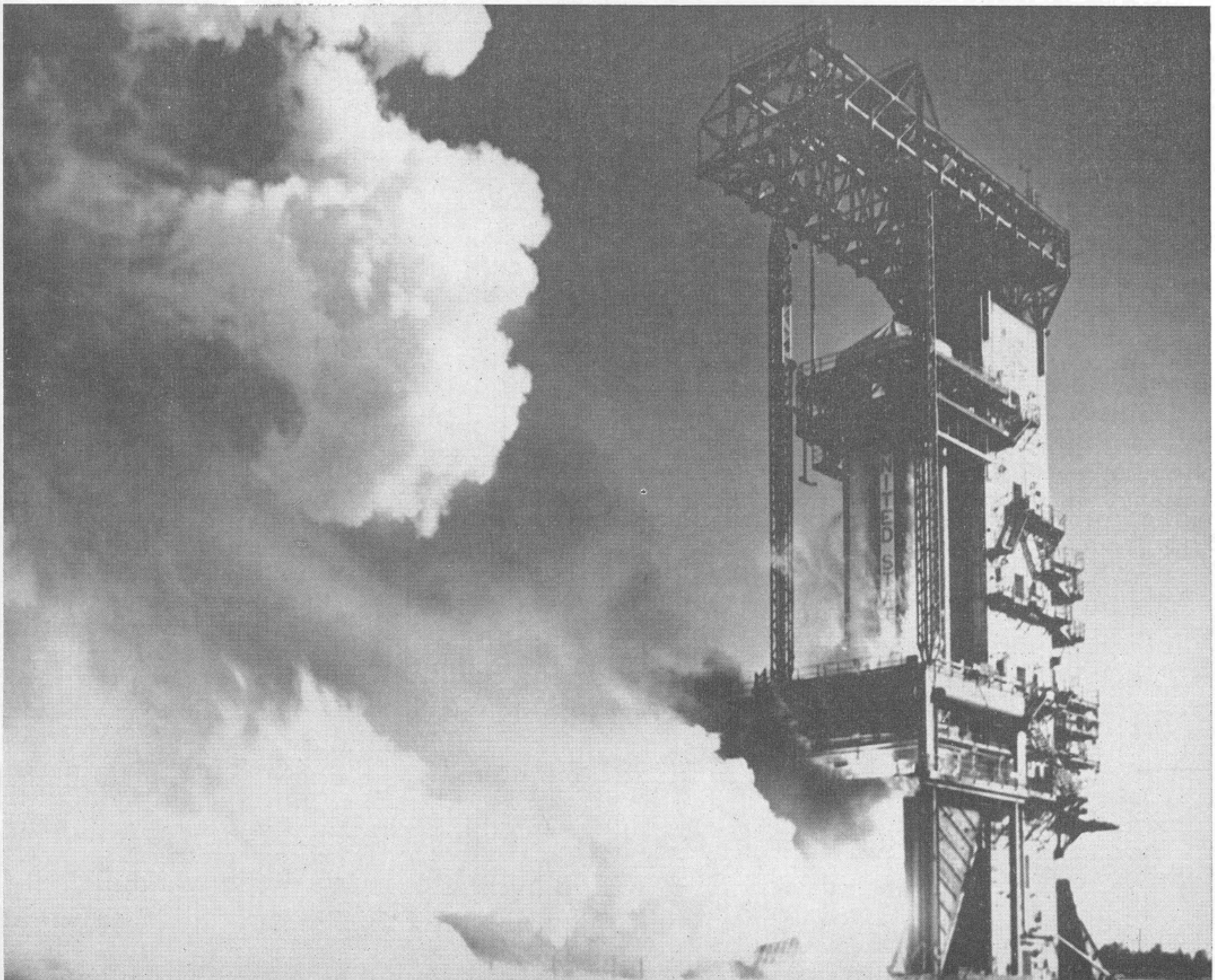
Rockets brought through at Huntsville were the launch vehicles for many of the Explorer and Pioneer satellites and space probes that have yielded such a wealth of information about the makeup of the realm

By Frank Giusti

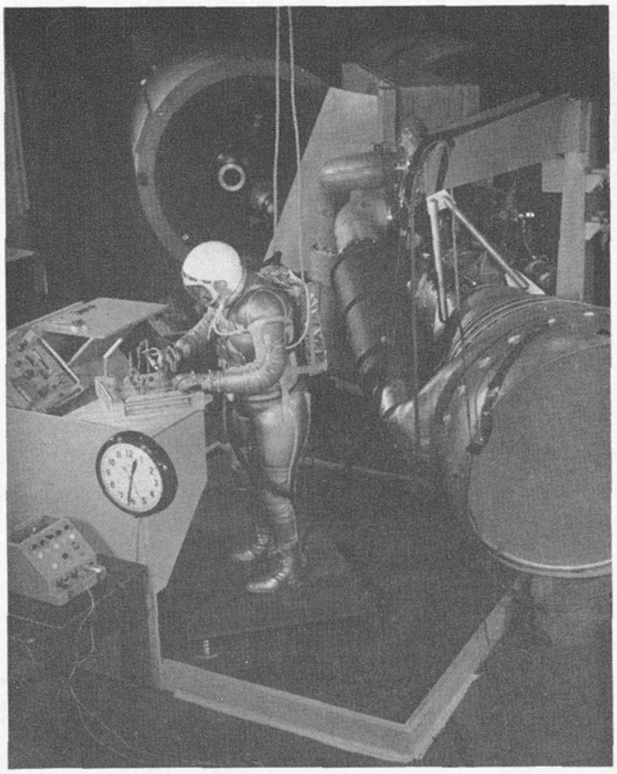
VILLE

beyond earth. And the Marshall Space Flight Center has had a major hand in Project Mercury as the developer and launcher of Redstone, the booster that propelled Alan Shepard and Virgil Grissom into sub-orbital flights last year, clearing the trail for John Glenn's three-orbit journey launched by a General Dynamics Atlas booster.

The Marshall complex itself occupies a 1,600-acre tract within the Army's 40,000-acre Redstone Arsenal, of which the center was a part — as a division of the Army Ballistic Missile Agency — before it was shifted to NASA in 1960. The center is a melting pot of space-oriented talents and skills drawn from all over the country and, indeed, the free world. Gathered at Huntsville, on whose streets one can hear 14 foreign languages spoken, scientists, engineers, technicians, and supporting personnel are busy generating ideas, concepts, computations, and solutions to the problems of space travel. In their laboratories, test chambers, and assembly plants, they are forging roadways to the moon and beyond.



A Saturn booster undergoes static firing at Marshall Center. Clouds of steam billow forth when exhaust meets water-cooled shield.



Standing on air-supported platform, test engineer performs repair chores similar to those an astronaut may need to do.

Physically, the Marshall Center reflects, in its growing dimensions, the prodigious outpouring of money, brainpower, and technological effort being channeled into the space race. It buzzes and whirs with things a-building. On every side, new facilities are taking shape, new buildings going up, most of them squat, severe structures of concrete block construction. In the hub of the layout, a new headquarters and central laboratory building rises at a cost of $4,000,000. Farther away, deep in the test area, the diggers have opened a huge excavation in the red earth for construction of a test stand designed to withstand 7,500,000 pounds of thrust for static-firing advanced Saturn vehicles.

Cattle Graze Amid The Rocketry

Yet, amid all the purposeful bustle, patches of placidity can be found — herds of Holsteins, Herefords, and Black Anguses chomp contentedly on the broad grassland around the rocket center in exercise of the grazing rights the Army grants to cattlemen for much of the unoccupied acreage within the Arsenal.

Despite the swift sprouting of new facilities, budgeted at more than $50,000,000 for the 1961-1962 period, the Marshall Center is hard-pressed to find space for a staff expected to grow to 8,000 or more over the next few years. In its desperation for office quarters, it has moved into a one-time cotton mill and taken over two motels outside the Arsenal. For its procurement and contracts offices, it leases four of the five floors of the venerable, dingy-brick Hotel Twickenham in downtown Huntsville.

The building boom stoked by Marshall's work reaches far beyond Alabama. For programs managed from Huntsville, construction dollars are going out to numerous points around the country — to Florida's Cape Canaveral for the acquisition of land and erection of launch facilities; to New Orleans, where Saturn stages will be produced; to Logtown, Mississippi, where behemoth boosters will undergo static testing; to the Pacific Missile Range for additional launch facilities; and to Jackass Flats, Nevada, development site of nuclear rocket propulsion.

Lift-off stage of the first generation Saturn is 82 feet long, 22 feet thick. It is powered by eight liquid fuel engines.

As deviser-in-chief of NASA's transport systems, the center is a pivotal participant in two current projects of high scientific significance. It is directing launch vehicle activities for the Ranger craft, designed to land on the moon, send close-up TV pictures of it back to earth, and gather data from the lunar surface.

It also manages the Centaur program, in which Pratt & Whitney Aircraft is taking part through development of the RL-10 liquid hydrogen-oxygen rocket engine. Two RL-10s form the powerplant for Centaur, destined to open the entire inner solar system to study by sending large instrumented payloads deep into space. Later, clustered RL-10s will power upper stages of Saturn, the series of multi-stage vehicles programmed as carriers for NASA's man-to-the-moon program, known as Project Apollo.

Just recently, a Saturn-Apollo office was opened at

Marshall to help integrate the booster Saturn with the space craft Apollo. "Developing a launch vehicle and getting it up there is one thing. Putting a man on the end of it is quite another," said Earl M. Butler of the new office. "We'll be making recommendations to Project Apollo about what Saturn can and cannot do with specific reference to the manned aspect of flight."

Even as the center presses on with the development of rockets to shoot man to the moon, its forward planners are peering farther down the spatial highway. What they see is travel to the planets.

"In our present studies, we are looking ahead to the mid-1970s," said Harry O. Ruppe, a German-born scientist who is assistant director of the future projects office. "By 1970, we are quite confident that manned lunar flight will be a matter of history. Then we will be preparing to go to Mars."

Travel to Mars will involve orbital rendezvous, a technique in which two vehicles come together while whirling around the earth to perform certain operations in preparation for kicking off from orbit to the outer reaches of space en route to the planet.

As it looks now, orbital launch will be employed for the first lunar landings, the vehicle being the advanced Saturn, or C-5. With 7,500,000 pounds of first-stage thrust, this rocket will stand 350 feet tall, or twice the height of the Statue of Liberty, and will be able to hurl a payload equal in weight to a Boeing 707 jetliner into orbit 300 miles above the earth. Beyond Saturn will tower the mammoth Nova carrier, which will stand higher than a 30-story building and deliver nearly twice C-5's power.

Drawing sketches on the blackboard in his matchbox office, Ruppe explained to a recent visitor some of the concepts the future projects office is pursuing to bring two craft together in orbit around the earth, refuel the lunar ship, and fire it to the moon.

Three Refueling Concepts Studied

Three ideas in particular are under intensive study. In one, two self-dependent propulsive units, each containing its own engines and fuel tanks, would be mated in orbit to provide the power needed for the lunar lunge. A second idea envisages actual refueling in space, much as a tanker plane feeds fuel to a B-52 bomber in flight. A space tanker would rendezvous with the lunar craft and, while both spun around the globe, would transfer liquid fuel through a line or boom to the latter's tanks.

In the third concept, the lunar craft with its human occupants would sail into orbit without fuel tanks. A second craft, bearing the tanks, would join it and the tanks then would be switched to the moon ship to supply fuel for the lunar leg of the voyage. There could be separate tanks for both liquid hydrogen and liquid oxygen, Ruppe said; or, since liquid hydrogen is far lighter than oxygen, perhaps the lunar ship would carry up its own hydrogen tank from the earth and only the oxygen tank would be installed in orbit.

Although the tank transfer approach holds the brightest long-range promise, Ruppe said, the technological problems it poses at the moment seem to dictate the use of either the self-contained units or the spatial refueling technique, probably the former initially because it raises fewer fuel-handling troubles.

Other modes of orbital rendezvous that present themselves to Marshall's space scientists include boarding, in which the complete orbital launch vehicle, fully fueled and loaded, is placed into orbit by a powerful carrier and a second, smaller vehicle flies the crewmen into orbit where they board the larger craft; and assembly, in which the launch vehicle is actually put together from orbiting subsystems such as propulsion units, structural components, propellants, and payloads.

Two Upper Stages To Meet

Wernher von Braun, director of the Marshall Space Flight Center, said recently that "as long as we do not have a Nova, we will depend on two Saturn C-5 upper stages rendezvousing in a low earth orbit" to carry out lunar landings. With Nova in commission, churning up 12,000,000 pounds of thrust at blast-off, direct flight to the moon, without orbital launch, would be possible.

For trips to Mars, Ruppe said, "we will need the tools that will be emerging in the next few years as part of the lunar program. Orbital launch, Nova, nuclear rockets — we will need all three."

Just as the Huntsville rocketmen are building bigger and better boosters for space journeys, so are they also devising ways to retrieve those boosters for re-use. As part of such research, they recently carried out experiments pointing up the desirability of trying to recover the booster engines even after they have been immersed in the ocean for extended periods.

An H-1 liquid propellant engine, eight of which make up the powerplant for the first generation Saturn booster, was sloshed around in salt water at Cape Canaveral for three periods of four hours each. The engine was brought back to Huntsville, flushed with fresh water, and given some new components. When it was fired, first in a ten-second burst, then in a full run-up of 150 seconds, it worked faultlessly. Since the renovation expense in each of the three tests came to only about ten per cent or less of the engine's cost, the experiment demonstrated both the economic merit and the technical feasibility of trying to recover the engines after launch.

Retrieval of complete boosters, including the engines and tankage, is the goal of studies sponsored by Marshall's recovery projects office. From the use of parachutes, which cannot be guided suitably, the recovery engineers are now shifting their attention to a device that is part parachute and part flexible wing. Called a paraglider, it resembles a Bunyanesque version of the triangular kites that boys send up in March winds.

The wing, mounted on three keels, would be folded between the booster's tanks during the powered stage of flight and would be unfurled at separation to glide the hardware, dangling on lines beneath it, back to earth. Through an autopilot operated from a recovery ship or a land station, the assembly would be guided to a selected landing spot either on land or sea. Depending on its weight and altitude at separation, the gliding booster would have a range of 50 to 150 miles, far greater than it would with a parachute.

"The ultimate recovery system probably will be a really flyable, fixed-wing booster that will do its launching job and then come down for a landing almost like an airplane," said Rudy M. Barrazo, chief of the recovery projects office. "But that's a long way off. As of now, the flexible wing concept looks like the best bet.

"We've had all kinds of recovery ideas proposed. For example, a balloon, which would float the booster back to earth; or a rotary wing assembly, something like the blades of a helicopter. But none of them lend themselves to meeting all the requirements, such as stabilizing the booster at separation so it enters the earth's atmosphere at the right attitude, decelerating it properly to lessen the reentry heat and load, and landing it in good, reusable condition. We have to accomplish all these things without complicating the booster too much or imposing too great a weight penalty."

A spaceman setting out for the moon will be too busy to worry whether the booster that launched him gets back to earth in reusable shape. Far from being a passive passenger, he probably will have certain maintenance and repair jobs to perform in and around his vehicle. In cooperation with NASA's Manned Spacecraft Center, Marshall is conducting tests at Huntsville to find out just what maintenance tasks a space traveler can do and how they will affect the design of both the vehicle itself and the gear he wears and wields.

In these experiments, an engineer dons a pressurized space suit, stands on a frictionless platform floating on compressed air, and performs a series of mechanical and electrical operations typical of those an astronaut might face. The air-supported platform duplicates to some degree the instability in space, for it eliminates all horizontal restraint. Thus the slightest lurch would send the platform and its rider scooting off to one side but for safeguards set up for the tests. Standing on the platform, the engineer carries out about 80 chores called out to him over a two-way voice circuit and covering electrical systems, tubing and piping, fasteners, and engines.

To work on his space systems, an astronaut will have to be equipped with tools specially fashioned in the light of the weightlessness he will experience. Working in zero gravity, he would tumble head over heels — a human pinwheel — at any pronounced forward or twisting movement, such as he might make in turning a screwdriver or pushing a wrench.

So special anti-torque tools are used in the tests. One is a screwdriver; another, a "plench," a combination of a pair of pliers and a wrench. Instead of being pushed, pulled, or turned, they are operated by being squeezed in one hand. Still another tool, called "spunfit" (space union and fittings wrench), is activated by one finger through a trigger-like arrangement on the handle.

The engineer submitting to these experiments is dressed in a suit like the one John Glenn wore during his recent orbital flight. Though designed only for use within a space ship, it could well form the basis for development of an outer space suit incorporating such features as jointed metal bearings for easier movement and an anchoring device to give the wearer stability. Then again, a NASA man pointed out, perhaps the astronaut, when he leaves his craft, won't be clad in an outside suit at all. Perhaps, instead, he will be encapsulated in a man-size tank having artificial arms and legs for him to manipulate.

But, to put first things first, man will have to be boosted up there before he can start shuffling around in space huddled in a tank with tentacles. At Huntsville right now, the principal project is the Saturn booster, projected as a family of big, multi-stage vehicles that will launch a series of shots leading to the landing of men on the moon by the end of this decade.

The lift-off stage, designated S-1, of the first generation Saturn was launched successfully last fall in a flight that carried it 85 miles up and 215 miles down range. The second S-1 stands on a launch pad at Cape Canaveral, ready for flight. And Nos. 3 and 4, when a recent visitor viewed them, were in full form at Marshall, one in final assembly, the other undergoing detailed checkout for its transfer to the test stand.

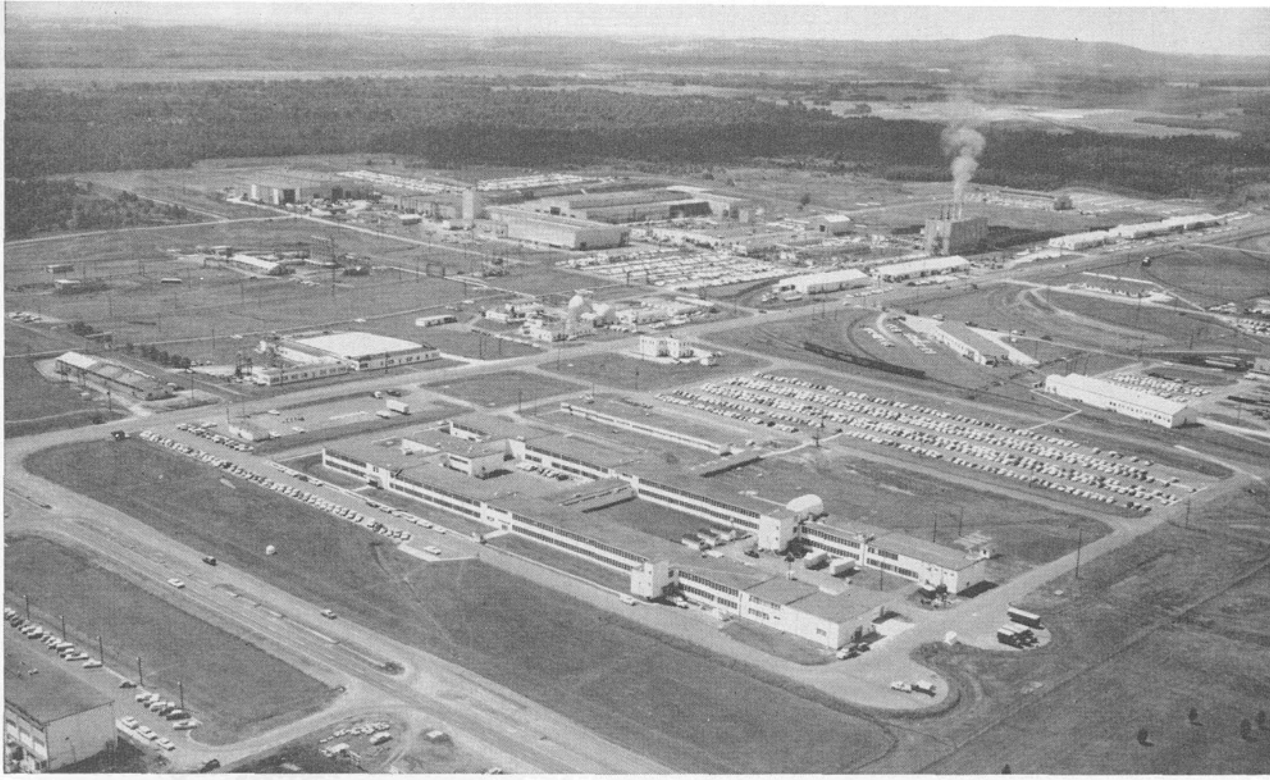
Basically, the stage consists of nine fuel tanks clustered atop eight 188,000-pound-thrust engines burning liquid oxygen and a kerosene-like fuel. For assembly, the booster lies horizontally in its rigging, with giant rings encircling it at each end. A tank 105 inches in diameter forms the stage's core. Around it are bundled eight 70-inch tanks made, like the center one, of a tough, aluminum-magnesium alloy. Each is lowered

FUEL CELL FOR MOON CRAFT BEING DEVELOPED BY P&WA

Pratt & Whitney Aircraft has been picked to participate in Project Apollo, NASA's man-to-the-moon program which will be launched under the direction of the Marshall Center.

The division has been awarded a contract by North American Aviation, prime contractor for Apollo, to design and develop a fuel cell system to supply electrical power that will operate equipment both in the command center module and the service module of the moon craft.

The fuel cell produces electrical power directly from fuel through a chemical reaction, using oxygen and hydrogen as its sources of energy. Pratt & Whitney Aircraft has been engaged in fuel cell research, as a company-financed effort, since 1958.



Marshall Space Flight Center, largest of NASA's field installations, occupies 1,600 acres of the 40,000-acre Redstone Arsenal.

by crane into a place made accessible by rotation of the rings cradling the booster.

Static firings of the completed stage, tethered vertically to a test stand 176 feet high, set up a shuddering roar heard for miles around. The exhaust from the engines pours down a curved chute and is deflected to one side. To cool the deflector, punctured with 7,000 tiny holes, water is blasted against it from the rear at 40,000 gallons a minute. Great clouds of steam roll up from the chute where the white-hot exhaust meets the jets of water squirting through the holes.

Barge Takes Booster To Cape

After assembly, pressure tests, static firing, checks and re-checks, the booster is trundled to a slip on the shore of the neighboring Tennessee River and loaded aboard a covered barge resembling a floating aircraft hangar. Down the Tennessee it goes on its way to the launch pad, a tortuous, ten-day trip covering 2,200 miles. It enters the Ohio River at Paducah, Kentucky, and switches to the Mississippi at Cairo, Illinois. Passing New Orleans, it emerges into the Gulf of Mexico and swings around Florida's tip up the Atlantic Coast to Cape Canaveral.

Unsurprisingly, all the rocketeering with its inpouring of personnel has had an explosive impact on the city of Huntsville, five miles from the space center. For years it was the hub of the leading cotton-producing county in Alabama. Spun pell-mell into the vortex of the space effort, it has undergone ineradicable changes, not only in its physical dimensions but also, just as deeply, in its character, its tone, its values. In the words of Mayor R. B. (Spec) Searcy, it has been transformed "from a sleepy southern country village into a real metropolitan center."

A genial, gravelly-voiced man who derives his nickname from the thick eyeglasses he wears, Searcy has served as mayor throughout Huntsville's period of great growth, having been elected to his first term in 1952 after a campaign he conducted between stops on his bread truck route. In the alabaster, box-styled city hall just off Courthouse Square, he sits at a horseshoe-shaped desk adorned with models of the local products, rockets.

Welcoming a caller to his office a few days ago, Searcy reeled off figures showing how the city has recast itself in the last decade. Population is up from 16,000 to 83,000 ("and I estimate it will be 125,000 in five years"). The annual municipal budget has leaped from $900,000 to $5,000,000. The area within the city limits has grown, through legislation, from 3½ to 50 square miles. Some $25,000,000 has been spent on gas, electrical, and water systems. Since 1955, new schools have gone up at the rate of a classroom a week, thanks to large infusions of federal aid.

New interests and new tastes have come to Huntsville. Moving in with their families by the thousands, the rocket builders have brought standards of culture and levels of intellect which have become strongly imparted to community life. No longer an easy-going, cotton-based town, Huntsville today takes pride in its public affairs seminars, art exhibits, little theaters, civic orchestra, community chorus, artists and writers groups.

"Some of the old-timers didn't want any part of it when all the rocket people started coming in and it became plain some big changes were in store here," Searcy said. "It pained them to see trees torn up and flower beds uprooted in the name of progress. But let me tell you, it was the finest thing that could have happened. It has made us big, growing, alive — in the center of things."

The S-62's Novel Rescue Platform

L. C. (Opie) Blanchard, Sikorsky test pilot, demonstrates operation of the S-62's rescue platform which he invented. Four feet long, the platform extends straight out from the craft's fuselage.

A GROUP of Coast Guard and Navy flyers sat around a table at the Patuxent River Naval Air Test Center in Maryland recently, planning a helicopter water rescue demonstration.

"There's a new rescue platform on the S-62 we've flown down here to show you," said Lloyd C. (Opie) Blanchard, an engineering test pilot for Sikorsky Aircraft. "We can pick a survivor out of the water in 20 seconds."

Good-natured laughter erupted around the table. "Opie," one of his listeners said, "you'll need at least two or three minutes." Blanchard smiled but made no reply.

Later that day, he set out to prove his claim. A "survivor" wearing a life jacket had been dropped into the water near the test center. As Blanchard, piloting the single-turbine Sikorsky S-62, made his approach, the crew chief slid open the cabin door and lowered a four-foot-long wooden platform which extended straight out from the fuselage. The boat-hulled helicopter alighted on the water a few feet from the "survivor" and taxied alongside him. The crew chief walked out on the platform and lifted the man from the water into the helicopter. Blanchard pulled

S-62 sets down on water for simulated rescue operation.

up on the collective stick, and the S-62 rose back into the air. An observer clicked his stop-watch. From hover to lift-off, only 14 seconds had elapsed. The rescue had been performed in almost one continuous motion.

By comparison, it takes from one to three minutes to make a water recovery using the conventional technique Sikorsky pioneered in which a helicopter hovers in the air and lifts a person into the cabin by hoist. The time savings afforded by the S-62's platform become even more important when a number of persons have to be rescued.

Demonstrations such as the one at Patuxent helped influence the Coast Guard's selection of the S-62, with the rescue platform, as its new search and rescue helicopter.

The idea for the platform came to Blanchard while he was on a European tour with the S-62. During a stopover in Stockholm, he was told that Swedish military leaders would like to see the water rescue capabilities of the S-62 demonstrated.

Blanchard is a former Air Force captain and, in the late 1940s, flew Grumman Albatross amphibians on search and rescue missions. When it was necessary to land on the ocean to recover survivors, the Albatross crews found that a small step outside the cabin helped them to assist people out of the water. Blanchard recalled these experiences as he began to map plans for the Swedish demonstration.

Having a talent for sketching and painting, he quickly drew the outlines of a platform that could fit into the doorway of the S-62. A Swedish wood shop built and installed the platform overnight, and next day Blanchard went aloft with it for the first time. While the Swedish military personnel watched and marveled, he swooped down to water landings and made recoveries in a fraction of the time required by any other helicopter.

After the tour ended and the S-62 returned to the United States, Blanchard was assigned to fly the aircraft in the Coast Guard and Navy evaluations. By now an improved platform had been installed, and repeated recoveries were carried out successfully. The platform-equipped S-62 won new acclaim during a demonstration at the Lakehurst Naval Air Station by recovering a dummy parachuted into the water from an airplane.

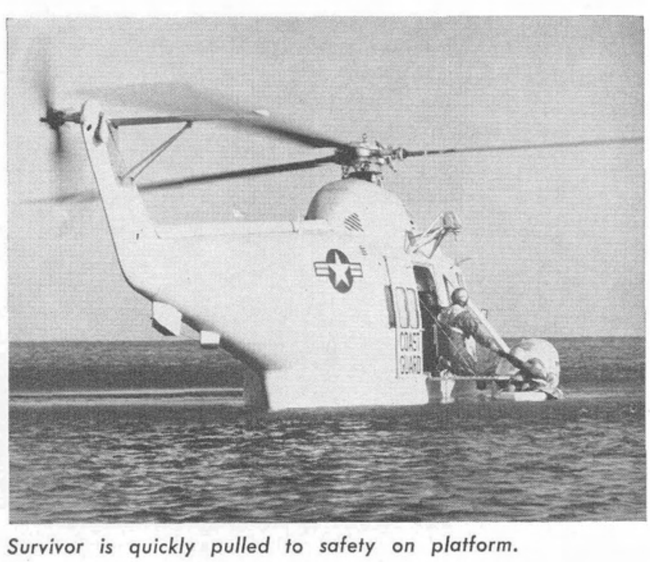
"One of the most difficult situations a helicopter pilot faces is rescuing an unconscious or injured man who has parachuted into the water," Blanchard says. "This problem is magnified if the parachute remains partially or fully inflated. The man might be dragged through the water or entangled in the shrouds. He is in great danger of drowning. With the S-62 and our rescue platform, however, we can reach the survivor, detach the parachute, and lift him aboard in a matter of seconds."

The platform is still in the development stage, and Sikorsky engineers and Blanchard are working on refinements to be incorporated in the final design. There is no doubt of the platform's acceptance or potential, however. The combined Coast Guard-Navy evaluation report on the S-62 gave it this stamp of approval:

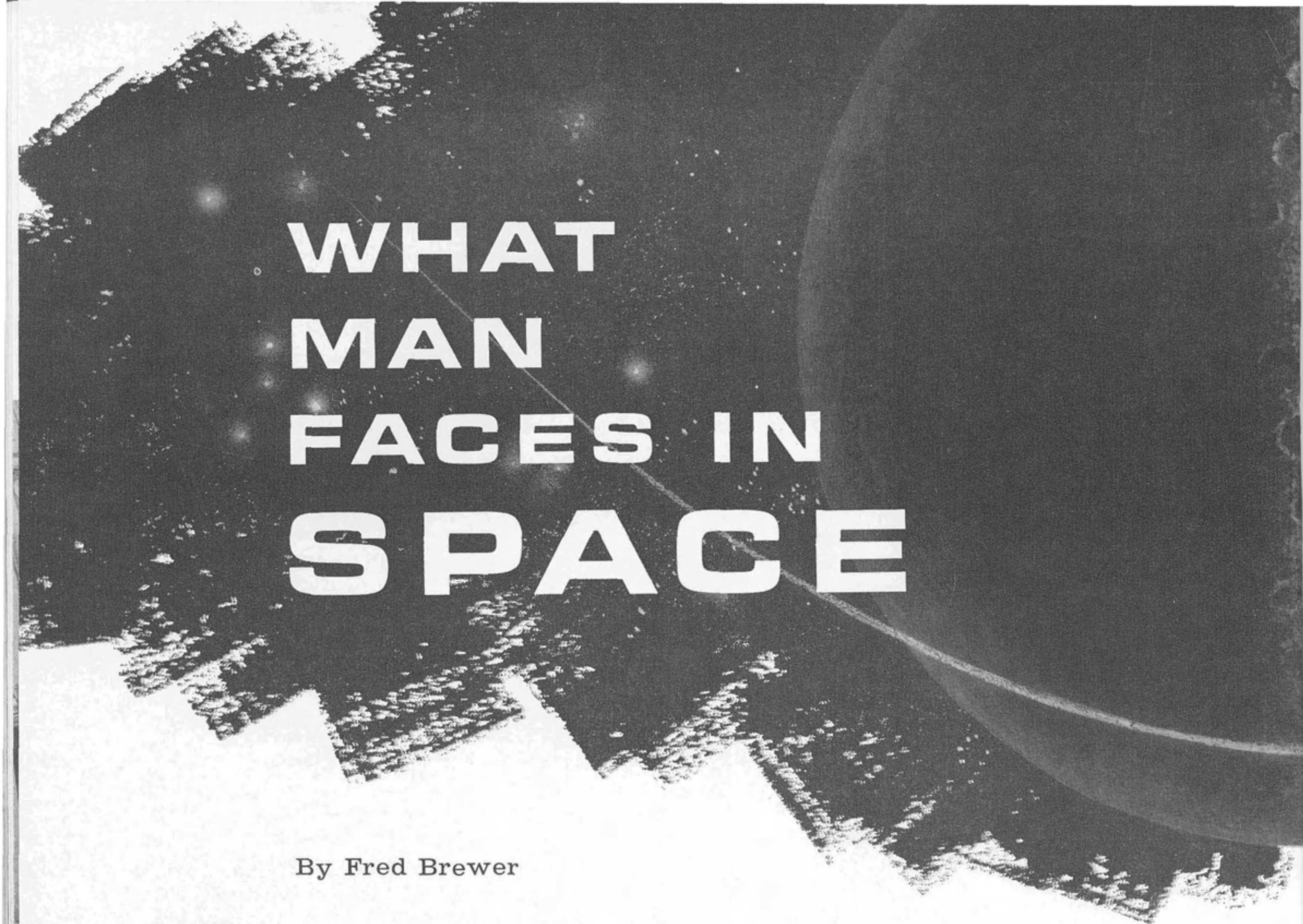
"The rescue platform represents a new approach to the long-standing problem of a helpless survivor. This feature of the S-62 is regarded as an outstanding contribution to search and rescue methods."

— Roger Dove

Crew chief on platform snags the raft with a rescue hook.



Survivor is quickly pulled to safety on platform.



WHAT MAN FACES IN SPACE

By Fred Brewer

SEVERAL years from now a rocket will be poised on its launching pad. Inside, firmly strapped onto specially molded chairs, three men will be waiting patiently. Earphones in their helmets will crackle with last-minute instructions and information. In a low building not far away a technician's voice will drone through the countdown. Nearby, other technicians will have their eyes on the jiggling needles of many softly lit dials. Their faces will be intent.

Everything will be going all right.

Yet this will not be just another orbital flight around the earth. Those experiments will have been concluded in the late 1960s. This space craft, magnificent in its design and instrumentation and majestic in its towering strength, will be poised for a journey far beyond earth. The dark depths of space await it and its crew.

The dangers of space also wait.

What are those dangers? Here is a survey of them as they are understood today.

The almost body-crushing gravitational forces set up by takeoff, the weightlessness in space, and the sudden shock and intense heat of atmosphere re-entry no longer seem severe threats to a spaceman's safety. Technology and the tough resilience of the healthy human body are quickly mastering these purely physical matters which, not many years ago, seemed over-huge. They still remain challenging, of course, but in his three-orbital flight earlier this year, Astronaut John Glenn was able to manually operate his space vehicle under conditions of weightlessness and extreme re-entry heat.

Man may constitute the greatest danger to himself in space. Scientists still have much to learn about the psychological effects of interplanetary travel. So far the few manned space probes – Glenn's highest orbit was only 158 miles up – have been too brief to contribute thorough understanding of mental reactions and attitudes that will occur to man when earth lies tens of thousands of miles away.

Emotional Stress On Man In Space An Unknown Factor

Because fear and anxiety are ruled out by the very nature of psychological experiments on the ground, only negligible information has been gained about the emotional stresses spacemen may undergo. During simulated flight conditions, the human "guinea pig" knows that he is in no danger, that fellow men are no more than a few feet away, and that he can break off the experiment whenever he wishes.

Yet the very real sense of isolation that spacemen will experience has its counterpart on earth – the "breakoff phenomenon" that overcomes many jet pilots. Brought on by the separation from familiar haunts and by the feeling of aloneness, the phenomenon sometimes gives pilots a keen sense of exhilaration, even a sense of God-like power and strength.

Other pilots, however, feel lonely, sad, and afraid.

When either highly elated or profoundly depressed, man is unable to perform tasks with skill. When he feels all-powerful, he often takes foolish risks. When he trembles with fear, he often cannot perform at all. Either could mean the difference between life and death in space. On the other hand, a man must not lack confidence in himself or in his craft and he must have some sense of fear, or else he would not be alert to possible dangers.

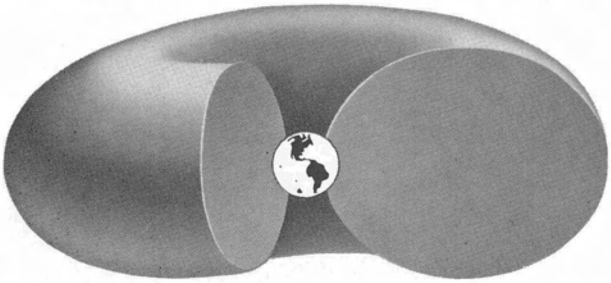
The space traveler will need work periods, so spaced and so varied that boredom, indifference, and frustration will not set in — potential human reactions if the flight is lengthy. He must feel that he is contributing to the success of the flight, that he is not just a passenger along for the ride, sealed up in a guided shell, powerless to control and guide at least part of his destiny.

A second probable danger source are celestial radiations which dart in great profusion through space. Fortunately, earth's protective atmosphere stops many dangerous rays from reaching us.

Sometime within the next 30 seconds an extremely tiny bit of matter will streak at a speed of many thousand miles an hour through your body. Called a secondary cosmic ray, this invisible, painless bullet will be the remnant of an atmospheric atom which, a split-second before, will have had a mishap more than a hundred miles overhead. There it, as well as trillions of its neighbors, will be in collision with highly energized atomic particles from outer space. The space particles, known as primary cosmic rays, most probably will be the kernels, or nuclei, of hydrogen atoms stripped of their single electrons and hurled from a star by a giant explosion. This explosion — astronomers call it a flare — may have occurred either on our own star, the sun, or on a star so far away the naked eye cannot see it.

Nuclear Radiation Weak As Compared To Cosmic Rays

In the time it took you to read the last paragraph, the accident happened. If you are sitting in a room with no great thicknesses of steel or concrete beneath your chair, the secondary cosmic ray that penetrated you has burrowed a thousand feet or more into the ground before exhausting the energy unleashed by the impact — evidence of the primary cosmic ray's tremendous power. Cosmic radiation, in fact, is the most powerful radiation known. Radiations from X-ray machines, radium, even nuclear bombs, are weak by comparison.



Van Allen radiation zone stretches 40,000 miles from earth.

Radiation is measured in units called roentgens. Atomic Energy Commission employees must not be exposed to more than five roentgens a year on an average, and not more than 15 roentgens in any given year. At sea level, you receive no more than one one-thousandth of a roentgen of cosmic radiation each 24 hours.

Surrounding earth is a vast region of radiation, apparently trapped by the earth's magnetism. Dr. James Van Allen, an Iowa State University physicist, discovered the region in 1958 after studying data collected by the first Explorer satellite sent aloft by the United States.

Van Allen Belt Is Vast Field Of Atomic Particles

Information from succeeding satellites led scientists to the belief that the field was divided into two distinct, doughnut-shaped belts. But last August, the National Aeronautics and Space Administration gathered new information about the radiation zone from its orbiting Explorer XII vehicle. The satellite's sensitive detectors revealed that earth is not surrounded by two radiation belts. Instead, there apparently is one large, pulsating band of radiation, beginning at 400 miles and reaching out about 40,000 miles. Scientists are now beginning to call this region the magnetosphere, suggesting that it is an extension of the earth's atmosphere where atomic particles, because of their electrical charge, have become trapped in the earth's magnetic field in much the same manner that iron filings cluster around a magnet.

Explorer XII revealed that the density of the radiation zone is not as great as originally surmised. While it is dense enough to endanger a man who spends too much time cruising in its invisible regions, the radiation levels are not believed to be so intense as to preclude quick trips through the zone by vehicles on their way to the moon or planets.

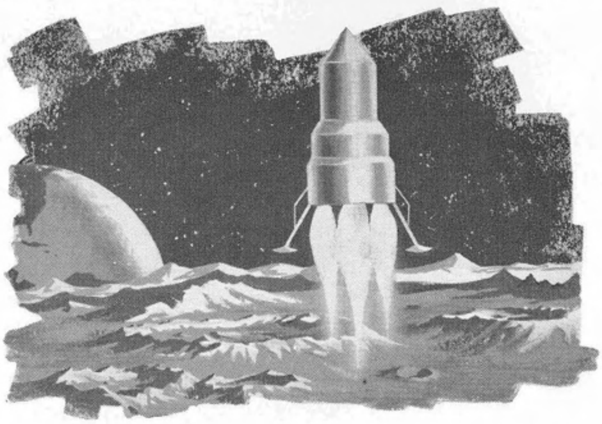
What happens when you are struck by high-energy radiation? First, let's examine the particle. Most cosmic rays are hydrogen atoms, although some are helium and some are heavier atoms up through iron. Each has lost its orbiting electron in the violent expulsion from the star. The hydrogen particles are now ions. The stripped-off electrons are also blown into space. They, along with the ions, form ion pairs. One roentgen equals 2,000,000,000 ion pairs in one cubic centimeter of tissue.

The action of radiation on living tissue still is not altogether understood. It is known, however, that when exposed to high-energy radiation the water in living cells becomes ionized. This means that electrically charged atoms of hydrogen and hydrogen peroxide are formed. At once, the charged atoms begin oxidizing the vital chemicals in the cells called enzymes. Cells need enzymes to burn fuels to get the energy essential for their life activity. Thus, the cells probably starve to death. Radiation may also kill cells by destroying their nuclei and by breaking the chemical bonds that hold proteins together.

Scientists also have found that high-energy radiation injures certain cells more easily than others. The toughest cells are those that make up the brain and muscles; the most sensitive are those found in the skin, the sex glands, bone marrow (where blood is manufactured), and in the lining of the intestines and stomach.

Radiation also can change living things through mutation, which is the abrupt appearance of new characteristics that were not apparent in the parents or the ancestors.

Cosmic ray exposure on jaunts to the moon, however, is expected to be slight. First, space craft, traveling seven miles a second, will pass through the Van Allen belt quickly. Space probes reveal, also, that beyond the belt there is a sharp decline in the number of cosmic rays. But when men launch out on longer journeys, such as round-trip voyages to Mars, the invisible rays may prove to be an evil menace. The crew will be exposed to them over a considerable length of time, and there will be no advance warning of a swarm of cosmic rays that may be rushing through space to engulf the slower moving, planet-bound craft.



Cosmic rays are not the only radiation space travelers will encounter. Our sun emits unending streams of ultraviolet rays which, even when filtered through earth's atmosphere, can burn enough to cause painful skin blisters. In space there is no ozone "umbrella," such as earth has, to check ultraviolet. But there should be little danger to a space crew. The ship's metal skin and specially treated windows and space helmets will turn back the rays. On the moon, though, where there is no protecting atmosphere, the savage shower of ultraviolet could prove dangerous. A spaceman who unwittingly bares his hands while strolling the sunlit lunar surface will soon find his hands fried by the rays. In space travel, the deeply sun-tanned crewman may be no healthy asset; he may be a major casualty.

The visible portion of the sun's radiation — light — also is a potential threat. In space, the sky is dark everywhere except where a body exists to emit or reflect light. Our sun will stab its corner of the sky with white, blinding brightness. If a space traveler looks at the sun without thick, dark sunglasses, the effect will be more intense than that of a flashbulb going off a few inches from the eyes. On a sunny day in earth's middle latitudes, solar illumination is about 10,000 foot-candles. But in the neighborhood of Mercury, the planet nearest the sun, light intensity leaps to about 80,000 foot-candles. Explorers of the Moon-Venus-Mercury district will have to develop an unconscious solar light sense. Perhaps the sense will be called "spaceman's squint."

The sun also is a powerful broadcaster of X-rays which, like cosmic rays, cause cell damage when living tissue is over-exposed to them. Heat or infrared rays, too, impose danger even though there is no temperature in space. Space, despite the drift of dust and atomic particles through it, is almost a perfect vacuum. You cannot heat a vacuum. But put something in space and at once it begins to absorb heat rays — the side towards the sun becomes intensely hot; the side away from the sun, intensely cold.

As though radiations were not sufficient menaces to space safety, creation has heaped other dangers into its vast fields — shooting stars, for example.

Rock Bits Dart About In Space At High Speeds

Shooting stars really are not stars at all. They are bits of rock or ore that rapidly burn up, as they enter earth's atmosphere, in the friction against air molecules, causing the light streaks we see against the background of stars. These bits are called meteorites, and every second thousands of them stab into our upper atmosphere at speeds of 20 to 60 miles a second.

Most meteorites weigh less than a milligram. Yet if one reached earth's surface with its initial velocity, it would seriously injure or kill any man it struck.

Space craft, of course, will have no protective mantle of air. A pinhead-sized meteorite could easily puncture its hull, causing decompression within the ship. If not clad in pressurized suits, the crew members would have about 15 seconds to plug the hole before losing consciousness. Manned space craft, however, probably will be double-hulled, just like modern passenger ships that ply the seas. The hulls would be covered with a criss-crossed network of detection wires to help the crew locate the puncture at once.

What about the larger meteorites? General Homer A. Boushey, the Air Force's advanced technology director, crisply described the result of a collision between an eight-ton space ship and a one-ounce meteorite.

"The voyage would end at once," he said.

Fortunately, as sampling devices on artificial satellites have revealed, meteorites weighing an ounce or more are extremely rare.

On the moon, however, spacemen outside their craft will have no protection against the tiny stony and metallic particles that probably smash onto the moon every moment. There may be no choice open to lunar explorers other than to dig in the second they clamber onto the moon's surface.

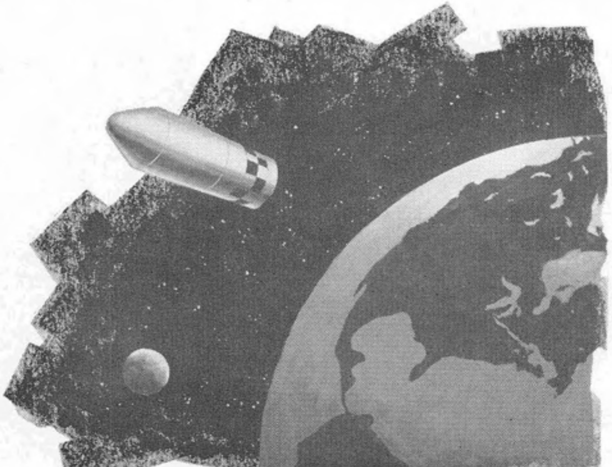
At casual glance, navigating space seems simple. There is the moon. Point your space craft at it and rocket away. But in space, navigation will have frustrations that could prove dangerous. The target — be it the moon, a planet, or even a package of precious fuel put in orbit to be picked up when needed — is always on the move. The laws of gravitation see to that. And a slight error in heading could, within a minute, swing a space ship thousands of miles off course.

In actual practice, however, navigators may find navigating space no more difficult than navigating the high seas or the air above them. On a moon flight, for example, the space craft first will orbit earth at a precise, pre-calculated height that will have been figured by a ballistic computer on the ground. The craft's navigator will know exactly when the rocket motors are to be fired and how much fuel he can burn in a given time. An analog computer probably will be standard equipment on ships bound for the planets. By feeding it information on the ever changing angles among the craft, sun, and planet, the navigator will have a running account of his position. When he nears the planet, radar can take over.

But what if a space vessel does get lost? In the early days of space travel, there will be no rescue ships. Spacemen will have to take a calculated risk that they can get back on their pre-arranged course. To help them in such emergencies, studies are currently being made to develop a repair capability aboard manned lunar rockets. This includes the training of space mechanics and the redesign of conventional space vehicles for easier maintenance and repair in flight. In later years, when the space lanes are more frequently traveled, radio signals from a ship in trouble may be able to summon rescue craft.

The rocket is poised and the crew waits. Then the moment comes. With terrifying speed, the home called earth recedes. Now the awesome reaches of the universe enfold the craft with its handful of men.

What dangers will close in and threaten? Our space technologists know some of those dangers and are finding ways to combat them. Yet space will remain, for the most part, a place of deep, silent shadows until man himself sets forth to spread the light of his questing spirit down its multiple and mysterious corridors.



A dozen leading collegiate coaches, questioned about the amazing mass improvement of track and field athletes in recent years, present their explanations for

THE BROKEN RECORDS

By Don Pierce

PLACING a limit on man's ultimate achievements in athletics, especially track and field, has been fashionable throughout the twentieth century. One set of standards after another has been bettered to expose as fallacious the belief that man physically has gone about as far as he can go.

A classic instance was pinpointed in a national magazine in February, 1932: "Probably one of the reasons why the quarter-mile has never been run in less than 47 seconds is that no human mechanism has yet been able to avoid excessive accumulation of waste products of combustion in the blood for a long enough period, when running at full speed."

The world record then was :47.4. It was held by Ted Meredith of Penn and had been on the books for 16 years. Ben Eastman of Stanford and Vic Williams of Southern California had tied it in 1931.

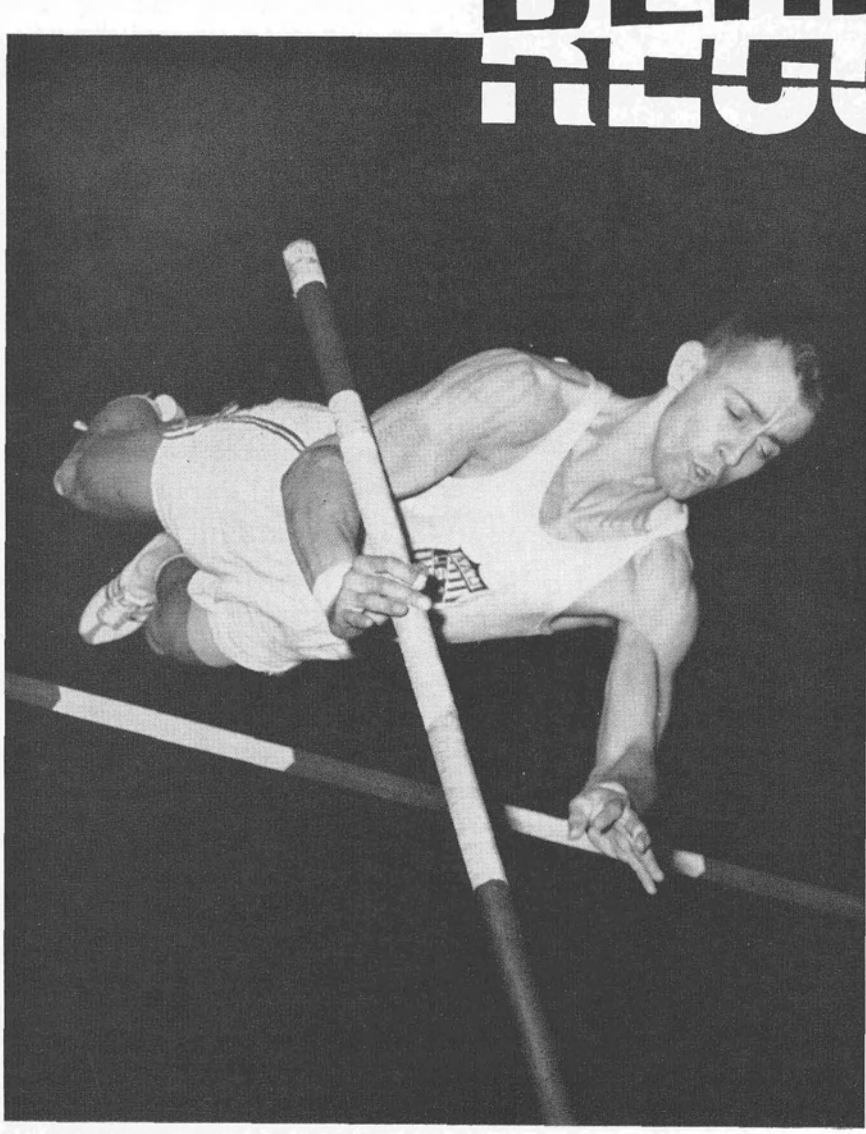
On March 26, 1932, Coach Dink Templeton of Stanford sent the brilliant Eastman after the supposedly impregnable record. Eastman blazed through the first 220 yards in :21.3 and finished in :46.4, a full second under a record which had endured physically, and perhaps as much psychologically, through 16 track seasons.

Do you know where Eastman would have placed with that clocking in the 1960 Olympic Games?

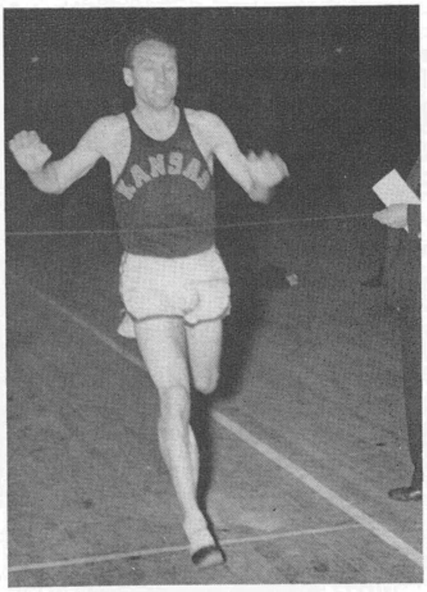
Nowhere.

The sixth-place runner in the final at Rome, Abilene Christian's Earl Young, was caught in :45.9 over the 400-meter distance which is only a stride less than 440 yards. Indeed, running his 1932 time, Eastman would have placed *no higher* than a tie for third and fourth in last year's NCAA championships.

On August 5, 1934, at Oslo, Nor-



Marine John Uelses has already topped 16 feet three times in the pole vault event.



Glenn Cunningham, top miler of the 1930s, set a world mark of 4:06.7 for the event.

way, Jack Torrance, a 310-pound behemoth from Louisiana State, put the 16-pound shot 57 feet, one inch. That still was the global standard when World War II ended. Nobody even approached it. Coaches and athletes began thinking nobody could match it unless they were as big as the old leviathan of the Bayous. You couldn't be any bigger and confine your action to the seven-foot circle.

Then on the morning of April 20, 1948, before a handful of spectators lounging about to watch the preliminaries of the Kansas Relays, Charles Fonville, a trim, quick, 190-pound athlete from the University of Michigan, put the shot 58 feet, ¾ inch, surpassing Torrance's mark by almost a foot.

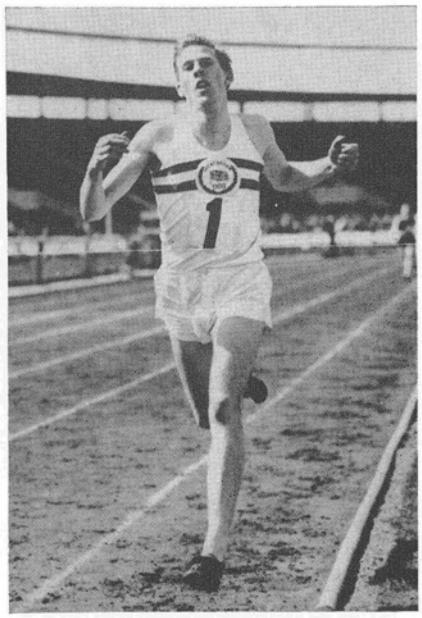
Fonville's historic toss on the Kansas plains would not have earned him a trip to Rome in 1960. Stanford's Jerry Winters was no better than fifth in the 1960 final American trials with 59 feet, 11¼ inches, a foot and a half beyond Fonville's put. Four others were over 61 feet.

These are but samples of the unrelenting assault on track and field barriers. The once unattainable heights of performance have been swept away. So has the next "impossible" barrier, and the next, and the next.

The once fictional four-minute mile, most romantic of all the impregnable standards, has been buffeted 73 times (seventy-three is correct) since Roger Bannister broke through on May 6, 1954. Peter Snell, the powerful New Zealand runner, a few weeks ago ran a 3:54.4 mile; and his boosters believe Snell may eventually lower the mark to 3:48.

Eight pole-vaulters scaled the once-insurmountable 15 feet in the NCAA championships last June. And this, of course, included only collegiate athletes. Now Marine John Uelses, with most of his career before him, has topped 16 feet twice indoors and still a third time outdoors a few days ago.

Sixty feet in the shot put? Unattainable, the experts said no less than



Four-minute mile was bettered for first time in 1954 by England's Roger Bannister.

ten years ago. Now collegiate athletes must achieve that distance even to place or show in NCAA competition. Bill Nieder of Kansas University holds the world record of 65 feet, 10 inches, but his performance likely will be topped soon by a New York University sophomore, Gary Gubner, who came off the winter circuit with a new American indoor record of 64 feet, 11¾ inches. Gubner, now only 19 years old, is probably four or five years away from his prime.

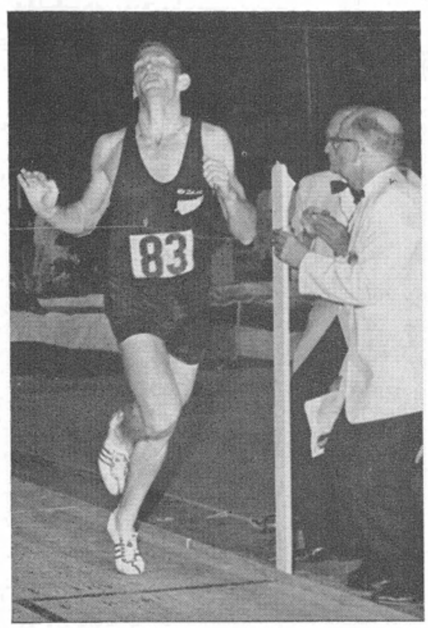
The high jump, where a leap of over 6 feet, 8 inches, once drew international attention, now claims many jumpers who have cleared 7 feet. The great Russian athlete, Valeriy Brumel, leaped 7 feet, 4⅝ inches, and John Thomas of Boston University has done 7 feet, 3¾ inches. The high hurdles are down to :13.2. Robert Hayes, a 19-year-old Florida A&M sophomore, tied Frank Budd's world 100-yard dash record of :09.2 in February, even before the outdoor season actually started. And his coach talks of a nine-flat performance for his protegé.

Otis Davis cut the quarter-mile standard a tenth under :45.0 to win the Olympic Games. Peter Snell pushed the half-mile down to 1:43.1; just 30 years ago a 1:50 half seemed unbelievable. Jay Silvester, Rink Babka, and Al Oerter all have hurled the discus to the threshold of 200 feet.

Even Jesse Owens' hallowed broad jump record of 26 feet, 8¼ inches, which remained on the books so long (since 1936) it became a sacred monument for the greatest of them all, is shattered. Ralph Boston leaped 27 feet, 1¾ inches a year ago and isn't through yet.

Boston himself has predicted that we'll some day see a 30-foot broad jump and a 17-foot pole vault. "Why not?" he said. "After all, who would have guessed a few years ago that John Glenn would orbit the earth three times?"

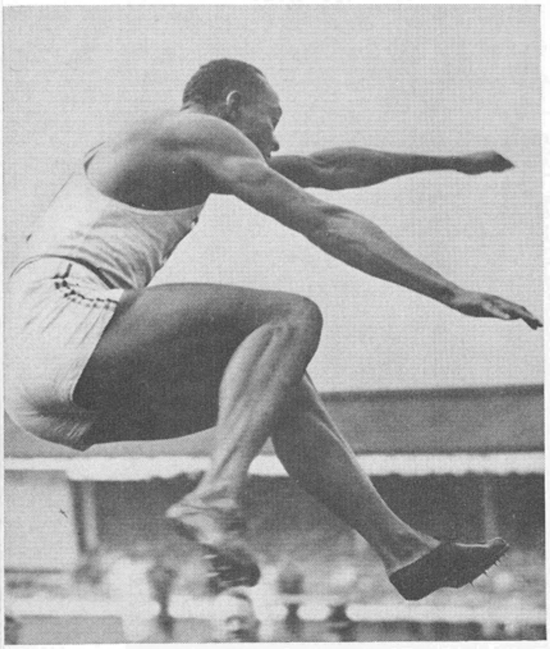
Today's track and field champions are the greatest in history. And the heirs-apparent are crowding up behind them, better than ever, rushing to scale new pinnacles and make the



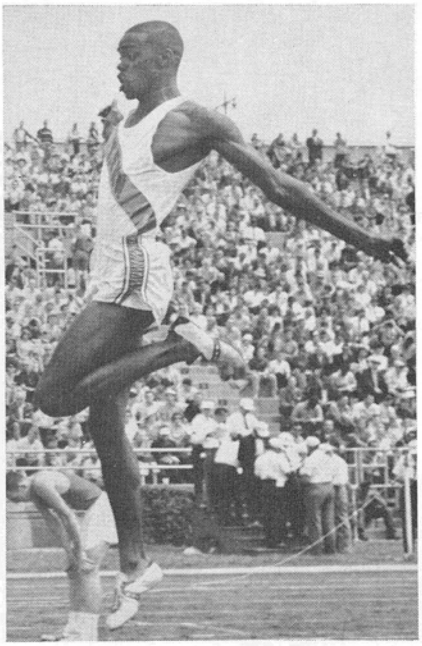
Boosters of Peter Snell believe he may eventually lower the mile record to 3:48.

old legends of prowess seem mediocre.

What has brought about this surge of record-smashing? How can it be sustained? Where will it stop? More than a dozen collegiate track coaches, representing all sections of the country, were queried on the subject recently. Specifically, they were asked about weight training, design and manufacture of equipment, modern athletic physique, specialization in one sport, and improvements of technique. There was general, though not unanimous, agreement that each one of these factors has contributed to the fantastic track and field pace of today. Three of the coaches, however, cited additional or overlapping factors which they said were at least as important, or more so, than those on which they were queried.



Broad jump record set by Jesse Owens in 1936 remained unbroken for 25 years.



Ralph Boston, current record-holder, sees likelihood of a 30-foot broad jump record.

Stanford's Payton Jordan attributed the improved performance chiefly to "emphasis and dedicated training, plus refinements in coaching and equipment."

Michigan's Don Canham listed the reasons for improvement this way:

"1. Greater interest with thousands of new athletes and track coaches participating; the cream comes to the top. 2. More coaches and better ones. 3. Improved techniques; the latest practices, such as weight training, interval training, and new event techniques, now spread from country to country in a short time. 4. Greater capacity for work; the body can do much more work than ever was dreamed of in the 1930s. 5. Refinement of the human race physique, which has become taller and stronger."

Colgate's Jack Warner said, "I am also certain that psychology has played a major role in this mass improvement. Evidence Bannister's breaking the four-minute mile. He showed it was humanly possible and the mass flow began. Many of the so-called psychological barriers have been broken. They were thought to be impossible in the past. Greater world-wide interest in track and field has also contributed. An increase in the number of competitors has helped. An increase in a more scientific approach has also helped and may be our best means to further improvement in the future. But more research is needed."

Warner is an all-out advocate of weight training as a means of improving performance in all track and field events, particularly in the sprints. "It has improved over-all body strength and endurance and deepened resistance to injury," he said. "It has contributed to sharper reflexes and reduced muscle viscosity. All of this contributes to greater speed. Leg strength has been improved greatly. I believe it also has improved breathing."

Many of the coaches, like Bob Karnes of Drake, Jim Kehoe of Maryland, Percy Beard of Florida, and Bill Bowerman of Oregon, agreed substantially with him but there were some dissenters on the panel.

Jack Patterson of Baylor, who has developed a number of fine dashmen in recent years, contended that weight training has chiefly helped the arms and chest and has had very little to do with aiding sprinters. This view was shared by Don Canham of Michigan and Johnny Morris of Houston.

Oliver Jackson, who developed the 1956 Olympic triple gold-medalist, Bobby Morrow, took the middle-of-the-road view. "Weight training has contributed to the development of additional over-all body strength for some sprinters," he said, "but I doubt that it has been a major factor in mass improvement."

Adverse Opinions Voiced

There was a similar split of opinion on the value of weight-lifting to middle-distance runners. Stanford's Jordan said this phase of training is of reasonable help because the upper body strength aids ability to get finishing kick. Houston's Morris, on the other hand, stated flatly that weight-lifting is of "very little help." But the coaches generally agreed that weight training has been a key factor in advancing the weight events.

On the matter of improved track and field equipment, Maryland's Kehoe struck the keynote for the panel. "As a general statement," he said, "there can be no question that improvements in design and manufacture of equipment have contributed materially to track and field marks. In my opinion, the most positive contributions have been in the vaulting and javelin events, with improved running and jumping shoes next in order."

As could be expected because of the controversy over John Uelses' indoor vaulting feats, the spun-glass pole he uses drew heaviest comment in the equipment category.

There was uniformity of opinion

that design and manufacture have helped pole vaulters, for several reasons. Poles, like baseball bats, now are being tailored to the vaulter's height, grip-height, and weight. The vaulter can replace a damaged pole with a duplicate. There is more consistency in the action of modern poles than there was with the old ash or bamboo sticks. However, the spun-glass pole does not receive complete certification as an automatic accelerator for all vaulters.

Bill Easton of Kansas gives this chronological analysis: "The metal pole is some improvement over the bamboo because it gives more confidence and allows a better hand-stand. It is an advantage to a big, heavy vaulter with good pull-strength and hand-stand strength. Also, more safety is a factor in the metal pole.

"We are now in the third stage, the spun-glass pole. This adds a foot to any good vaulter and to some mediocre ones, also. However, it takes a well-coordinated, acrobatic vaulter to use the spun-glass pole. He must be a high-bar artist, although he doesn't need great speed. Glass probably has twice the whip of metal and even more than bamboo, which frequently broke."

Warmerdam Had Potential

Canham, a 1940 NCAA co-champion in the vault, projected a graphic example of improvement because of design. "I still feel Cornelius Warmerdam (a long-time world indoor and outdoor record holder and the world's first 15-footer) is the only man I've ever seen who could vault 15 feet, 6 inches with a bamboo pole," he said. "He probably could have gone 16 feet with steel and 16 feet, 10 inches with glass."

There was unanimous agreement that modern javelin designs have brought about mass improvement. Several important attributes were cited by some or all of the coaches. Increased diameter of the javelin has increased gliding ability. Metal javelins cut down vibrations, give uniform balance, do not dry, absorb moisture, or warp.

As Bowerman put it, "Now it's an instrument. It *was* a stick."

Most members of the panel felt that shoes have contributed to overall track improvement because of greater comfort, if nothing else. Jackson translated this into "aiding runners in relaxation, which is so essential to successful running. The same is true with jumping shoes."

"Modern shoes are much improved," Easton explains. "They are lighter, fit the foot better, have removable spikes which can be used on any surface, and have a protective heel built-in. All this appeals to the runner. Jumping shoes fit better. The pre-war shoe did not have removable spikes, did not fit as well, and was not as light."

Canham was the only dissenter. He conceded that shoes improved sprinting and jumping but said their contributions have been very small in other events. "The 30-year-old Spaulding-T shoe was as good or better than any shoe made today," he added.

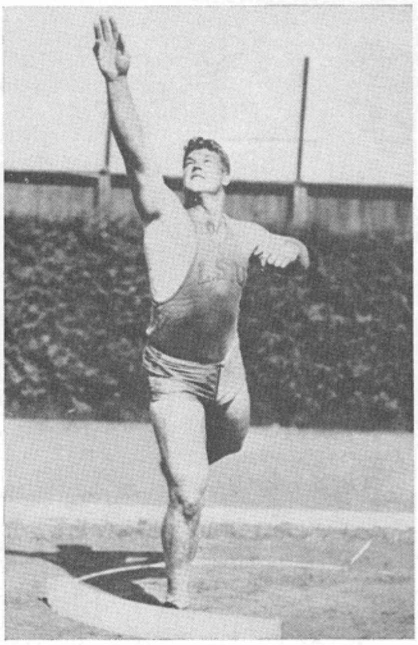
Canham also is a holdout against the theory that modern ring composition for weight men (now hard-surfaced with smoothness roughened just enough to allow foot traction) has pushed marks upward. "This has contributed little," he said. "Many of the world's best marks were made from clay, not asphalt or cement."

There was universal agreement among the others. All cited greater throwing consistency and greater speed because of the sameness of surfaces and because the modern hard-surface aprons are affected only slightly by foul weather. All agreed, too, that there is more equity in competition since the last man in a flight of throwers is not handicapped by holes and cuts dredged by previous heavers, as was the case in the cinder and clay days.

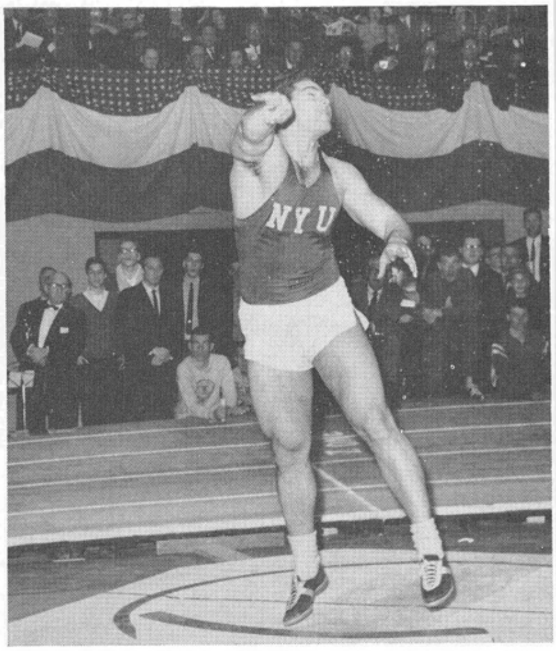
The coaches' pattern of response was the same on the question of how much hard-surfaced takeoffs have contributed to jumping improvement. There was agreement that more consistency and speed (in pole vault and broad jump) is created, greater confidence engendered, especially in the high jump, and fair competition assured because of the elimination of cutting and holing.

Most of the coaches agreed that even sprinters, middle-distance, and distance men are taller and heavier than a generation or two ago. Even those who felt there is little or no difference in size add, "but stronger," to their view.

"In general this has to be true on the average," Canham said. "The human race is simply getting taller, heavier, stronger. Many studies have shown this. There are exceptions in



Shot put record set by Jack Torrance in 1934 has been bettered by over eight feet.



Gary Gubner, holder of indoor shot put record, is expected to break outdoor mark.

every era, but, on the average, athletes are taller and stronger and this has contributed to better performances."

"All U. S. people are taller and healthier," Bowerman noted, "but the average citizen is softer due to lack of motivation to make or cause him to want to be at least average."

Most of the coaches agreed that specialization has helped in mass improvement, but the reasons were variable and far-reaching. Many felt that the versatile athletes of yesteryear such as Jesse Hill, Jackie Robinson (a fine halfback, basketball player, and 25-foot broad jumper at UCLA before he ever gained major league baseball fame), Jess Mortensen, Jim Bausch, Al Blozis, Jay Berwanger, and Cy Leland, could perform just as spectacularly today in an age where multi-sport athletes are supposed to be fast disappearing as they did in their day.

Specialists Perform Better

"I think specialization has played a very important part in mass improvement," Kehoe said. "All things being equal, I do not see how it can be argued that an individual concentrating 12 months of the year in one area would not be a better performer than if he divided his time with one or more other activities. As I see it, it isn't a question of some of our outstanding people having the ability to compete in several sports, but rather of their attaining greatness by concentrating on one."

"Specialization probably has contributed," said Jordan, "but the fact that greater numbers now take part is the key. It is rather doubtful in my mind whether such men as Hill, Robinson, or Mortensen could keep up with the competition if they divided their energies between two or more sports. This is a special problem today with the heavy emphasis on football. The academic rigors play a definite part. Frankly, I feel it is not so much specialization, but rather intensity of preparation and training that will not allow a man's efforts to spread too thin."

Canham pointed out that there are still many two-sport athletes, but practically none of these are world champions. "At Michigan the football staff encourages boys to compete in track as well as football," he said. "Ben McRae, present Big Ten hurdle record holder, and Dave Owen, former NCAA shot put champion, are examples. I'm quite certain, however, that men who miss fall track practice for football never attain the heights they could in track had they concentrated more. McRae and Owen could have been even greater than they were."

Patterson predicted more boys will specialize in the future. "We demand a great deal more in the classroom and on the athletic field," he said. "So it takes an unusual boy to participate in two sports."

All agreed that changes in techniques have contributed to mass improvement. But few coaches blanketed all events with this reason. Specific events, chiefly the weights and jumps, were singled out. Some listed only two or three even in this category. All agreed movies are a great teaching aid.

Easton and Warner cited many concrete examples, such as the turn-around position in the shot, the one and three-quarters turn in the discus, the American adaptation of the Scandinavian front cross-over in javelin throwing, and the straddle-roll in high jump.

Both cited far-reaching effects for movies also. "Athletes have been able to look at champions and copy them," Easton pointed out. "This means the major portion of champions today have contributed to the world upheaval. Russia took 10,000 feet of movies at the Helsinki games in 1956."

"I believe," said Warner, "that motion pictures shown to others than the athletes themselves have interested them in participating, thus bringing greater numbers to the sport, which also contributes to improvement of standards."

Canham coupled technique with better informed coaches teaching these techniques and improving them further. "Movies, technical articles, clinics (now held much more often than 20 years ago) all have played a part in more well-informed coaches," he said. "All events save the sprints have been affected about equally, the reason being that in the sprints an athlete can usually thank his ancestry rather than his coach."

A somewhat random sampling of how track and field performances have improved in eight popular events since the turn of the century shows:

100-YARD DASH

Time		Year
9.8	John Owen Jr., USA	1890
9.6	Dan J. Kelly, USA	1906
9.4	Frank C. Wykoff, USA	1930
9.2	Frank Budd, USA	1961
9.2	Robert Hayes, USA	1962

440-YARD DASH

47.8	Maxwell W. Long, USA	1900
46.4	Ben B. Eastman, USA	1932
46.0	Herb McKenley, Jamaica	1948
45.7	Glenn Davis, USA	1958

880-YARD RUN

1:52.8	Emilio Lunghi, Italy	1909
1:49.8	Ben B. Eastman, USA	1934
1:49.2	M. G. Whitfield, USA	1950
1:45.6	Peter Snell, N. Zealand	1962

ONE MILE RUN

4:15.4	John P. Jones, USA	1911
4:06.7	Glenn Cunningham, USA	1934
3:59.4	Roger Bannister, England	1954
3:54.4	Peter Snell, N. Zealand	1962

SHOT PUT

Distance		Year
49-10	Ralph Rose, USA	1908
57-01	John Torrance, USA	1934
58-00⅜	Chas. Fonville, USA	1948
65-10	William Neider, USA	1960

JAVELIN

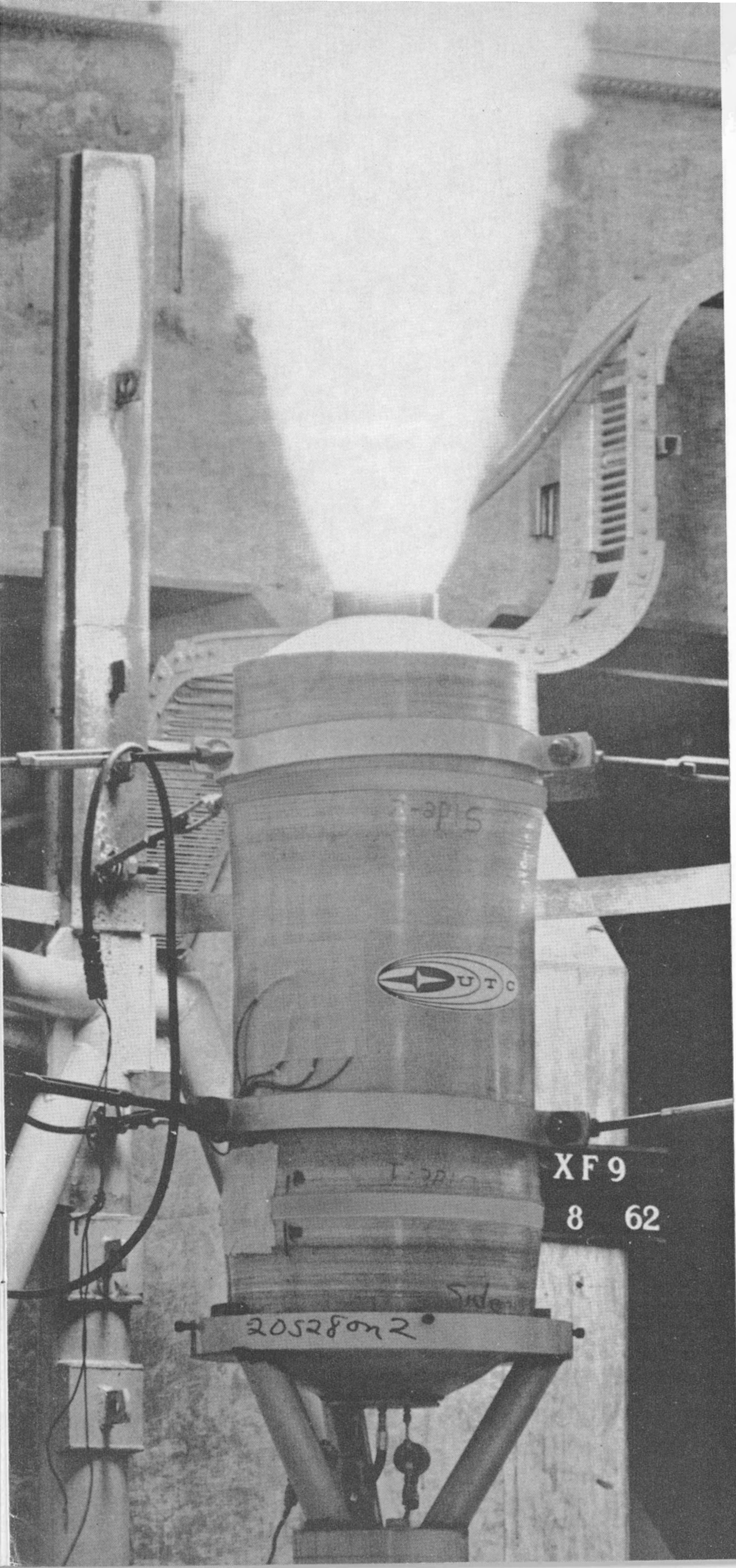
120-00	H. Anderssen, Sweden	1904
218-06⅞	G. Lindstrom, Sweden	1924
253-04½	M. Jarvinen, Finland	1936
282-03½	Al Cantello, USA	1959

DISCUS

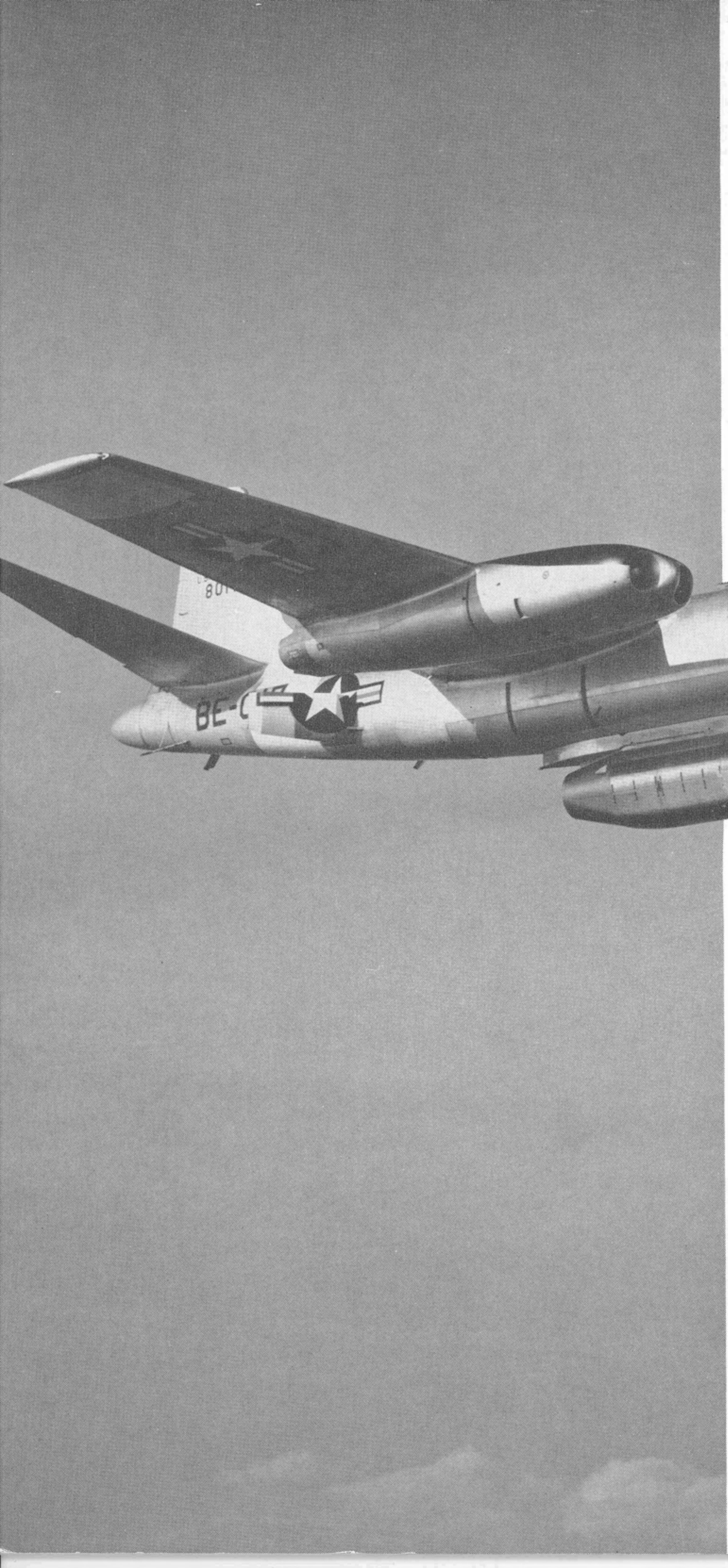
120-07¾	M. J. Sheridan, USA	1901
169-08⅞	Paul Jessup, USA	1930
180-02¾	R. E. Fitch, USA	1946
196-06¼	Ed. Piatkowski, Poland	1960

HIGH JUMP

6-07	G. L. Horine, USA	1912
6-10⅜	M. Walker, USA	1937
7-1	Yuri Stepanov, Russia	1957
7-3¾	John Thomas, USA	1960
7-4⅝	Valeriy Brumel, Russia	1960



ITS three segments made of fiberglass and held together by metal joints, a solid-propellant rocket motor, designed and developed by United Technology Corporation, sends up white-hot exhaust in generating 12,000 pounds of thrust during a static firing at the company's California development center. The test indicated the feasibility of using fiberglass to fabricate the casings for large, segmented boosters and securing the individual segments together by mechanical metal joints, specially developed by UTC. By nearly halving the weight of a segment casing, the use of fiberglass would permit greater rocket payloads. Fiberglass casings also can be produced more cheaply and quickly than the steel cases now in use.



THE Pratt & Whitney Aircraft JTF-10A engine, which has been selected to power the proposed F-111A (TFX) advanced tactical fighter aircraft, goes aloft for flight tests slung beneath a B-45 bomber. The Boeing Company and General Dynamics Corporation, which are engaged in the final phase of the design competition for the F-111A, have been advised by the government to base their final designs on the use of the JTF-10A. The F-111A is being considered for development for ultimate use by both the Navy and Air Force.